CONFERENCE
PROGRAM

STSA 68th ANNUAL MEETING

Meeting Dates
November 3–6, 2021

Exhibit Dates
November 4–5, 2021

WEDNESDAY
SCIENTIFIC PAPERS

POSTGRADUATE CONGENITAL VIDEO BREAKOUT

CONG-PG-V1. SIMPLIFIED SINUS OF VALSALVA ANEURYSM WITH ASSOCIATED DOUBLY-COMMITTED VENTRICULAR SEPTAL DEFECT REPAIR

AUTHORS
Alexander Merriman, Peter Kouretas, Nicole Cresalia, Shunji Sano

AUTHOR INSTITUTION(S)
University of California, San Francisco, San Francisco, CA

OBJECTIVES:
We present a surgical video highlighting our simplified approach to the management of a sinus of Valsalva aneurysm associated with a doubly-committed VSD.

METHODS:
We present a 65-year-old male patient with a sinus of Valsalva aneurysm of the right coronary sinus measuring 3cm and a doubly-committed VSD associated with mild aortic valve insufficiency. Pre-operative transesophageal echocardiography showed herniation of the right aortic sinus into a doubly committed ventricular septal defect. Our approach to repair this defect is to close the VSD with a Gore-Tex patch via a pulmonary arterial approach, thus buttressing the aneurysmal sinus and avoiding the need for aortic sinus reconstruction. Furthermore, the aortic valve is carefully inspected and repaired.

RESULTS:
Post-operative transesophageal echocardiography demonstrated complete coverage of the sinus of Valsalva aneurysm by the Gore-Tex patch and only trivial aortic insufficiency after aortic valve repair with a modified commissuroplasty.

CONCLUSIONS:
Our simplified approach avoids the need for aneurysmal sac resection and coronary reimplantation, instead focusing on adequate buttressing of the defect from the pulmonary arterial side. For this approach to be successful, it is imperative that the entire aneurysm is reinforced by the patch, requiring thorough coverage of the defect which is confirmed by intraoperative echocardiography. We have also applied this approach in patients where the VSD has previously closed, broadening the applicability of this approach to all patients that present with a sinus of Valsalva aneurysm.

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POSTGRADUATE CONGENITAL VIDEO BREAKOUT

CONG-PG-V2. KONNO PROCEDURE FOR TUNNEL SUBAORTIC STENOSIS

AUTHORS
Elizabeth Stephens, Joseph Dearani

AUTHOR INSTITUTION(S)
Mayo Clinic, Rochester, MN

OBJECTIVES:
Left ventricular outflow tract obstruction and small aortic roots can prove challenging to manage surgically. The goal of this video is to illustrate the Konno procedure for left ventricular outflow tract obstruction.

METHODS:
Clinical data, preoperative imaging, operative footage and post-operative imaging were reviewed to illustrate this technique.

RESULTS:
In this video we provide diagrams demonstrating the relevant anatomy along with operative footage demonstrating an aortic valve replacement with Konno procedure. The patient is a 47yo female with a history of subaortic membrane status-post resection in 1982 and 1997 at an outside institution, who presented to us with severe tunnel subaortic stenosis and severe aortic regurgitation with a hypoplastic root, as well as an anomalous left circumflex artery off the right coronary cusp with a retroaortic course which precluded posterior annular enlargement. In this video we demonstrate a Konno-Rastan aortic valve replacement with a 23mm OnX valve.

CONCLUSIONS:
The Konno procedure can be invaluable in relieving left ventricular outflow tract obstruction. This video illustrates the caveats related to performing this operation safely and reproducibly.

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POSTGRADUATE CONGENITAL VIDEO BREAKOUT

CONG-PG-V3. PATENT DUCTUS ARTERIOSUS EXCLUSION TECHNIQUE USING THORACIC ENDOVASCULAR AORTIC REPAIR

AUTHORS
Kirsten Freeman, Dean Arnaoutakis, James Fudge, Jr, Tomas Martin, George Arnaoutakis

AUTHOR INSTITUTION(S)
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OBJECTIVES:
A large patent ductus arteriosus (PDA) is an uncommon etiology of shortness of breath in an adult. As imaging modalities have improved and less invasive techniques have developed, many PDAs are closed with occlusion devices or coiling and without need for open surgical intervention, particularly in the pediatric population. However in the adult population, patients may present with a large PDA or with other anatomical considerations, including calcification, which may not be amenable to device occlusion or coiling.

METHODS:
A previously healthy 31 year old man was referred to our institution for a large 2.7cm PDA and accompanying heart failure symptoms. Originally the patient presented to an outside hospital with shortness of breath and was found to have a PDA on a transthoracic echocardiogram (TTE), and then further confirmed by a computed tomography angiography (CTA). Additionally, he was found to have pulmonary over-circulation and severe pulmonary hypertension with a pulmonary artery pressure of 70/48mmHg. His Qp:Qs was 3.4:1 at 21% oxygen and 6.8:1 at 100% oxygen. His left ventricular ejection fraction was normal at 55%.

RESULTS:
Attempt was made at closure of the PDA with a percutaneous occluder device, however ultimately the device proved not to be large enough and was unable to prevent left to right shunting. Consideration was given for alternatives to percutaneous closure including traditional open repair via sternotomy versus exclusion of the PDA with thoracic endovascular aortic repair (TEVAR). Open repair would likely necessitate circulatory arrest and/or balloon occlusion of the aorta, in addition to patch closure of the defect given the PDA size. After a multidisciplinary review, a collaborative decision was made to proceed with TEVAR as a less invasive treatment modality. Zone 2 landing of the endograft was considered necessary to obtain adequate proximal seal, and therefore underwent left carotid to left subclavian bypass prior to TEVAR. Due to size discrepancy between zone 2 and the descending aorta, a tapered graft was chosen. A second endograft was placed for proximal extension for complete coverage of the left subclavian. Intraoperative angiography following endograft deployment showed no residual left to right shunting of blood flow and successful exclusion of the PDA.

CONCLUSIONS:
The patient presented in this case was found to have an uncommonly large PDA. This patient's PDA was too large for typical percutaneous interventions. Open repair of the large non-calcified PDA is certainly an option and would definitively treat the PDA, but would require a sternotomy, cardiopulmonary bypass, likely circulatory arrest, and recovery time. As an alternative to repair or closure of the PDA, TEVAR was discussed as an option for exclusion of the PDA to prevent further shunting. Minimally invasive techniques have altered the landscape of surgery over the last several decades. Additionally, using the TEVAR exclusion technique of the PDA in lieu of an open repair, decreases the patient's length of stay post-operatively and thereby decreases the exposure to hospital infections. Overall, we conclude that TEVAR is a safe and effective option.

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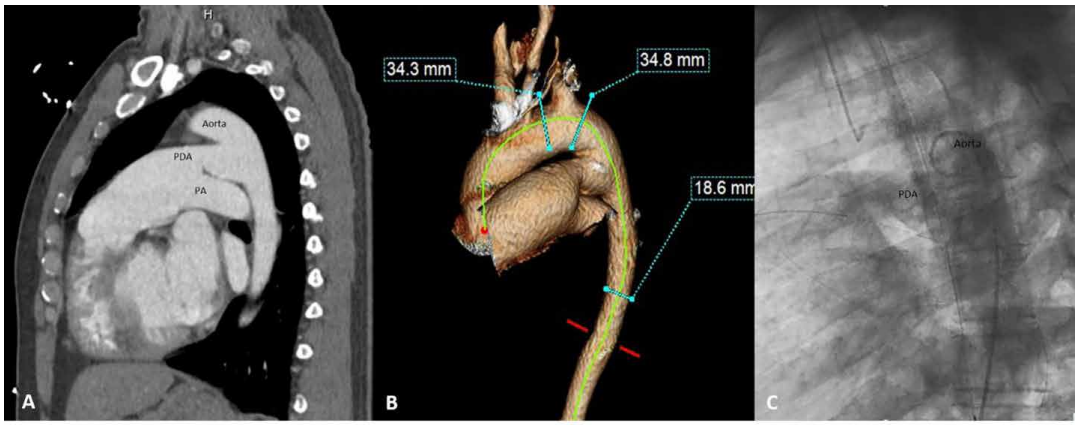
POSTGRADUATE CONGENITAL VIDEO BREAKOUT

CONG-PG-V3. PATENT DUCTUS ARTERIOSUS EXCLUSION TECHNIQUE USING THORACIC ENDOVASCULAR AORTIC REPAIR

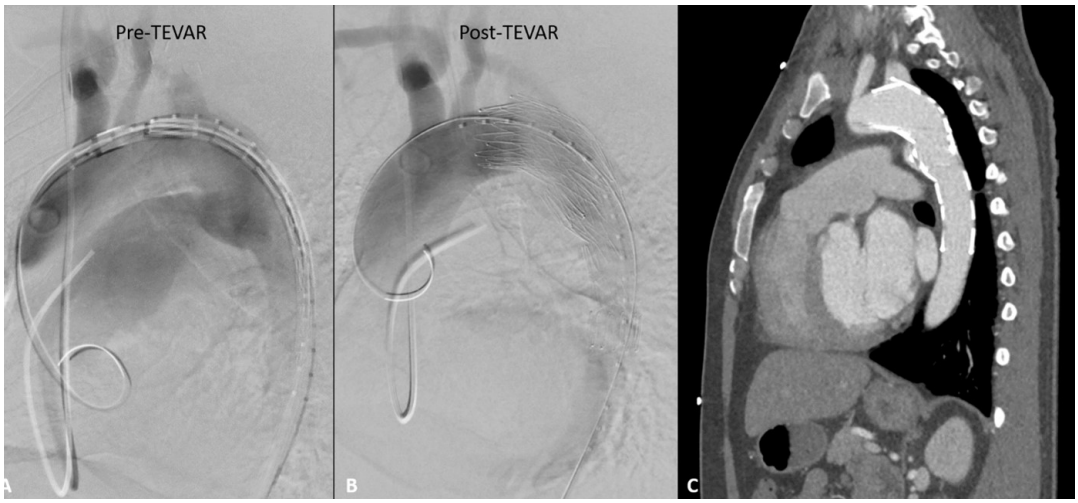
CONTINUED

Large PDA Pre-Operative Imaging



(A) CTA in the sagittal view showing large PDA. (B) 3D reconstruction of the aorta and PDA. (C) Aortogram showing left to right shunt of the PDA.

TEVAR Exclusion of PDA



(A) Aortogram prior to TEVAR deployment. (B) After TEVAR placement showing exclusion of the PDA. (C) CTA post-operatively showing no residual flow in the PDA.

POSTGRADUATE CONGENITAL VIDEO BREAKOUT

CONG-PG-V4. TWO STAGE REPAIR OF ADULT VASCULAR RING: RIGHT AORTIC ARCH AND ABERRANT LEFT SUBCLAVIAN ARTERY

AUTHORS
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AUTHOR INSTITUTION(S)
Mayo Clinic, Rochester, MN

OBJECTIVES:
Adults who present with vascular rings can be difficult to surgically manage and provide a comprehensive repair. We present our method for the two-stage surgical repair of right aortic arch and aberrant left subclavian artery.

METHODS:
Clinical data, preoperative imaging, operative footage and post-operative imaging were reviewed to illustrate this technique.

RESULTS:
In this video, we provide diagrams demonstrating the relevant anatomy along with two case examples with the patient clinical presentation, preoperative imaging, operative footage, and postoperative imaging. The operative repair includes a first stage left subclavian to left common carotid transposition performed via a neck incision, followed the next day by replacement of the aorta containing the Kommerrell's diverticulum via a right thoracotomy utilizing partial cardiopulmonary bypass.

CONCLUSIONS:
This two-stage approach for right aortic arch and aberrant left subclavian artery allows complete resection of the abnormal aorta and Komerrell's diverticulum and transposition of the subclavian, thereby completely relieving esophageal and tracheal obstruction.

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POSTGRADUATE CONGENITAL VIDEO BREAKOUT

CONG-PG-V5. REPAIR OF BICUSPID PULMONARY VALVE INSUFFICIENCY AND NEO-ROOT ANEURYSM LATE AFTER ARTERIAL SWITCH PROCEDURE

AUTHORS
John Kupferschmid[1], J. Scott Rankin[2]

COMMERCIAL RELATIONSHIPS:
J. Kupferschmid: Consultant/Advisory Board: Biostable

AUTHOR INSTITUTION(S)
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OBJECTIVES:
After arterial switch procedures for transposition, freedom from systemic pulmonary valve insufficiency: 1) is inversely related to degree of insufficiency at discharge; 2) deteriorates over time; 3) requires reoperation in 5-10% at 15-20 years and more over the longer term; is worse with bicuspid pulmonary valves; and currently is managed primarily with prosthetic valve replacement. A better method of valve management is needed, employing standardized autologous valve repair.

METHODS:
A 27 year old male underwent arterial switch in infancy and recently developed palpitations, mild heart failure/LV dysfunction, a 42 mm symmetrically enlarged pulmonary neo-root, and severe insufficiency of a systemic bicuspid pulmonary valve. Anatomically, the valve was similar to a Type 1 bicuspid aortic valve with a R/L commissural fusion and cleft. The annulus was enlarged at 33 mm. The non-coronary leaflet and inter-commissural distance both sized to a 23 mm bicuspid annuloplasty ring, and the posts of the ring were sutured to the two sub-commissural triangles. Extra annular looping sutures were placed in both sinuses, because of the large annulus, for a total of 11 trans-annular sutures.

RESULTS:
After the ring sutures were tied and fixed laterally to avoid leaflet contact, the non-fused leaflet was plicated to a reference effective height of 10 mm. The corresponding cleft in the fused leaflet was closed with a linear suture line to achieve similar lengths and effective heights of the two leaflets, and therefore, a competent valve. Both enlarged sinuses were excised, and coronary buttons were fashioned. Two 180 degree tongues of a 30 mm Valsalva graft were sutured to both sinus bases, and the coronary buttons were re-implanted. After completion of the distal anastomosis, bypass was discontinued, and the valve was fully competent. The patient did well long-term, with a 16 mmHg mean pressure gradient.

CONCLUSIONS:
Aortic ring annuloplasty is a simple adjunct for repair of insufficient neo-root valves after arterial switch procedures for transposition. When combined with root remodeling, ring annuloplasty affords significant anatomic versatility, even for reconstruction of bicuspid neo-root aneurysms

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POSTGRADUATE CONGENITAL VIDEO BREAKOUT

CONG-PG-V6. MODIFIED RE-IMPLANTATION TECHNIQUE FOR ANOMALOUS ORIGIN OF RIGHT CORONARY ARTERY FROM LEFT SINUS WITH INTER-ARTERIAL COURSE AND SHORT INTRAMURAL COURSE

AUTHORS
Hani Najm[1], Samantha Xu[2], Lin Chen[2], Joanna Ghobrial[1], Tara Karamlou[1]

AUTHOR INSTITUTION(S)
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OBJECTIVES:
Anomalous aortic origin of a coronary artery (AAOCA) is the second leading cause of sudden cardiac death in young athletes, yet optimal management strategy for AAOCA is controversial. While coronary unroofing of the intramural segment is advocated by many, patients with an inter-arterial course but short intramural segment may derive less benefit from this approach. The reimplantation technique previously described, consisting of anterior coronary arteriotomy and direct aortic anastomosis, may cause angulation, making the coronary more susceptible to kinking.

METHODS:
We describe a modification of this reimplantation technique in an adolescent patient with an intra-arterial course of anomalous origin of right coronary artery (AAORCA), but a short intramural course, that may avoid this issue.

RESULTS:
17-year old 70kg male with history of anomalous origin of right coronary artery (AAORCA) with prior non-invasive negative stress testing presented to the emergency department after a basketball tournament with sudden cardiac arrest. Following resuscitation, brain magnetic resonance imaging (MRI) showed bilateral occipital cortical infarcts due to possible hypoxic injury. Fortunately, the adolescent recovered full neurologic function, and underwent evaluation of his AAORCA. Computed tomography with angiography (CTA) confirmed AAORCA with a high take off at the level of the ST junction, inter-arterial segment, and a short intramural segment measuring 0.6cm in length (Figure 1). Cardiac catheterization demonstrated, left anterior descending myocardial bridging, dominant AAORCA with instantaneous wave-free ratio (iFR) of 0.84 with dobutamine, positive for stress ischemia. Intravascular ultrasound (IVUS) of the AAORCA confirmed intramural course with slit-like lumen measuring 0.6 x 0.3cm in dimensions.

Through median sternotomy, the AAORCA was completely dissected to allow mobilization (Video). Appropriate location on the aorta was marked for coronary re-implantation. Following bypass and aortic cross-clamp, oblique limited aortotomy confirmed the diagnosis and also allowed septal myectomy. AAORCA was transected just beyond the take-off, and the proximal artery was oversewn. The coronary was spatulated in fashion analogous to proximal anastomosis during coronary revascularization. End- to side anastomosis using running 8-0 suture was performed. After separation from bypass, post-operative transesophageal echocardiogram showed widely patent coronary artery with excellent flow. Patient was discharged with no complications on postoperative day #5. CTA showed an excellent anatomic result (Figure 2).

CONCLUSIONS:
Our modified re-implantation technique for AAOCA is suitable for patients with inter-arterial course without a long intramural segment. Configuration of the aortocoronary anastomosis using a posterior spatulated approach, similar to that used in coronary revascularization, provides a favorable anatomic lie and should reduce angulation or kinking.

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POSTGRADUATE CONGENITAL VIDEO BREAKOUT

CONG-PG-V6. MODIFIED RE-IMPLANTATION TECHNIQUE FOR ANOMALOUS ORIGIN OF RIGHT CORONARY ARTERY FROM LEFT SINUS WITH INTER-ARTERIAL COURSE AND SHORT INTRAMURAL COURSE

CONTINUED

Figure 1. Preoperative image of AAORCA using computed tomography angiography

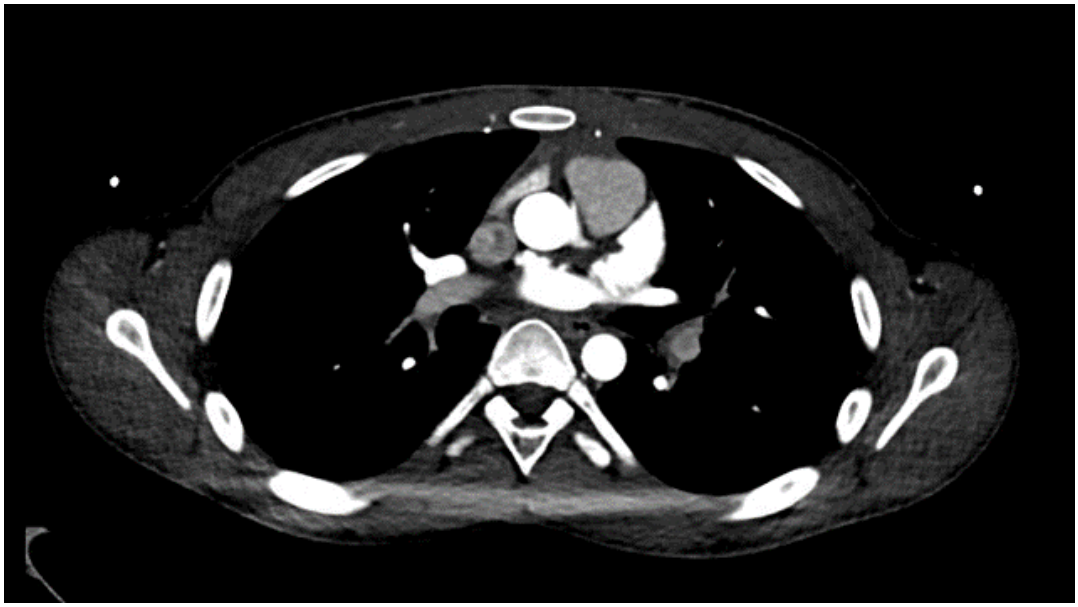
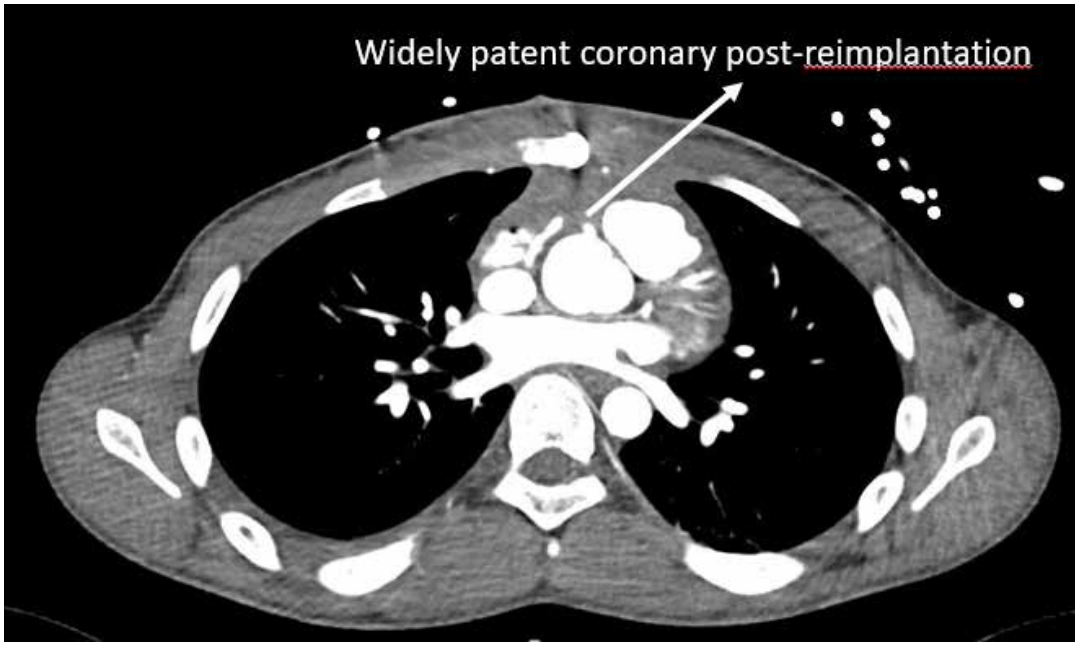


Figure 2. Postoperative image of transection and reimplantation assessed using computed tomography angiography



THURSDAY
SCIENTIFIC PAPERS

BASIC SCIENCE FORUM

1B. SIMVASTATIN INHIBITS HISTOLOGIC CHANGES ASSOCIATED WITH GASTRODUODENAL REFLUX IN A MURINE MODEL

AUTHORS
Anna Gergen[1], Helen Madsen[1], Anqi Li[1], Linling Cheng[1], Xianzhong Meng[1], David Fullerton[1], Akshay Pratap[1], Michael Weyant[2]

AUTHOR INSTITUTION(S)
[1]University of Colorado, Aurora, CO; [2]INOVA Hospital System, Fairfax, VA

OBJECTIVES:
Esophageal cancer is a devastating diagnosis with overall poor prognosis. Observational studies demonstrate a potential protective effect of statins on the development and progression of esophageal adenocarcinoma. While statins have been shown to decrease proliferation of esophageal cells in vitro, this effect has yet to be confirmed in vivo. Using a mixed gastroduodenal reflux mouse model, we hypothesized that oral administration of simvastatin would attenuate reflux-induced mucosal changes of the distal esophagus.

METHODS:
Human Barrett's (CPB) and esophageal adenocarcinoma (FLO1 and OE19) cells were treated with increasing doses of simvastatin for 48 hours. Cell proliferation and apoptosis were evaluated using the MTS proliferation and annexin V apoptosis assays, respectively. A surgical reflux mouse model was generated by performing a side-to-side anastomosis between the gastroesophageal junction and the first portion of the duodenum (duodeno-gastroesophageal anastomosis, DGEA). Control animals underwent laparotomy with esophagotomy and closure (sham). DGEA mice were fed a standard diet or simvastatin-containing diet following surgery. Mice were euthanized 6 weeks post-operatively and esophageal sections were evaluated using hematoxylin and eosin staining, immunohistochemistry, and immunoblotting.

RESULTS:
Simvastatin significantly decreased cellular proliferation in CPB, FLO1, and OE19 cells in a dose-dependent fashion. Likewise, all three cell lines demonstrated a significant increase in early and late apoptosis. Compared to control animals, mice undergoing DGEA who were fed a standard diet demonstrated a 4-fold increase in mucosal thickness ($p<0.0001$) and significant increase in number of proliferating cells ($p<0.0001$) following prolonged reflux exposure (Figure 1A and 1B). DGEA mice fed a simvastatin-containing diet demonstrated an attenuated response to reflux, with a significant reduction in mucosal hyperplasia ($p<0.0001$) and number of proliferating cells ($p<0.0001$) compared to DGEA mice fed a standard diet. In addition, in DGEA mice fed a simvastatin-containing diet, there was significant upregulation of both procaspase-3 ($p=0.009$) and cleaved caspase-3 ($p=0.034$) in the distal esophagus, indicating increased activation of apoptotic signaling (Figure 1C).

CONCLUSIONS:
These results demonstrate for the first time a reduction in reflux-induced histologic changes of the distal esophagus following oral administration of simvastatin in vivo. Through inhibition of early mucosal changes developing in the setting of chronic reflux exposure, simvastatin may prevent the progression of normal esophageal epithelium to premalignant or malignant disease. These findings identify simvastatin as a potential therapeutic agent to prevent the development and progression of reflux-induced esophageal injury.

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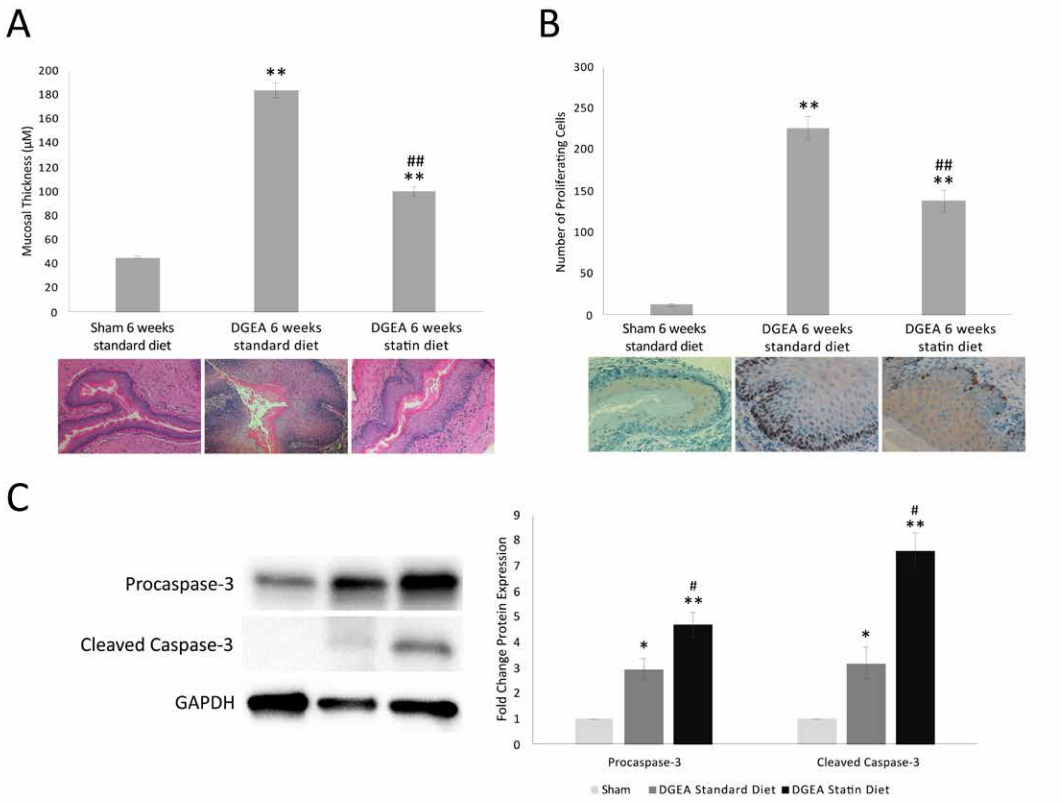
BASIC SCIENCE FORUM

1B. SIMVASTATIN INHIBITS HISTOLOGIC CHANGES ASSOCIATED WITH GASTRODUODENAL REFLUX IN A MURINE MODEL

CONTINUED

Esophageal changes in mice undergoing sham procedure, duodeno-gastroesophageal anastomosis (DGEA) with a standard diet, and DGEA with a simvastatin-containing diet.



A) H&E analysis at 20x magnification of the distal esophageal segment reveals a 4-fold increase in mucosal thickness of animals undergoing DGEA compared to sham procedure. In contrast, DGEA mice fed a simvastatin-containing diet demonstrate attenuation of this response, with significant reduction in mucosal hyperplasia. B) Immunohistochemical staining of ki67 at 40x magnification demonstrates a significant increase in the number of proliferating cells in mice undergoing DGEA, whereas mice fed a simvastatin-containing diet show attenuation of this response. C) Compared to sham mice and DGEA mice fed a standard diet, DGEA mice fed a simvastatin-containing diet demonstrate increased expression of procaspase-3 and cleaved caspase-3, signifying increased activation of apoptotic signaling.*p<0.05 to sham, **p<0.0001 to sham, #p<0.05 to DGEA standard diet, ##p<0.0001 to DGEA standard diet. n=9 per each group. DGEA: duodeno-gastroesophageal anastomosis.

BASIC SCIENCE FORUM

2B. VALPROIC ACID PRESERVE DONOR HEART FUNCTION AFTER PROLONGED COLD ISCHEMIC STORAGE THROUGH SUPPRESSING INNATE IMMUNITY ACTIVATION

AUTHORS
Ienglam Lei[1], Wei Huang[1], Zhong Wang[1], Y. Eugene Chen[1], Francis Pagani[1], Paul Tang[1]

AUTHOR INSTITUTION(S)
[1]University of Michigan, Ann Arbor, MI

OBJECTIVES:
Reperfusion injury following donor heart preservation is known to contribute to primary graft dysfunction following heart transplantation. The underlying mechanisms by which preservation processes contribute to donor heart dysfunction (primary graft failure) remains unclear. Valproic acid (VPA) has been used as an anti-epileptic and mood modulating drug. However, it is also known to inhibit inflammatory responses and promote cellular survival with recent recognition of potential utility in cardiovascular and oncological pathologies. We test its efficacy in optimizing donor heart function after cold storage preservation for the standard 4 hour clinical threshold and after an extended 8 hour period.

METHODS:
C57BL/6J strain Murine donor hearts were placed in cold storage with either HTK (histidine-trytophan-ketoglutarate) cardioplegia solution alone or with VPA for 0, 4, and 8 hours. Following cold storage, hearts were reanimated on an ex-vivo Langendorff apparatus using Krebs buffer perfusate for 90 minutes. Donor heart contractility (dP/dt Max) and relaxation (dP/dt min) was assessed as well as cardiac rhythm. Cell death was assessed by TUNEL staining per manufacturer instructions. Total RNA sequencing was performed by constructing a cDNA library and then amplified using multiplexing sequencing primers. The cDNA library was then sequenced with HiSeq 4000 using paired end mode. MyD88-/- mice were obtained from Jackson laboratory (Bar Harbor, ME).

RESULTS:
Increasing storage time with cold cardioplegic storage of murine donor hearts using HTK solution resulted in a progressive decline in contractility during ex-vivo perfusion. Preservation for 8 hours with HTK lead to severe primary graft dysfunction with a noncontractile heart. Addition of VPA with HTK solution (n=5) significantly improved cardiac function with an observed coordinated perfusing rhythm compared to asystole or ventricular fibrillation in HTK treated hearts alone (n=5) after 8hrs of storage. We also observed that VPA (n=5) reduced TUNEL positive apoptotic cells compared to HTK alone (figure, n=5, $P<0.05$). Total RNA sequencing with gene set enrichment analysis of donor hearts (n=4) demonstrated that innate immunity signaling pathway gene sets were significantly repressed by VPA. Further, 75% of MyD88-/- donor hearts (n=4) reanimated into a coordinated rhythm after 8 hours of storage compared to all wild type hearts (n=4) displaying severe dysfunction including asystole and ventricular fibrillation.

CONCLUSIONS:
VPA reduced the inflammatory and cell death response of donor hearts to cold cardioplegic preservation with HTK. This corroborated with the most dramatic improvement in donor heart function at the 8 hours storage time point with ex-vivo cardiac perfusion. Using the genetic MyD88-/- mice model, we believe that innate immune activation during preservation and following reperfusion likely plays a nonredundant role in primary graft dysfunction.

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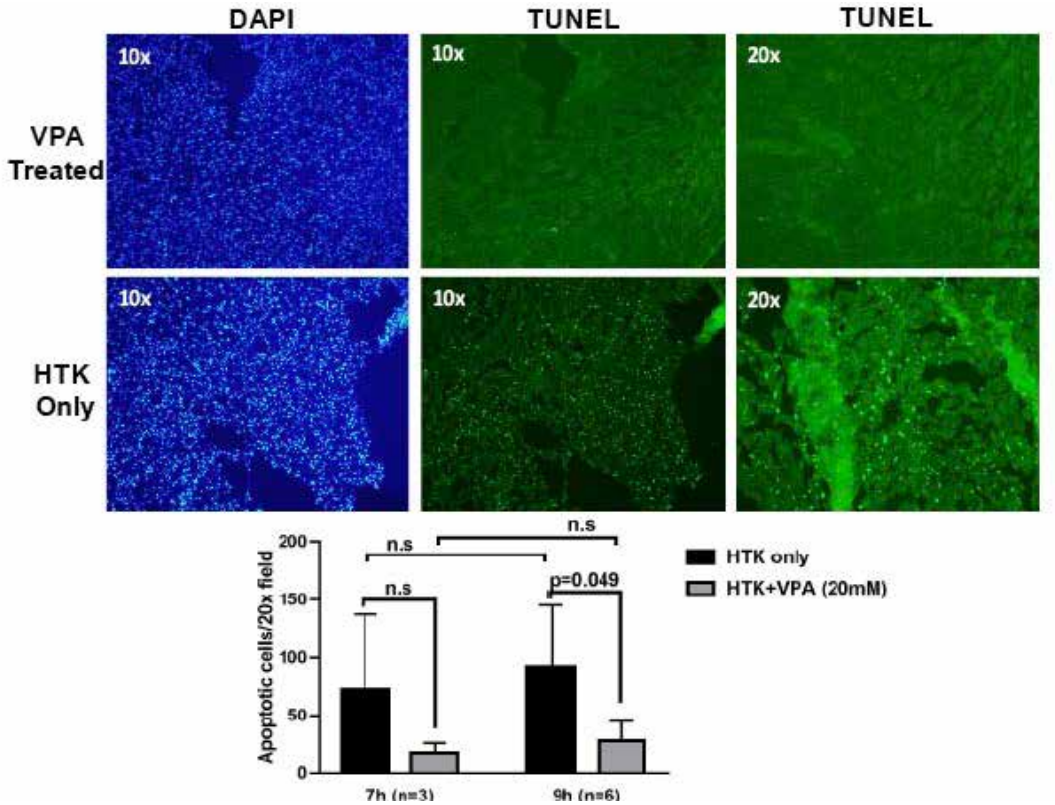
BASIC SCIENCE FORUM

2B. VALPROIC ACID PRESERVE DONOR HEART FUNCTION AFTER PROLONGED COLD ISCHEMIC STORAGE THROUGH SUPPRESSING INNATE IMMUNITY ACTIVATION

CONTINUED

Figure



Increased cellular survival in VPA treated hearts

BASIC SCIENCE FORUM

3B. DEVELOPMENT OF A PORCINE MODEL OF ARDS VIA GASTRIC ASPIRATION AND VENTILATOR-INDUCED INJURY

AUTHORS
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AUTHOR INSTITUTION(S)
[1]University of Virginia, Charlottesville, VA

OBJECTIVES:
Mainstays of current treatment for acute respiratory distress syndrome (ARDS) focus on supportive care and rely on intrinsic organ recovery. Organ-specific treatment strategies are lacking. While there are various animal models of ARDS, many are compromised by multi-organ injury or profound hemodynamic collapse. We hypothesize that superimposing gastric aspiration and ventilator-induced injury will induce ARDS with minimal hemodynamic impact.

METHODS:
Adult swine (n=7) were subjected to a 12-hour injury period followed by 24 hours of post-injury monitoring. Pre-injury labs, lung compliance, and bilateral bronchoalveolar lavage were obtained using standard ventilator settings: tidal volume (TV) = 10cc/kg, positive end expiratory pressure (PEEP) = 5 cm water, respiratory rate 12-15, FiO2 = 100%. The injury period began upon instillation of pooled, porcine gastric secretions (3cc/kg body weight/lung, pH 1-2) into right and left mainstem bronchi under direct bronchoscopic vision. Following instillation, ventilator settings were titrated to TV=20cc/kg, PEEP of 5 cm water for the first two hours, followed by PEEP of 0 for the subsequent 10 hours. Following the injury period, subjects were returned to standard ventilator settings. Arterial blood gas, lung compliance, and laboratory values were obtained at scheduled intervals.

RESULTS:
During the injury period there was no significant difference in mean PaO2/FiO2 ratio or dynamic compliance at 6 hours. Following the injury period at 12 hours, PaO2/FiO2 ratio (Figure 1) and static and dynamic compliance (Figure 2) were significantly reduced from baseline (all $p<0.05$). During the post-injury period, animals showed no signs of recovery as PaO2/FiO2 ratio and lung compliance remained significantly diminished. Mean arterial blood pressure did not change significantly throughout the duration of the injury and post-injury period ($p>0.05$), however 3/7 (42.9%) subjects did require intermittent or continuous use of vasopressors (norepinephrine) to maintain hemodynamic stability (median total dose 1.8g, interquartile range (IQR) = 1.35g-9.6g). Median time of death was 27.5 hours (IQR = 16.75-29.5) from initiation of injury.

CONCLUSIONS:
Twelve hours of high tidal volume and low PEEP in conjunction with low-pH gastric content instillation produces significant lung-specific injury. This large animal injury model may be useful for testing ARDS treatment strategies.

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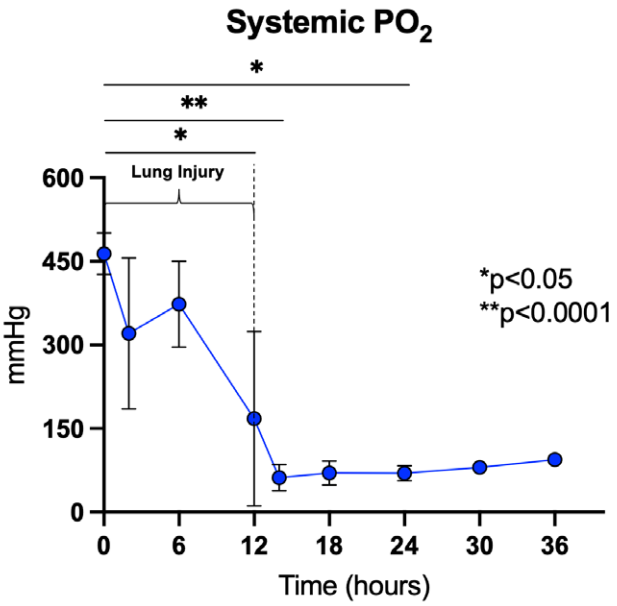
BASIC SCIENCE FORUM

3B. DEVELOPMENT OF A PORCINE MODEL OF ARDS VIA GASTRIC ASPIRATION AND VENTILATOR-INDUCED INJURY

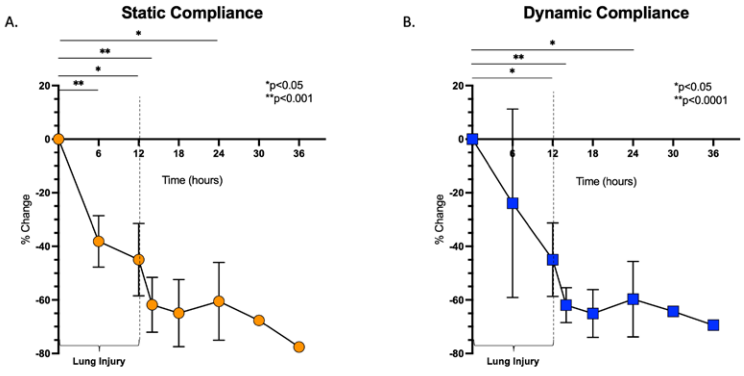
CONTINUED

Gastric aspiration and ventilator-induced injury effect on lung function: systemic arterial oxygenation.



A. Mean arterial oxygenation before, during and after 12-hour lung injury.

Gastric aspiration and ventilator-induced injury effect on lung function. A. Change in Static Lung Compliance. B. Change in Dynamic Lung Compliance.



Percent change in static and dynamic lung compliance from pre-injury baseline.

BASIC SCIENCE FORUM

4B. A PERCUTANEOUS PULMONARY ARTERY DRAINAGE DEVICE UNLOADS THE LEFT VENTRICLE IN A VA ECMO SUPPORTED SEVERE CARDIOGENIC SHOCK SHEEP MODEL

AUTHORS
Li Li[1], Cherry Ballard-Croft[1], Guangfeng Zhao[2], Stephen Topaz[2], Joseph Zwischenberger[1], Dongfang Wang[1]

COMMERCIAL RELATIONSHIPS:
D. Wang: Employment/ Research Grant/Ownership Interest: W-Z Biotech, Getinge; Other: AvalonElite

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OBJECTIVES:
We are developing a percutaneous pulmonary artery drainage device (pPADD) to unload the left ventricle (LV) during venoarterial extracorporeal membrane oxygenation (VA ECMO)-supported severe cardiogenic shock (CS).

METHODS:
The pPADD is a coaxial catheter with an inner/outer catheter and an expandable cylinder net (CN) woven with super-elastic nitinol alloy wire. Two types of pPADDs were fabricated with different CN mountings. In type 1, one end of CN was mounted on outer catheter tip and the other end on inner catheter body. In type 2, both ends of pre-shaped expanded CN were mounted on inner catheter body, with the CN folded inside outer catheter for safe/smooth insertion/advancement. When the pPADD is properly installed into PA via a peripheral vein, the expanded CN opens the PA/tricuspid valves for regurgitation flow from left atrium (LA)-right atrium (RA) through PA-right ventricle (RV) for ECMO drainage (Figure). The pPADD was tested in our VA-ECMO-supported severe CS with LV distension sheep model (n=3 type 1, n=3 type 2). Severe CS was induced by ligation of two left coronary artery branches. When severe CS criteria was met (cardiac output<2 L/min), VA ECMO via right jugular vein and carotid artery was initiated with 3.5-4.5 L/min flow. When left atrial pressure (LAP) was >18 mm Hg, LV distension was verified, and the pPADD was installed.

RESULTS:
In all 6 sheep, the severe CS model was successfully created (Table). VA ECMO flow restored the systemic circulation flow, stabilizing the hemodynamics to maintain perfusion. All animals on VA ECMO developed LV distension as shown by increased LAP and LV end diastolic pressure (LVEDP). The pPADD type 1 was inserted directly through the RA-RV to the PA. The pPADD type 2 was inserted through the right femoral vein into the PA via a guidewire. The CN was deployed in the desired location for opening the PA/tricuspid valves in all sheep. Expansion of the pPADD cylinder net immediately achieved 0.2±0.1 L/min regurgitation flow from the LA to PA. The LV was successfully unloaded in all sheep within one minute as demonstrated by the significantly decreased LVEDP and LAP. At necropsy, the pPADD CN was correctly positioned with the PA/tricuspid valves opened and withdrawn without difficulty. No injury/thrombosis was observed in the heart and PA/tricuspid valves.

CONCLUSIONS:
Our pPADD successfully induced sufficient retrograde PA blood flow to efficiently unload the LV in our VA ECMO-supported severe CS with LV distension sheep model.

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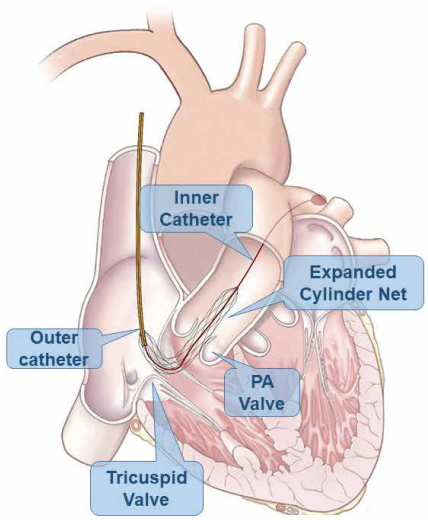
BASIC SCIENCE FORUM

4B. A PERCUTANEOUS PULMONARY ARTERY DRAINAGE DEVICE UNLOADS THE LEFT VENTRICLE IN A VA ECMO SUPPORTED SEVERE CARDIOGENIC SHOCK SHEEP MODEL

CONTINUED

The Percutaneous Pulmonary Artery Drainage Device (pPADD)



The pPADD is a coaxial catheter with an inner/outer catheter and an expandable cylinder net. Deployment of the pPADD with cylinder net expansion opens the PA and tricuspid valves.

Table: Hemodynamics

	Baseline	CS model	ECMO Support	LV Distension	pPADD assist
sABP (mm Hg)	115±4	47±7†	78±10*†	73±9†	76±4†
mABP (mm Hg)	87±11	35±9†	76±4*	72±9†	75±4†
CVP (mm Hg)	7±0.8	10±1.4†	10±1.2†	10±2.1†	9±1.2
PA flow (CO) (l/min)	4.2±0.5	1.5±0.7†	0.2±0.1*†	0*†	-0.2±0.1*†
ECMO flow (l/min)	0	0	3.7±0.3*†	3.7±0.2†	4.1±0.2*†
LVESP (mm Hg)	101±7.1	43±7.4†	77±10.1†	44±4.5†	22±2.7*†
LVEDP (mm Hg)	11±1.4	17±0.8†	19±1.2*†	21±1.3*†	11±2.1*†
LAP (mm Hg)	7±1.6	17±1.2†	19±1.3*†	21±1.6*†	11±2.2*†
mPAP (mm Hg)	14±1.5	17±1.2†	12±1.7*	19±1.5*†	11±1.6*†
HR (bpm)	107±6	278±49†	NA	NA	NA

* P<0.05 compared to the previous column † p<0.05 compared to Baseline
(N=6 sheep)
CS: Cardiogenic Shock, ECMO: Extracorporeal Membrane Oxygenation, LV: Left Ventricle, pPADD: Percutaneous Pulmonary Artery Drainage Device, sABP: Systolic Arterial Blood Pressure, mABP: Mean Arterial Blood Pressure, CVP: Central Venous Pressure, PA: Pulmonary Artery, CO: Cardiac Output, LVESP: Left Ventricular End-Systolic Pressure, LVEDP: Left Ventricular End-Diastolic Pressure, LAP: Left Atrial Pressure, mPAP: Mean Pulmonary Artery Pressure, HR: Heart Rate.

Hemodynamics during the testing of the pPADD device in sheep. Severe cardiogenic shock developed in all sheep. LV distension was present in all sheep supported by VA ECMO. The pPADD unloaded the LV.

BASIC SCIENCE FORUM

5B. BIOMARKER MULTIPLEX ASSAY IN CRITICALLY ILL COVID-19 PATIENTS REQUIRING EXTRACORPOREAL MEMBRANE OXYGENATION SUPPORT

AUTHORS
Alexey Abramov[1], Richard Dubois[1], Andrew Thornton[1], Danielle Feldhaus[1], Philippe Lemaitre[1], Cara Agerstrand[1], Daniel Brodie[1], Joshua Sonett[1], B. Payne Stanifer[1]

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OBJECTIVES:
Reports suggest up to 5% of cases develop critical illness with severe acute respiratory disease (ARDS). Inflammatory cytokine release has been implicated in disease progression and novel therapeutic interventions targeting distinct molecular pathways are currently under study in randomized control trials. While advanced age, comorbidities, organ dysfunction and hyperinflammatory state have been previously associated with mortality, optimal patient selection for extracorporeal membrane oxygenation (ECMO) remains unclear.

METHODS:
Retrospective chart review was performed on all SARS-CoV-2 positive patients cannulated to veno-venous, veno-arterial and veno-arterio-venous ECMO at an urban high-volume referral center from March 1st 2020 through January 1st, 2021. Demographics, clinical history, ventilation and ECMO settings, laboratory values, and hospital course data were collected. Patient serum was collected and frozen for later analysis performed on Luminex multiplex assay for the following biomarkers: Interleukin (IL)-2, IL-6, IL-8, IL-10, IFN-gamma, TNF-alpha, and CCL5 (RANTES) based on previous literature supporting their roles in Covid-19 disease and interventions. Primary outcome was defined as in-hospital mortality, and secondary outcomes included APACHE II (Acute Physiology and Chronic Health Evaluation) severity score, hospital length of stay, duration of ECMO run, tracheostomy status, administration of anti-inflammatory medications, clinical laboratory and inflammatory biomarkers panel at time of cannulation. R Project for Statistical Computing was used for statistical analysis with mean (standard deviation) or median (interquartile range) reported with Student, t-test, Mann-Whitney, correlation plots and linear regression for continuous variables, Fisher's exact test and logistic regression for categorical variables, and Kaplan-Meier used for time to event analysis.

RESULTS:
Thirty-three patients (27 male and six female) met inclusion criteria with mean age 46.6 years old (12.4) and BMI 30.7 kg/m2 (6.77). Eight patients (24.2%) had no comorbidities. Mean APACHE II score was 28.1 (5.18). Mean hospital day of initiation ECMO was 10.4 (6.06) and mean duration of ECMO run was 36.5 days (27.4). Seventeen patients (51.5%) died, and 16 (48.5%) survived to hospital discharge. Patient serum for multiplex assay available for 18 patients at time of cannulation (9 died, 9 survived) did not attain significance but revealed clinically meaningful differences (Figure1). Higher median IL-6 was observed in survivor group compared to non-survivors (2393 pg/mL vs. 379.21pg/mL, p = 0.339) and median CCL5 (RANTES) was lower in survival group 25697 vs. 42218.5, p = 0.515). Patients with lower CCL5 (RANTES) below the sample median (33,987 pg/mL) was also associated with a significant survival benefit (p = 0.03).

CONCLUSIONS:
COVID-19 patients with refractory respiratory failure who mount an initially robust inflammatory response with higher IL-6 and lower CCL5 (RANTES) may be better candidates for ECMO support. Consideration of inflammatory markers at time of cannulation and further biomarker trends when in a resource-challenged healthcare setting may optimize candidate selection and help predict survival to hospital discharge.

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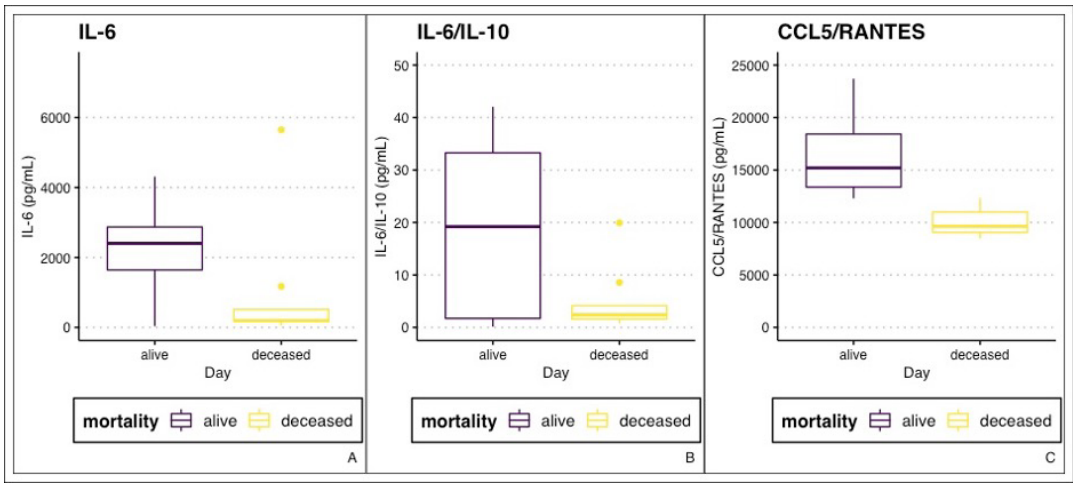
BASIC SCIENCE FORUM

5B. BIOMARKER MULTIPLEX ASSAY IN CRITICALLY ILL COVID-19 PATIENTS REQUIRING EXTRACORPOREAL MEMBRANE OXYGENATION SUPPORT

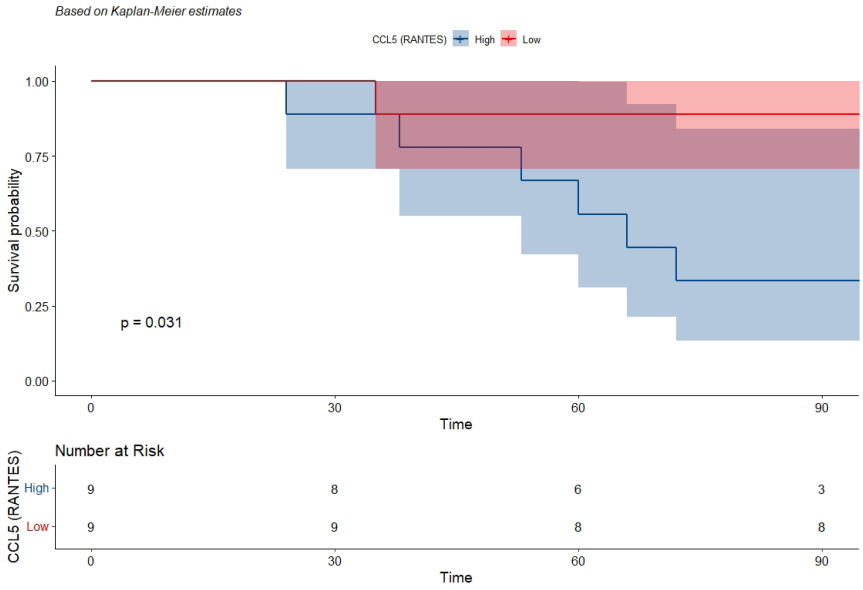
CONTINUED

Multiplex Immunoassay of Inflammatory Biomarkers in Covid-19 Patients on Extracorporeal Membrane Oxygentation



Boxplots demonstrating clinically meaningful differences from serum collected from 18 patients with Covid-19 requiring extracorporeal membrane oxygenation support, collected at time of cannulation. Values of (A) interleukin-6, (B) interleukin-6: interleukin 10 ratio, (C) CCL5 / RANTES are shown.

CCL5 (RANTES) in Covid-19 Patients on Extracorporeal Membrane Oxygenation Support



Kaplan Meier plot of CCL5 (RANTES) values (pg/mL) from Covid-19 patients with serum collected at time of extracorporeal membrane oxygenation cannulation. Patients stratified to High had a CCL5 (RANTES) value above the sample median value of 33897 pg/mL, and Low were below sample median.

FIRST SCIENTIFIC SESSION

1. CONCOMITANT INITIAL PALLIATION AND VAD INSERTION IN 15 HIGH-RISK NEONATES AND INFANTS WITH FUNCTIONALLY UNIVENTRICULAR HEARTS (HLHS OR HRHS)

AUTHORS
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OBJECTIVES:
Some patients with hypoplastic left heart syndrome (HLHS) or hypoplastic right heart syndrome (HRHS) are high risk for conventional surgical palliation. Primary cardiac transplantation offers the best option for survival of these challenging neonates; however, waitlist mortality must be minimized. We report 15 high-risk neonates and infants with HLHS (n=9) or HRHS (n=6) stabilized with concomitant initial palliation + VAD insertion (Palliation+VAD) in preparation for transplantation.

METHODS:
Fifteen patients with HLHS (7 neonates, 2 infants [Table 1]) or HRHS (4 neonates, 2 infants [Table 2]) presented with anatomical and/or physiological features associated with increased risk for conventional univentricular palliation (large coronary sinusoids with ventricular dependent coronary circulation, severe systemic tricuspid regurgitation, cardiogenic shock, or restrictive atrial septum). These patients underwent combined VAD insertion (Berlin EXCOR) and initial palliation (HLHS: application of bilateral pulmonary bands, stent placement in the PDA, and atrial septectomy if needed; HRHS: central shunt or stent placement in the PDA).

During this same era, at our institution, 50 neonates underwent Norwood Operation (with Operative Mortality of 4.0% [2/50]), three neonates underwent Hybrid Approach "Stage 1" without VAD, and three HLHS patients were supported with prostaglandin while awaiting transplantation; while 21 neonates and infants underwent initial palliation for HRHS with systemic-to-pulmonary artery shunts (12), PA Bands (3), or primary Glenn (6) (with Operative Mortality of 4.8% [1/21]).

RESULTS:
At Palliation+VAD, median age = 21 days (range = 4-143) and median weight = 3.47 kilograms (range = 2.43-4.68). Ten patients survive (67%) and five patients died (33%). Seven survivors are at home doing well after successful transplantation and three survivors are doing well in the ICU on VAD support awaiting transplantation.

Only two of nine patients with HLHS experienced strokes, and both of these strokes were after 150 days on VAD. Two of six patients with HRHS experienced strokes (one after 90 days on VAD and one after 10 days on VAD in a patient with Factor V Leiden in whom anticoagulation was stopped due to bleeding from the VAD cannula)

Only two of ten survivors (20%) required intubation more than 10 days after Palliation+VAD. In twelve patients no longer on VAD, median length of VAD support was 99.5 days (range = 30-196 days).

CONCLUSIONS:
High-risk patients with HLHS or HRHS who are suboptimal candidates for conventional palliation can be successfully stabilized with pulsatile VAD insertion along with initial palliation while awaiting cardiac transplantation; these patients may be extubated, enterally nourished, and optimized for transplantation while on VAD.

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FIRST SCIENTIFIC SESSION

1. CONCOMITANT INITIAL PALLIATION AND VAD INSERTION IN 15 HIGH-RISK NEONATES AND INFANTS WITH FUNCTIONALLY UNIVENTRICULAR HEARTS (HLHS OR HRHS)

CONTINUED

Table 1. Clinical Characteristics, Indications for Support, Procedural Details and Outcomes of Nine Patients with HLHS supported with HYBRID+VAD

VAD Implant Year	Diagnosis	Indication for VAD	Surgery Prior to VAD Implant	Age at VAD Implant (days)	Weight at VAD Implant (kilograms)	Transplant vs. Death	Length of VAD Support (days)	Days in Hospital prior to VAD Implant	Intubation >10 Days After VAD implant
Survivors									
2017	HLHS (MA+AA)	Cardiogenic shock with incessant arrhythmia	None	20	3.8	Transplant	64	20	No
2018	HLHS (MS+AA) Large Coronary Sinusoids	Unfavorable anatomy (Large Coronary Sinusoids)	None	20	2.43	Transplant	162	20	Yes
2020	HLHS (MS+AA)	Cardiogenic shock needing ECMO	None	13	4	Transplant	101	13	No
2020	HLHS (MS+AA) Large Coronary Sinusoids	Unfavorable anatomy (Large Coronary Sinusoids with coronary stenoses confirmed on catheterization)	None	25	3.1	Transplant	196	24	No
2020	HLHS (MA+AA) Severe pulmonary venous obstruction, cor triatriatum, and restrictive atrial septum	Heart failure	Hybrid	100	4.2	Doing well in the ICU (Still on VAD awaiting transplant)	263 days as of April 3, 2021	25	No
2020	HLHS (MS+AA) Large Coronary Sinusoids	Unfavorable anatomy (Large Coronary Sinusoids)	None	19	3.19	Transplant	188	19	No
Non-Survivors									
2017	HLHS (MA+AA) Severe Tricuspid Regurgitation	Late referral with Heart Failure and associated end organ dysfunction	None	143	3.85	Death from Sepsis and MODS. End organ function made marginal improvement on VAD	138	111	Yes
2018	HLHS (MS+AA) Large Coronary Sinusoids	Unfavorable anatomy (Large Coronary Sinusoids)	None	18	3.25	Withdrawal severe liver dysfunction	56	13	Yes
2018	HLHS (MA+AS) Severe Tricuspid Regurgitation	Heart Failure and Severe Tricuspid Regurgitation	None	24	2.9	Bowel infarct in SMA territory	98	23	No

Table 2. Clinical Characteristics, Indications for Support, Procedural Details and Outcomes of Six Patients with HRHS supported with PALLIATION+VAD

Date of VAD Implant	Diagnosis	Indication for VAD	Surgery Prior to VAD Implant	Age at VAD Implant (days)	Weight at VAD Implant (kilograms)	Transplant vs. Death	Length of VAD Support (days)	Days in Hospital prior to VAD Implant	Intubation >10 Days After VAD implant
Survivors									
2017	Pulmonary atresia and Intact Ventricular Septum with RV dependent coronary artery circulation	Signs of coronary ischemia	None	110	3.47	Transplant	167	24	Yes
2018	Pulmonary atresia and Intact Ventricular Septum with RV dependent coronary artery circulation	Cardiogenic Shock	None	4	4.68	Transplant	64	4	No
2020	Pulmonary atresia and Intact Ventricular Septum with RV dependent coronary artery circulation	Unfavorable anatomy (Large Coronary Sinusoids)	None	21	4.3	Doing well in the ICU (Still on VAD awaiting transplant)	172 days as of April 3, 2021	21	No
2020	Pulmonary atresia and Intact Ventricular Septum with RV dependent coronary artery circulation	Unfavorable anatomy (Large Coronary Sinusoids)	None	25	3.6	Doing well in the ICU (Still on VAD awaiting transplant)	151 days as of April 3, 2021	25	No
Non-Survivors									
2019	Pulmonary atresia and Intact Ventricular Septum with RV dependent coronary artery circulation	Unfavorable anatomy (Large Coronary Sinusoids)	None	18	3.18	Death from liver failure	80	18	No
2019	DORV with pulmonary valve atresia	Cardiogenic shock Bridge from ECPR	Central Shunt	34	2.7	Death from MODS	30	34	Yes

FIRST SCIENTIFIC SESSION

2. INCIDENCE AND IMPACT OF PROSTHESIS-PATIENT MISMATCH AFTER SURGICAL AORTIC VALVE REPLACEMENT: ANALYSIS OF THE PARTNER RANDOMIZED TRIALS

AUTHORS
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COMMERCIAL RELATIONSHIPS:
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OBJECTIVES:
The clinical effects of prosthesis-patient mismatch (PPM) after SAVR remains controversial and prior studies were performed retrospectively without an echo core laboratory. Our objective was to compare the incidence and impact of PPM at 2 years following SAVR within the prospective, randomized PARTNER trials.

METHODS:
1,682 SAVR patients from the PARTNER 1, 2, and 3 trials were included for this analysis. PPM was classified as moderate if indexed EOA (EOAi) was ≤0.85cm2/m2 (or ≤0.70 cm2/m2 if obese: body mass index ≥ 30 kg/m2) and severe if EOAi≤0.65cm2/m2 (or ≤0.55cm2/m2 if obese). Predicted PPM was determined by using the normal reference values of EOA previously reported for each model and size of prosthetic valve and indexed for BSA. All echocardiography was adjudicated by a core laboratory and all major outcomes by a CEC. The primary endpoint was the composite of all-cause death/re-hospitalization at two years.

RESULTS:
There was a 29.6% rate of moderate (28.4%) and severe (1.2%) PPM in all patients. The average age was 80.0±7.6 years and predominantly male (59.5%). The mean crossclamp time was 74.5±28.9 mins and CPB time 102.7±42.1 mins. While there was no difference in baseline AVA among groups (p=0.78), there was a significant difference at 2 years (no PPM:1.63±0.46cm2, moderate PPM:1.38±0.39cm2, and severe PPM:1.17±0.37cm2, p<0.0001). Correspondingly, the mean gradient was similar among groups at baseline (p=0.28); but was significantly higher in the severe PPM patients at 2 years (no PPM:10.3±4.1mmHg, moderate PPM:13.7±5.0mmHg, and severe PPM:17.6±6.2mmHg,p<0.0001). Interestingly, there was no difference in indexed LV mass regression among groups at 2 years (no PPM:98.7±28.4, moderate PPM:98.5±27.9, and severe PPM:104.9±27.3,p=0.76). There was no significant difference in the primary endpoint among groups at 2 years (no PPM:32.2%, moderate PPM:34.2%, and severe PPM:47.4%,p=0.14). However, there was a trend to higher all-cause death in the severe PPM group at 2 years (no PPM:16.8%, moderate PPM:19.6%, and severe PPM:30.2%, p=0.055); which was significant when comparing no PPM to severe PPM (p=0.04)(Figure). Other major comorbidities were similar among groups at 2 years (Table).

CONCLUSIONS:
Approximately 30% of all patients undergoing SAVR in the PARTNER trials had moderate to severe PPM at 2 years by core lab adjudication. There was a higher all-cause mortality in those with severe PPM. Other techniques, like measured EOAi, may provide additional information and will be compared to predicted EOAi in the presentation. Surgical techniques to minimize severe PPM remains critical and longer follow-up is required to assess the ongoing effects of PPM after SAVR.

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2. INCIDENCE AND IMPACT OF PROSTHESIS-PATIENT MISMATCH AFTER SURGICAL AORTIC VALVE REPLACEMENT: ANALYSIS OF THE PARTNER RANDOMIZED TRIALS

CONTINUED

Figure 1: All Cause and Cardiac Mortality

Figure 1A: All Cause Mortality

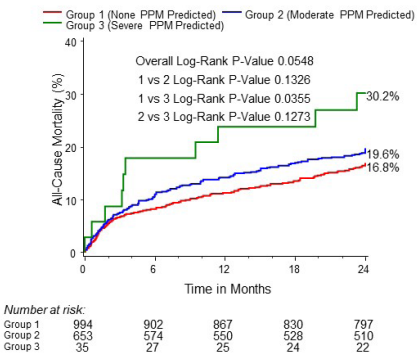

Figure 1B: Cardiac Mortality

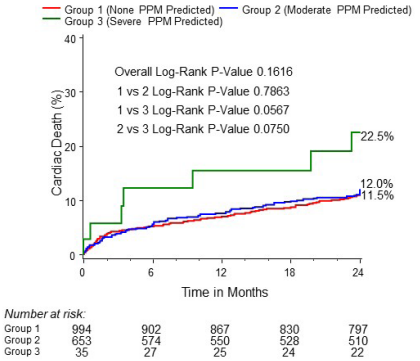

Table 1. Major Adverse Events

Outcomes	No PPM	Mod PPM	Severe PPM	All Patients	P values
Death, rehospitalization, or stroke	245 (35.51%)	189 (37.74%)	15 (50.77%)	449 (36.79%)	0.19
Death or rehospitalization	221 (32.15%)	171 (34.23%)	14 (47.43%)	406 (33.37%)	0.14
Death or stroke	191 (19.62%)	150 (23.37%)	11 (33.14%)	352 (21.35%)	0.05
Death or major stroke	182 (18.59%)	139 (21.60%)	10 (30.23%)	331 (19.98%)	0.12
All-Cause Death	164 (16.78%)	126 (19.61%)	10 (30.23%)	300 (18.14%)	0.055
Cardiovascular Death	109 (11.53%)	73 (11.98%)	7 (22.51%)	189 (11.91%)	0.16
Non-cardiovascular Death	93 (9.94%)	74 (12.05%)	4 (13.87%)	171 (10.84%)	0.36
Stroke	89 (9.57%)	55 (9.15%)	2 (7.35%)	146 (9.36%)	0.86
Major (disabling)	80 (8.60%)	43 (7.17%)	1 (4.35%)	124 (7.97%)	0.41
Minor (non-disabling)	47 (5.21%)	36 (6.24%)	2 (7.35%)	85 (5.64%)	0.69
Any Myocardial infarction	54 (6.02%)	37 (6.28%)	3 (10.95%)	94 (6.21%)	0.6
Major Vascular Complication	70 (7.48%)	50 (8.18%)	4 (13.41%)	124 (7.87%)	0.49
new Acute Stage III/IV Kidney Injury	35 (5.35%)	37 (7.82%)	3 (12.46%)	75 (6.51%)	0.16
New Pacemaker	105 (11.37%)	62 (10.42%)	4 (13.78%)	171 (11.05%)	0.76

FIRST SCIENTIFIC SESSION

3. EXTRACORPOREAL MEMBRANE OXYGENATION FOR PATIENTS WITH THORACIC NEOPLASM

AUTHORS
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OBJECTIVES:
Extracorporeal Membrane Oxygenation (ECMO) is utilized in the management of severe respiratory and circulatory failure. Although advanced malignancy is a contraindication, the indication for ECMO in the oncologic population has not been clearly established due to the wide spectrum of malignant disease and prognoses. Among malignancies, thoracic neoplasms are unique in their effect on cardiopulmonary function, due to both direct tumor effects and associated cardiothoracic interventions. This study aims to better define the role of ECMO for thoracic neoplasms.

METHODS:
The Extracorporeal Life Support Organization (ELSO) database was queried for patients older than 18 years with an International Classification of Diseases, Ninth and Tenth Revision (ICD-9 and 10) code of neoplasm over the past two decades (2000-2019). Outcomes and clinical data including associated procedures were analyzed.

RESULTS:
Four hundred and ninety-eight patients met inclusion criteria: 34 upper airway, 247 lung, 45 unspecified respiratory tract, 4 pleura, 19 heart, 40 mediastinum, 108 esophagus, and 1 unspecified intrathoracic neoplasm. One hundred and ninety-eight patients survived to discharge and survival rate was significantly lower than ECMO for overall diagnosis in the same time period (39.8 % vs 49.0%; p<0.001). Among subtypes of thoracic neoplasm, upper airway neoplasms were associated with better prognosis (73.5%; p=0.004) while lung neoplasms were associated with worse prognosis (30.0%; p<0.001) when compared with ECMO for overall diagnosis (Table 1). One hundred and sixty-one cases were associated with major thoracic or airway procedures which were primarily performed before ECMO initiation. Favorable prognosis was associated with tracheal procedure (71.4%, n=7) and major bronchoscopic intervention (58.8%, n=17), while poor prognosis was seen with pneumonectomy (15.2%, n=33), any types of lung resection (24.1%, n=87), and esophageal procedures (20.0%, n=15) (Table 2). Thirty-five patients underwent cardiac procedures with survival rate of 47.1%. Lung transplant was performed in 12 patients (7 with malignant neoplasm and 5 with neoplasm of uncertain behavior), which resulted a survival rate of 58.3%.

CONCLUSIONS:
Utility of ECMO for patients with thoracic neoplasms has increased over time along with an overall upswing in adult ECMO applications. The outcome for ECMO among patients with a thoracic neoplasm is variable, depending on clinical factors including tumor subtype, stage, and type of associated procedure. Clinicians should continue to focus on individualized patient selection, utilizing results of past experiences.

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3. EXTRACORPOREAL MEMBRANE OXYGENATION FOR PATIENTS WITH THORACIC NEOPLASM

CONTINUED

Table 1: Survival by Neoplasm Subtype

Neoplasm Subtype	Total	Survivor	Survival Rate	*p* value*
Upper Airway	34	25	73.5%	**0.004**
Lung	247	74	30.0%	**<0.001**
Respiratory Tract Unspecified	45	24	53.3%	0.342
Pleura	4	2	50.0%	0.967
Mediastinum	40	23	57.5%	0.281
Heart	19	7	36.8%	0.290
Esophagus	108	43	39.8%	0.057
Thoracic Unspecified	1	0	0.0%	0.307
Total of Thoracic Malignancy	498	198	39.8%	**<0.001**
Overall Diagnosis 2010-2019	60129	29447	49.0%	

*Comparison with overall diagnosis while same time period

Table 2: Survival by Procedure

Procedure	Total	Timing of Procedure		Support Type		Suvival at Discharge
Pneumonectomy	33	Pre-ECMO	30	Pulmonary	25	5 (15.2%)
		On-ECMO	3	Cardiac	6	
		Post-ECMO	0	ECPR	2	
Lobectomy	48	Pre-ECMO	41	Pulmonary	37	14 (29.2%)
		On-ECMO	6	Cardiac	8	
		Post-ECMO	1	ECPR	3	
Sublober Lung Resection	5	Pre-ECMO	4	Pulmonary	3	1 (20.0%)
		On-ECMO	1	Cardiac	2	
		Post-ECMO	0	ECPR	0	
Any Types of Lung Resection	87	Pre-ECMO	76	Pulmonary	66	21 (24.1%)
		On-ECMO	10	Cardiac	16	
		Post-ECMO	1	ECPR	5	
Bronchoscopic Procedure	17	Pre-ECMO	4	Pulmonary	16	10 (58.8%)
		On-ECMO	11	Cardiac	0	
		Post-ECMO	2	ECPR	1	
Tracheal and Bronchial Procedure	7	Pre-ECMO	5	Pulmonary	7	5 (71.4%)
		On-ECMO	2	Cardiac	0	
		Post-ECMO	0	ECPR	0	
Esophageal Procedure	15	Pre-ECMO	14	Pulmonary	13	3 (20.0%)
		On-ECMO	1	Cardiac	2	
		Post-ECMO	0	ECPR	0	
Lung Transplant	12	Pre-ECMO	9	Pulmonary	11	7 (58.3%)
		On-ECMO	3	Cardiac	0	
		Post-ECMO	0	ECPR	1	
Crdiac Procedure	35	Pre-ECMO	28	Pulmonary	10	16 (47.1%)
		On-ECMO	7	Cardiac	19	
		Post-ECMO	0	ECPR	6	

FIRST SCIENTIFIC SESSION

4. COMPLEXITY AND OUTCOME OF REOPERATIONS AFTER THE ROSS PROCEDURE IN THE CURRENT ERA

AUTHORS
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OBJECTIVES:
The Ross procedure is an aortic valve replacement option with the potential for longer durability without anti-coagulation. Despite potential advantages, the need for reintervention is inevitable for many and procedures may be complex. The aim of this study was to examine the complexity and outcomes of reoperation after the Ross procedure.

METHODS:
Retrospective chart review was performed of patients with prior Ross procedure who underwent their first reoperation at our institution from September 1991 to January 2021. Demographic, echocardiographic, surgical, and perioperative data were collected. Descriptive statistical analysis was performed.

RESULTS:
A total of 99 patients underwent reoperation after a Ross procedure performed either at our institution (n=16, 16.2%) or elsewhere (n=83, 83.8%). Mean age at Ross was 28 ±17years and mean age at first reoperation was 38.3 ±18.7 years. Indications for surgery varied (Table) with the most common being severe combined autograft regurgitation/stenosis. A total of 235 procedures were performed in these 99 patients (Table). Autograft valve replacement or root replacement was performed in 74 patients (74.7%). Pulmonary valve or conduit replacement was performed in 47 patients (47.5%), with intraoperative right pulmonary artery stent in 1 patient. Double root replacement was performed in 11 patients (11.1%). Aortic reconstruction was performed in 38 patients (38.4%); ascending aortic replacement in 20 (20.2%), combined ascending/hemi arch replacement in 14 (14.1%), valve sparing root replacement in 2 (2%) and total arch replacement in 1 patient (1%). There were 4 early deaths (4%); one with endocarditis post-operatively, one with ARDS and multi-organ failure and two who underwent multi-valve plus aortic intervention. Complications included arrhythmia in 20 (20.2%), ECMO in 4 (4%), Post op respiratory failure in 6(6%) and stroke in 1 patient (1%). There were 17 patients who required subsequent interventions (20.3%), including 2 patients who underwent transcatheter pulmonary valve replacement 6 years after surgery, 1 patient who underwent transcatheter pulmonary and aortic valve replacement 7 years after reoperation, and 1 patient that underwent heart transplant. Late deaths occurred in 9 patients (9%; total mortality 13.1%) during a median follow-up of 42 months (3–179 months). Patients with ejection fraction <30% on preoperative echo had shorter duration between Ross and subsequent reoperation (p=0.03).

CONCLUSIONS:
Reoperations after the Ross procedure are complex, performed for a wide range of indications, and are associated with significant morbidity and mortality. Protocolized imaging follow-up is essential and reoperation should be advised prior to LV dysfunction. Percutaneous and intraoperative transcatheter techniques may enhance management of these complex patients.

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4. COMPLEXITY AND OUTCOME OF REOPERATIONS AFTER THE ROSS PROCEDURE IN THE CURRENT ERA

CONTINUED

Table 1: Demographic and procedural factors of patients having reoperation after the Ross procedure.

Variables	Estimate
Sex, male, n (%)	68 (68.7)
Age at Ross, Mean ± SD	28 ±17
Age at first reoperation at our institution, Mean ± SD	38.3 ±18.7
Indications for surgery, n (%)	
Severe Combined autograft regurgitation/stenosis	24 (24.2)
Lone severe pulmonary conduit regurgitation/stenosis	18(18.1)
Combined autograft regurgitation, ascending aortic aneurysm	15 (15.1)
Combined autograft regurgitation/dilation	15 (15.1)
Isolated severe autograft regurgitation	6 (6)
Procedures performed, n (%)	
Autograft valve/root replacement	74 (74.4)
Aortic root replacement	50 (50.5)
Isolated valve replacement	24 (24.2)
Pulmonary valve/conduit replacement	47 (47.4)
Pulmonary conduit replacement	21 (21.2)
Isolated valve replacement	26 (26.2)
Double root replacement	11 (11.1)
Aortic surgery	38 (38.4)
Ascending aortic aneurysm repair	20 (20.2)
Combined ascending/hemi arch replacement	14 (14.1)
Valve sparing root replacement	2 (2)
Total arch replacement	1 (1)
Isolated arch repair	1 (1)
Percutaneous interventions, n (%)	
Percutaneous stent placement	4 (4)
Percutaneous valve implantation	3 (3)
Percutaneous balloon dilation	3 (3)

n: Number of patients; %: Percentage of total number of patients (99 patients);

FIRST SCIENTIFIC SESSION

5. CONTEMPORARY MANAGEMENT OF ISCHEMIC MITRAL REGURGITATION AT THE TIME OF CORONARY ARTERY BYPASS GRAFTING

AUTHORS
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OBJECTIVES:
Recent guidelines have changed regarding the treatment of moderate or severe ischemic mitral regurgitation (IMR) in patients undergoing coronary artery bypass grafting (CABG). The purpose of this study was to assess the real world impact of changing guidelines and the development of transcatheter interventions on the volume and management of IMR during CABG over time.

METHODS:
Patients undergoing CABG in a statewide collaborative database (2011-2020) were stratified by severity of IMR. Patients with degenerative MR, endocarditis, or concomitant aortic/ aortic valve procedures were excluded. Pairs of patients with and without mitral intervention were propensity score matched to further compare outcomes. Perioperative complications and mortality were compared between groups. Finally, rates of mitral intervention including repair versus replacement rates were evaluated.

RESULTS:
A total of 11,676 patients underwent CABG including 6,431 (54.9%) with no MR, 3,490 (30.1%) with mild MR, 1,355 (11.6%) with moderate MR, and 390 (3.3%) with severe MR. Mitral valve surgery was performed in 522 patients (421 repair, 101 replacement), including 0.1% of patients with mild MR, 0.8% of patients with mild MR, 12.7% of patients with moderate MR, and 80.3% of severe MR. The overall rate of mitral intervention at the time of CABG remained stable (p-trend 0.96). Rates of mitral intervention for moderate MR decreased over time (2011: 17.7%, 2020: 7.5%, p-trend 0.001), while the rates of mitral replacement remained steady for severe MR (Replacement: 2011 11.1%, 2020: 13.3%, p-trend 0.14) (Figure). The addition of a mitral operation did not increase operative mortality (Table). However, major morbidity was higher among patients with moderate IMR who underwent mitral intervention compared to those who did not (29.1% vs 19.9%, p=0.005). In a propensity analysis of 249 well-matched pairs, there was no significant difference in major morbidity (29.3% with mitral intervention vs. 23.7% without, p=0.16) or operative mortality (1.2% with mitral intervention vs. 2.4% without, p=0.5). However, intensive care unit length of stay (6.2 days vs. 4.8 days, p=0.03) and overall length of stay (11.6 days vs. 10.3 days, p=0.03) were longer for patients undergoing mitral intervention.

CONCLUSIONS:
Consistent with recent guideline updates, patients with moderate ischemic MR were less likely to undergo mitral repair. However, contrary to guidelines updates, the rate of replacement for severe ischemic MR did not change. Mitral intervention does not impact mortality or morbidity, but results in longer hospital stays.

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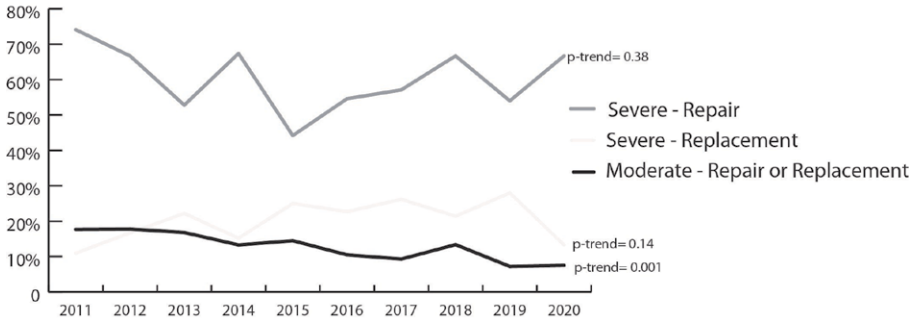
FIRST SCIENTIFIC SESSION

5. CONTEMPORARY MANAGEMENT OF ISCHEMIC MITRAL REGURGITATION AT THE TIME OF CORONARY ARTERY BYPASS GRAFTING

CONTINUED

Rate of Mitral Intervention by Year and Mitral Regurgitation Severity



Major Morbidity and Mortality by Severity of Mitral Regurgitation and Mitral Intervention

MR Severity	Mitral Intervention	Major Morbidity	Mortality
None (n=6,413)	No (n=6,404; 99.9%)	845 (13.2%)	40 (0.6%)
	Yes (n=9; 0.01%)	3 (33.3%)	0 (0%)
		p=0.1	p>0.999
Mild (n=3,518)	No (n=3,490; 99.2%)	556 (15.9%)	32 (0.92%)
	Yes (n=28; 0.8%)	7 (25%)	0 (0%)
		p=0.19	p>0.999
Moderate (n=1,355)	No (n=1,183; 87.3%)	235 (19.9%)	12 (1.0%)
	Yes (172; 12.7%)	50 (29.0%)	1 (0.58%)
		p=0.005	p=>0.999
Severe (n=390)	No (77; 19.7%)	16 (20.8%)	2 (2.6%)
	Yes (313; 80.3%)	89 (28.4%)	7 (2.2%)
		p=0.17	p=0.69

FIRST SCIENTIFIC SESSION

6. CONVERSION TO THORACOTOMY DURING THORACOSCOPIC AND ROBOTIC LOBECTOMY: PREDICTORS AND IMPACT ON MORBIDITY AND MORTALITY

AUTHORS
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OBJECTIVES:
Conversion to thoracotomy during minimally invasive lobectomy for lung cancer is occasionally necessary. Predictors of conversion, outcomes, and differences between video-assisted thoracoscopic (VATS) and robotic-assisted (RATS) lobectomy conversion have not been elucidated. We utilized The Society of Thoracic Surgeons (STS) General Thoracic Surgery Database (GTSD) to study conversion.

METHODS:
We queried the GTSD from January 1, 2015 to December 31, 2018. Patients with prior thoracic operations and metastatic disease were excluded. Data were analyzed using Chi-squared and Kruskal-Wallis tests for univariate analyses and multivariate logistic regression modeling.

RESULTS:
This study included 27,695 minimally invasive lobectomies from 269 centers. Conversion to thoracotomy occurred in 11.0% of VATS and 6.0% of RATS ($p<0.001$). Conversion was associated with increased mortality ($p<0.001$), major complications ($p<0.001$), and intra- ($p<0.001$) and post-operative ($p<0.001$) blood transfusions (Table 1). Conversion from RATS occurred emergently ($p<0.001$) and for vascular injury ($p<0.001$) more frequently than from VATS with no difference in major complications or mortality; however, conversion from RATS was associated with increased rate of intraoperative blood transfusion (Table 2). Mortality following conversion was similar between RATS and VATS (3.1% vs 2.2%, respectively, $p=0.24$). Clinical cancer stage II or III ($p<0.001$), preoperative chemotherapy ($p=0.003$), decreased FEV1 ($p=0.006$), BMI ($p<0.001$), and left-sided resection ($p=0.002$) independently predicted VATS conversion. For RATS, clinical stage III ($p=0.037$) and decreased FEV1 ($p=0.002$) predicted conversion. Lower volume centers had increased rates of conversion ($p<0.001$).

CONCLUSIONS:
Conversion from minimally invasive to open lobectomy is associated with increased morbidity and mortality. Conversion occurs more frequently during VATS compared to RATS lobectomy; however, rates of mortality and major complications are similar whether converting from VATS or RATS. Predictors, urgency, and reasons for conversion differ between RATS and VATS lobectomy and may assist in patient selection.

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6. CONVERSION TO THORACOTOMY DURING THORACOSCOPIC AND ROBOTIC LOBECTOMY: PREDICTORS AND IMPACT ON MORBIDITY AND MORTALITY

CONTINUED

Table 1

	Mortality[a]		Major Complication[b]		Intraoperative blood products		Post-operative blood products	
	Adjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value	Adjusted OR (95% CI)	P-value
RATS vs VATS	0.85 (0.62, 1.16)	0.31	0.96 (0.83, 1.12)	0.65	1.19 (0.79, 1.80)	0.42	0.84 (0.64, 1.10)	0.20
Conversion vs no conversion	2.35 (1.67, 3.31)	**<0.001**	2.04 (1.72, 2.41)	**<0.001**	19.5 (14.30, 26.60)	**<0.001**	3.15 (2.55, 3.89)	**<0.001**

a – Operative mortality is defined in STS GTSD as (1) all deaths, regardless of cause, occurring during the hospitalization in which the operation was performed, even if after 30 days (including patients transferred to other acute care facilities); and (2) all deaths, regardless of cause, occurring after discharge from the hospital, but before the end of the 30th postoperative day.

b – Major complication is defined as one or more postoperative events comprising the composite risk models for lobectomy (pneumonia, acute respiratory distress syndrome (ARDS), bronchopleural fistula, pulmonary embolus, initial ventilator support > 48 hours, reintubation/respiratory failure, tracheostomy, myocardial infarction, unexpected return to OR)

Adjusted odds ratios of outcomes with RATS versus VATS lobectomy and with conversion to open thoracotomy

Table 2

	Univariable			Multivariable	
	RATS to Open	VATS to Open	P-value	Adjusted OR (RATS vs VATS) (95% CI)	P-value
Operative mortality	3.08%	2.19%	0.24	1.03 (0.58-1.83)	0.91
Major postoperative complication	13.8%	13.1%	0.68	0.91 (0.65-1.29)	0.61
Intraoperative blood transfusion	13.6%	7.5%	<0.001	**1.68 (1.07-2.64)**	**0.024**
Postoperative blood transfusion	8.4%	7.3%	0.39	0.95 (0.61-1.46)	0.80

Associations between outcomes and RATS versus VATS lobectomy conversion to open thoracotomy

FIRST SCIENTIFIC SESSION

7. REGIONALIZATION OF CARDIAC SURGICAL SERVICES IN THE UNITED STATES

AUTHORS
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OBJECTIVES:
As health systems evolve, there may be benefits of regionalization to enhance quality of care. Concentration of experiences may lead to improved quality and expanded portfolio of operative procedures. We sought to examine the potential impacts of regionalization on the delivery of cardiac surgery in the United States.

METHODS:
With the US facing a shortage of 2,000 cardiothoracic surgeons by 2030, we examined the number of cases, the number of centers or programs and the number of surgeons in Australia, Canada, and the United States. We collected data on the case volumes, surgeon concentration, and relative land mass and patient volumes to compare relative access. After analyzing the three separate yet somewhat similar systems, we re-modeled the US system to evaluate an alternative care delivery strategy in the US.

RESULTS:
Australia had 15,000 cases, 50 centers and 146 cardiac surgeons in 2018. Canada had 30,360 cases, 32 centers and 186 surgeons in 2016. The US had 1,027 programs, 287,872 cases, 2,058 cardiac surgeons according to the AMA MASTERFILE (2017) and the STS database executive summary in 2018. Table 1 reveals the cases per year for surgeons, centers or programs. In Australia, the cases per surgeon were 103, in Canada they were 167 and in the US 140. The cases per center or program were 300 in Australia, 949 in Canada, 280 in the US. According to the author's database, 26% of the cases were complex (183/715) including heart and lung transplants in the last fiscal year. For CABG's, the mortality rate in US was 2.3% in 2017; in Canada was 1.4%. For SAVR it was 2.2% in the US; in Canada it was 1.2%.

CONCLUSIONS:
If the US were to adopt a Canadian model, 6 surgeons/program and 343 programs, Table 1, the per center volume would increase, enabling higher cases per program, the opportunity for increased mentorship and an improved work-life balance due to a higher concentration of skilled faculty, and perhaps better outcomes.

Comparison Between Australia, Canada, and the United States

	AUSTRALIA	CANADA	USA	USA USING 6 SURGEONS IN CANADIAN MODEL
POPULATION	23,200,000	35,600,000	326,600,000	326,600,000
LAND SIZE - SQ KM	7,741,220	9,984,670	9,833,517	9,833,517
TOTAL CASES 2018	15,000	30,360	287,872	287,872
CARDIAC SURGEONS	146	182	2,058	2,058
CENTERS OR PROGRAMS	50	32	1,027	343
SURGEONS / PROGRAMS	3	6	2	6
CASES PER YEAR PER SURGEON	103	167	140	140
CASES PER YEAR PER CENTER	300	949	280	840
POPULATION PER CENTER	464,000	1,112,500	318,014	952,187

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FIRST SCIENTIFIC SESSION

8. ASSOCIATION BETWEEN HOSPITAL VOLUME, ONCOLOGIC CARE PROCESSES, AND SURVIVAL FOR ESOPHAGEAL AND GASTROESOPHAGEAL JUNCTION CANCER

AUTHORS
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OBJECTIVES:
There is a well-established relationship between surgical volume and better perioperative outcomes for patients with esophageal and gastroesophageal junction (GEJ) cancer. In addition, multimodality therapy (MMT) and an adequate lymphadenectomy (AL) are recommended by national treatment guidelines for the management of patients with resectable esophageal and gastroesophageal disease. However, it is unclear whether surgical care at high volume hospitals is associated with receipt of MMT and/or AL and whether differences in management might translate into better long-term survival.

METHODS:
National cohort study of 11,620 patients with resected (i.e.: >cT2 and/or cN+) esophageal and GEJ adenocarcinoma and squamous cell carcinoma treated at 1,023 hospitals within the National Cancer Database (2006 - 2015). Patients were categorized as receiving MMT (resection preceded by either neoadjuvant chemotherapy or neoadjuvant chemoradiotherapy) and AL (>15 lymph nodes). Hospitals performing >20 esophagectomies were categorized as high volume using established thresholds. The association between hospital volume and treatment received was evaluated using multivariable hierarchical regression and the association with overall risk of death was evaluated using multivariable cox shared frailty modeling.

RESULTS:
Overall, 67.4% and 32.6% of patients were treated at 983 low and 40 high volume hospitals, respectively. Care at high volume hospitals was not associated with receipt of MMT (Odds Ratio [OR] 1.13, 95% Confidence Interval [0.82 – 1.57]), but was associated with receipt of an AL (OR 2.54 [1.89-3.42]) and both MMT and AL together (OR 2.48 [1.85-3.31]). Relative to patients treated at low volume hospitals, those treated at high volume hospitals had a lower risk of death (Hazard Ratio [HR] 0.85 [0.77-0.93]). Similarly, receipt of an AL alone (HR 0.83 [0.74-0.92]), MMT alone (HR 0.79 [0.72-0.86]), and both an AL and MMT together (HR 0.73 [0.67-0.80]) were all associated with a lower risk of death.

CONCLUSIONS:
Care at high volume hospitals is associated with better long-term survival for patients with esophageal and GEJ cancers. This does not appear to be related to differences in delivery of MMT,but may be a function of the quality of the operation performed. These results suggest efforts to centralize esophageal surgery to high volume hospitals may be beneficial for improving oncological surgical quality, but not necessarily the overall quality of oncologic care. Future work is needed to delineate whether there are identifiable differences in the operation performed by high volume providers that could be used to better standardize the quality of surgical care.

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8. ASSOCIATION BETWEEN HOSPITAL VOLUME, ONCOLOGIC CARE PROCESSES, AND SURVIVAL FOR ESOPHAGEAL AND GASTROESOPHAGEAL JUNCTION CANCER

CONTINUED

Association Between Treating Hospital Volume, Receipt of MMT, Receipt of AL, and Overall Survival

MMT Receipt	Odds Ratio (95% Confidence Interval)
Hospital-level (REF: Low-Volume Hospitals)	
High-Volume Hospitals	1.33 (0.92– 1.91)

AL Receipt	Odds Ratio (95% Confidence Interval)
Hospital-level (REF: Low-Volume Hospitals)	
High-Volume Hospitals	2.52 (1.86 – 3.41)

Receipt of MMT and AL	Odds Ratio (95% Confidence Interval)
Hospital-level (REF: Low-Volume Hospitals)	
High-Volume Hospitals	2.61 (1.94 – 3.53)

Overall Survival	Hazard Ratio (95% Confidence Interval)
Hospital-level (REF: Low-Volume Hospitals)	
High-Volume Hospitals	0.84 (0.76 – 0.92)
Patient-level: (REF: Neither)	
AL Alone	0.78 (0.69 – 0.88)
MMT Alone	0.68 (0.62 – 0.76)
Both	0.64 (0.58 – 0.72)

MMT = Multimodality Therapy; NT = Neoadjuvant Therapy; AT = Adjuvant Therapy

FIRST SCIENTIFIC SESSION

9. FACTORS AFFECTING INTEREST IN CARDIOTHORACIC SURGERY: SURVEY OF NORTH AMERICAN CARDIOTHORACIC AND GENERAL SURGERY TRAINEES

AUTHORS
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OBJECTIVES:
To elucidate factors motivating the decision to pursue Cardiothoracic Surgery (CTS) among both CTS and general surgery (GS) trainees. To evaluate and address a potential gap in recruitment to the field of CTS.

METHODS:
From August 2020 to January 2021, two surveys totaling 31 questions were distributed electronically to all CTS residents and GS programs. The surveys were validated and reviewed by the Thoracic Surgery Resident Association (TSRA) and Thoracic Surgery Director's Association (TSDA). All CTS trainees and GS residents who self-identified as having current or previous interest in pursuing CTS training were included.

RESULTS:
234 responses were received, including 124 GS residents (Male=68.5%) and 110 CTS residents (Male=72.7%). Of the CTS trainees, 80 (62.7%) were residents in integrated CTS training pathways and 61 (55.5%) were interested in an academic specialty practice. Among the 110 respondents who had successfully entered CTS training pathways, 105 (95.5%) had exposure to CTS during either medical school or general surgery training, with 67.3% spending greater than 4 weeks on a CTS service during medical school. Among both groups of trainees, the majority of respondents were discouraged from applying to CTS training (n=70, 63.7% CTS vs n=80, 65.5% GS), many of CTS trainees reported dissuasion by a non-CTS mentor (n=43, 40.2%). Current CTS residents (n = 98; 89.1%) reported discouragement by mentors including the following rationales: 'cardiology has taken over,' (n =89; 80.9%), CTS is 'a dying field,' and that 'there are no jobs (n= 82; 74.5%)' GS resident respondents reported a high incidence of discouragement against careers in CTS by the same rationales; n = 93 (75%), n = 89 (71.8%) and n =63 (50.2%), respectively.

CONCLUSIONS:
Early clinical exposure and positive mentorship are critical for cultivating interest in CTS among GS residents. Educators in CTS should consider taking an active role in the recruitment of young trainees to the field.

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HAROLD URSCHEL HISTORY LECTURESHIP

10. GEORGE RONALD DAICOFF, SR., M.D. (NOVEMBER 10, 1930 - FEBRUARY 5, 2020): A PIONEERING SURGEON AND HUMANITARIAN OF THE SOUTHERN THORACIC SURGICAL ASSOCIATION (STSA)

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OBJECTIVES:
George Daicoff was a great human being, surgical pioneer, and active STSA participant for decades. The STSA Congenital Heart Surgery President's Award is named the George Daicoff President's Award. In this presentation, we pay tribute to the life of George Daicoff.

METHODS:
George celebrated his 89th birthday at the 2019 STSA meeting. At this meeting, George clearly stated: "This will be my last meeting." George is missed by many. We consider his contributions in the domains of clinical practice, academics, and professional advocacy.

RESULTS:
George Daicoff performed cardiac surgery on thousands of babies, children, and adults. In 1966, he was a Fellow in Cardiovascular Surgery at Mayo Clinic in Rochester, under the tutelage of John Kirklin, MD. George Daicoff served on faculty at University of Florida (UF) from 1967-1977. He served as UF Professor of Thoracic and Cardiovascular Surgery (1970-1977), and UF Division Chief of Thoracic and Cardiovascular Surgery (1972-1977). In 1977, George relocated to Saint Petersburg, Florida where he was a key leader in the development of the All Children's Hospital (ACH) cardiac surgery program. He served as ACH Chief of Cardiovascular Surgery (1977-1998). In 1988, George recruited Jim Quintessenza to ACH, where Jim is the current Chief of Cardiac Surgery. A Medline search of "Daicoff-G" reveals 51 publications dating back to 1958! George published many important papers over the course of his career, including important contributions in the early 1970s related to congestive heart failure in infancy treated by early VSD repair, and the intra-operative evaluation of surgical systemic-to-pulmonary artery shunts. George is also an author on several ACH publications about pediatric cardiac transplantation. George Daicoff is a founding member of the Congenital Heart Surgeons' Society (CHSS). He was one of 10 surgeons to attend the inaugural 1973 CHSS meeting in Florida. STSA was the favorite professional organization of George Daicoff. In 1970, George Daicoff won the STSA President's Award recognizing the best scientific paper delivered at STSA. In 1996, 26 years later, George won the STSA Osler Abbot Award! In 2015, after STSA began to award three Presidents Awards, the Congenital Heart Surgery President's Award was named the George Daicoff President's Award. George routinely attended essentially every STSA annual meeting, and he was in attendance and sitting in the front row in November 2019 at the age of 89!!!

CONCLUSION:
George Daicoff was a pioneering surgeon and STSA humanitarian who excelled in patient care, academics, and professional advocacy.

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HAROLD URSCHEL HISTORY LECTURESHIP

10. GEORGE RONALD DAICOFF, SR., M.D. (NOVEMBER 10, 1930 - FEBRUARY 5, 2020): A PIONEERING SURGEON AND HUMANITARIAN OF THE SOUTHERN THORACIC SURGICAL ASSOCIATION (STSA)

CONTINUED

Figure 1: George Ronald Daicoff, Sr., M.D. (November 10, 1930 - February 5, 2020)

George R. Daicoff was a pioneering surgeon and STSA humanitarian who excelled in patient care, academics, and professional advocacy.

SECOND SCIENTIFIC SESSION: AORTIC VALVE BREAKOUT

11. VALVE-IN-VALVE TRANSCATHETER AORTIC VALVE REPLACEMENT VERSUS REDO SURGICAL AORTIC VALVE REPLACEMENT FOR FAILED SURGICAL BIOPROSTHESIS

AUTHORS
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OBJECTIVES:
Despite the rapid adoption of valve-in-valve transcatheter aortic valve replacement (TAVR) within surgical bioprosthesis (TAVR-in-SAVR), there are scant data comparing TAVR-in-SAVR outcomes with redo surgical aortic valve replacement (SAVR) following initial SAVR procedure.

METHODS:
Between 2007 and 2020, 480 consecutive post-SAVR patients, consisting of 184 (38.3%) stented and 296 (61.7%) stentless bioprostheses, underwent a repeat aortic valve replacement. We retrospectively reviewed perioperative and follow-up outcomes on these patients.

RESULTS:
Valve reinterventions including 286 (59.6%) redo SAVRs and 194 (40.4%) TAVR-in-SAVR procedures were performed. Of these, 6 (3.1%) TAVR-in-SAVR within stentless bioprosthesis were aborted or converted to redo SAVR due to device positioning issue and one (0.4%) redo SAVR was aborted due to intraoperative significant bleeding. Patients with TAVR-in-SAVR were older (68.9 vs. 59.8, p<0.001) and more likely had a previous coronary artery bypass grafting (CABG) (25.9 vs. 12.5%, p<0.001) thanpatients with redo SAVR. Despite the high endocarditis rate (18.5%) and complex concurrent procedures including 32.2% aortic root, 14.7% of mitral and 10.1% of CABG in the redo SAVR group, the in-hospital mortality was similar between patients with TAVR-in-SAVR and redo SAVR (2.1% vs. 2.4%, p=0.78). The overall median follow-up period was 3.6 years (interquartile range 1.9–6.1). The cumulative incidence of valve failure assessed using the competing risk regression (death, prosthetic valve endocarditis and durable left ventricular assist device implantation as competing events) was consistently higher in the TAVR-in-SAVR group regarding the entire (15.1% vs. 3.9%, subdistribution hazard ratio [SHR] 4.2, 95% confidence interval [CI] 1.9–9.3, p=0.001) (Figure 1), stented bioprosthesis (17.0 vs. 5.5%, SHR 3.3, 95% CI 1.0-10.9, p=0.050) (Figure 2A) and stentless bioprosthesis cohort (14.6 vs. 3.0%, SHR 5.2, 95% CI 1.7-15.8, p=0.003)(Figure 2B) at 7 years. Among valve failure cases following a redo SAVR, 80.0% (8 out of 10 cases) received an externally wrapped bioprosthesis.

CONCLUSIONS:
Perioperative mortality was comparable between redo SAVR and TAVR-in-SAVR, while TAVR-in-SAVR was associated with higher rates of bioprosthetic valve failure regardless of the original SAVR valve type. Redo SAVR using a prosthesis with non-externally wrapped design appears a durable option.

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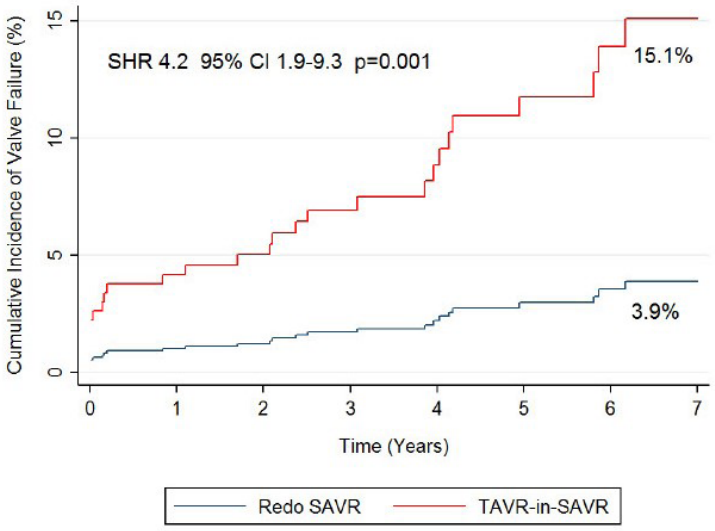
SECOND SCIENTIFIC SESSION: AORTIC VALVE BREAKOUT

11. VALVE-IN-VALVE TRANSCATHETER AORTIC VALVE REPLACEMENT VERSUS REDO SURGICAL AORTIC VALVE REPLACEMENT FOR FAILED SURGICAL BIOPROSTHESIS

CONTINUED

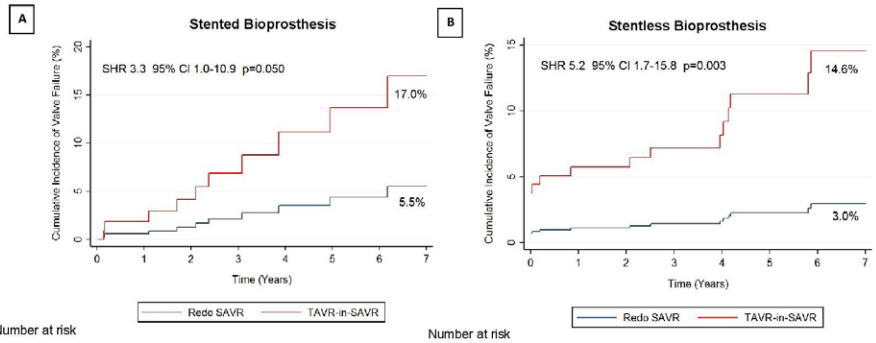
Cumulative incidence of valve failure following repeat aortic valve intervention.



Number at risk				
Redo SAVR	286	223	153	100
TAVR-in-SAVR	194	120	56	18

The cumulative incidence was estimated using a competing risks regression by the method of Fine and Gray. Deaths, prosthetic valve endocarditis and durable left ventricular assist device implantations were counted as competing events. SAVR, surgical aortic valve replacement; TAVR-in-SAVR, transcatheter aortic valve replacement within surgical bioprosthesis

Cumulative incidence of valve failure following repeat aortic valve intervention stratified by the original surgical valve type.



Number at risk				
Redo SAVR	112	78	49	34
TAVR-in-SAVR	72	34	7	0

Number at risk				
Redo SAVR	174	145	104	66
TAVR-in-SAVR	122	86	49	18

(A) Patients with stented bioprosthesis. (B) Patients with stentless bioprosthesis. SAVR, surgical aortic valve replacement; TAVR-in-SAVR, transcatheter aortic valve replacement within surgical bioprosthesis

SECOND SCIENTIFIC SESSION: AORTIC VALVE BREAKOUT

12. THE RELATIONSHIP OF LEFT VENTRICULAR MASS REGRESSION TO SURVIVAL: A LONG-TERM ANALYSIS OF VETERANS UNDERGOING SURGICAL OR TRANSCATHETER AORTIC VALVE REPLACEMENT

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OBJECTIVES:
LV mass regression has been associated with improved outcomes and reduced mortality after aortic valve replacement. TAVR may be less effective in LV mass regression when compared to SAVR; however, this has not been well studied in the veteran population. Accordingly, we present a long-term analysis of veterans who underwent TAVR and SAVR, evaluating clinical and echocardiographic data; specifically, the degree of left ventricular mass regression and its association with survival.

METHODS:
We performed a retrospective review of TAVR (n = 194) and SAVR (n = 365) patients who underwent AVR at a Veterans Affairs Hospital from 2011 to 2019. Following 1:1 propensity-matching, we evaluated primary (short and long-term mortality—up to 8 years) and secondary outcomes. Long-term echocardiographic data was used to evaluate left ventricular mass regression (between preop and the most recent echocardiogram), its association with survival, and predictors of LV mass regression.

RESULTS:
Following propensity-matching, there was no difference in 30-day, 1-year, long term mortality (up to 8 years), stroke at 30-days, MI, renal failure, prolonged ventilation, reoperation, or structural valve deterioration. SAVR patients (67.3% [101 out of 150] vs 55.7% [44 out of 79], p = 0.11) were more likely to have an LV mass regression compared to TAVR patients. Furthermore, the degree of LV mass regression was greater for SAVR patients (mean = -25.9%, median = -23.3%) compared to the TAVR patients (mean = -20.5%, median = -17.8%, p = 0.062). Kaplan Meier survival curves (Figure) demonstrated that that SAVR patients with an LVMI regression had a survival advantage compared to those that did not (p = 0.016). However, no survival benefit was demonstrated for TAVR patients with an LVMI regression (p=0.248). Multivariable analysis revealed that age, creatinine, elevated LVMI (i.e., LV hypertrophy), greater preoperative EF, and mechanical valve were associated with a greater degree of LV mass regression.

CONCLUSIONS:
Although there were no major differences in the primary or secondary clinical outcomes, SAVR patients had a higher rate and degree of LV mass regression when compared to TAVR patients. SAVR patients with an LV mass regression also demonstrated a survival advantage compared to those that did not. However, the same relationship was not demonstrated for TAVR patients. Further investigation into the preoperative and echocardiographic variables that predict LV mass regression may help determine which patients are more likely to benefit from SAVR versus TAVR.

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SECOND SCIENTIFIC SESSION: AORTIC VALVE BREAKOUT

13. THE ECONOMIC IMPACT OF TRANSCATHETER AORTIC VALVE REPLACEMENT FOR THE TREATMENT OF AORTIC STENOSIS IN THE US MEDICARE POPULATION

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OBJECTIVES:
Transcatheter aortic valve replacement (TAVR) emerged as a paradigm shifting approach to treat aortic stenosis (AS) in 2011, and has now surpassed surgical aortic valve replacement (SAVR) as the dominant therapeutic option. We examined the temporal shifts in economic burden for the treatment of AS on the US healthcare system with this changing treatment strategy.

METHODS:
We performed a retrospective cohort study, using data from a 20% Medicare beneficiaries' sample (n=16,525,400) from 2008-2017. Medicare fee-for-service beneficiaries, aged ≥65 years with at least 2 years of enrollment were included. Three age-groups were identified; 66-74 years, 75-84 years and ≥85 years. We used multivariable regression to evaluate crude and adjusted changes in annual Medicare spending per beneficiary across age groups, and changes in spending associated with SAVR and TAVR.

RESULTS:
The average annual Medicare spending for beneficiaries with AS was $18,577 in 2010, and increased annually by $365. The total sum of payment for beneficiaries with AS increased by 46% (Figure 1). Inpatient payments increased 1.6% per year with the highest increase in patients ≥85 years old (2.4%). Outpatient payments increased by 7.4%, equally among all age-groups (Figure 2). The percentage of beneficiaries undergoing a SAVR decreased from 3.7% to 2.2%, and annual spending on SAVR decreased with an average of 7.1% per year (Figure 1). The percentage of beneficiaries undergoing TAVR increased from 0% in 2010 to 3.1% in 2017, and annual spending for TAVR increased by 533.3% per year (Figure 1).

CONCLUSIONS:
Although average annual Medicare spending per beneficiary modestly increased over the study period, the increase in beneficiaries eligible for intervention and the increase in prevalence of AS has led to a substantial increase in overall Medicare payments for beneficiaries with AS. This finding, potentially useful to inform future health policy, highlights the economic impact on the US healthcare system as a novel therapeutic option emerged to shift management not only between two possible interventions, but as an option to extend intervention to those patients who were previously managed with medical therapy alone.

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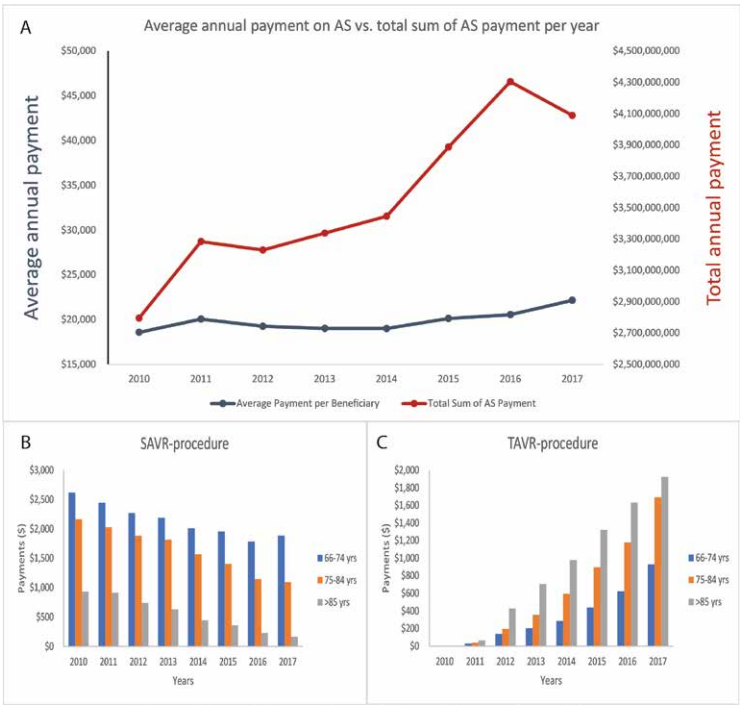
SECOND SCIENTIFIC SESSION: AORTIC VALVE BREAKOUT

13. THE ECONOMIC IMPACT OF TRANSCATHETER AORTIC VALVE REPLACEMENT FOR THE TREATMENT OF AORTIC STENOSIS IN THE US MEDICARE POPULATION

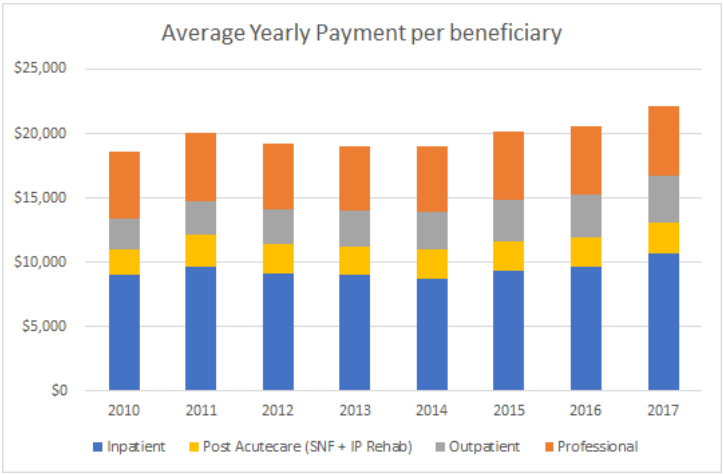
CONTINUED

Temporal Change in Aortic Stenosis Annual Payments for Medicare Beneficiaries



A. Average annual Medicare payment per beneficiary with prevalent AS; Total annual Medicare payment for beneficiaries with prevalent AS. B. Average annual Medicare payment per beneficiary for SAVR C. Average annual Medicare payment per beneficiary for TAVR (AS=Aortic Stenosis; SAVR=Surgical Aortic Valve Replacement; TAVR=Transcatheter Aortic Valve Replacement

Average Yearly Medicare Payment per beneficiary ($) for Inpatient, Post Acutecare, Outpatient and Professional Payments



SECOND SCIENTIFIC SESSION: LESSONS LEARNED FROM COVID BREAKOUT

14. THE IMPACT OF MORBID OBESITY ON THE OUTCOME OF COVID-19 ASSOCIATED ARDS SUPPORTED BY VENOVENOUS ECMO: A REVIEW OF THE COVID-19 CRITICAL CARE CONSORTIUM DATABASE

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OBJECTIVES:
Obesity is a known risk factor for worse prognosis in patients with Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-COVI-2) infection. Venovenous (VV) Extracorporeal membrane oxygenation (ECMO) has been recommended as a rescue intervention in patients with COVID-19 associated severe Acute Respiratory Distress Syndrome (ARDS). However, the direct impact of morbid obesity on patients supported by VV ECMO remains unclear.

METHODS:
This is an observational study of critically ill, adult patients with COVID-19 supported by VV ECMO drawn from 78 institutions participating in COVID-19 Critical Care Consortium international registry. Patients were enrolled during the study period of February 19, 2020 to January 25, 2021. They were stratified based on Body Mass Index (BMI) more than 40 kg/m2 vs. less than or equal 40kg/m2. Multi-state survival analysis was used to understand the effect of the morbid obesity on patient survival to hospital discharge. The data distribution in the study population was not uniform and to account for outliers, median values with interquartile ranges (IQR) were used to characterize the continuous variables.

RESULTS:
A total of 297 patients were supported on VV ECMO, of which 14 had missing ECMO data and 12 patients had missing BMI data. These 26 patients were excluded, leaving a study cohort of 271 supported on VV ECMO with available BMI and survival data.

The demographics and co-morbidities of the two cohorts were statistically similar. However, there was a trend towards the 'high BMI' group being younger and with a lower Apache II score. (Table 1) When a cumulative regression model was used to analyze the data, older age (HR 1.54, CI: 1.27 to 1.86) and higher BMI (HR 1.16, CI: 1.03 to 1.30) were associated with an increased risk of death. (Table 2) Using the deviance information criteria we attempted to model a threshold for a "safe" BMI below which VV ECMO can used. However, there was not a BMI threshold above which the risk of death or discharge changed. We used sensitivity analysis to show that the results were not a specific study site.

CONCLUSIONS:
In patients with COVID-19 and severe ARDS who are supported on VV ECMO, there is a risk of death associated with higher BMI and advanced age. The risk is additive and there was no BMI cutoff beyond which the risk for death greatly increases. It should be noted that the high BMI group represented 11 % of the study population and the study may be insufficiently powered to discern other significant differences. A prospective randomized study would need to be performed to better define the suitability VV ECMO in morbidly obese patients with Covid-19 and ARDS.

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SECOND SCIENTIFIC SESSION: LESSONS LEARNED FROM COVID BREAKOUT

14. THE IMPACT OF MORBID OBESITY ON THE OUTCOME OF COVID-19 ASSOCIATED ARDS SUPPORTED BY VENOVENOUS ECMO: A REVIEW OF THE COVID-19 CRITICAL CARE CONSORTIUM DATABASE

CONTINUED

Table 1

Study Group Characteristics

	Study population		BMI < 40 kg/m²		BMI >40 kg/m²	
Size (N)	271		240	(89%)	31	(11%)
	Median	IQR	Median	IQR	Median	IQR
Age	53	(44 - 61)	54	(45 - 61)	31	(34 - 54)
BMI	31	(27 - 35)	29	(26 - 33)	44	(42 - 47)
Apache II Score	19	(12 - 25)	19	(12 - 24)	15	(11 -22)
Sofa Score	7	(4 - 10)	7	(4 - 10)	7	(5 - 10)

BMI: Body Mass Index, IQR: Interquartile Range

Study Group Characteristics

Table 2

Estimated Risk of Death and Discharge

Variable	Death		Discharge	
	HR	CI	HR	CI
Age (+10 years)	1.54	1.27 to 1.86	0.77	0.65 to 0.90
Time on ECMO (+1 month)	1.02	0.96 to 1.08	0.78	0.70 to 0.88
Male Sex	1.3	0.86 to 1.99	0.81	0.54 to 1.21
BMI (+5 kg/m²)	1.16	1.03 to 1.30	0.98	0.87 to 1.11
APACHE Score	1.18	0.70 to 2.01	1.29	0.74 to 2.23

BMI: Body Mass Index, HR: Hazard Ratio, CI: Confidence Interval
Performed using a cumulative probability regression model

Estimated Risk of Death and Discharge

SECOND SCIENTIFIC SESSION: LESSONS LEARNED FROM COVID BREAKOUT

15. MULTI-INSTITUTIONAL ANALYSIS OF 342 CONSECUTIVE PATIENTS WITH COVID-19 TREATED WITH EXTRACORPOREAL MEMBRANE OXYGENATION (ECMO): SURVIVAL IS BETTER IN YOUNGER PATIENTS AND THOSE PLACED ON MECHANICAL VENTILATION SOONER

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OBJECTIVES:
The role of extracorporeal membrane oxygenation (ECMO) in the management of severely ill patients with COVID-19 continues to evolve. The purpose of this abstract is to review our clinical experience in 342 patients with confirmed COVID-19 treated with ECMO and to estimate risk factors for mortality.

METHODS:
A multi-institutional database was created and utilized to assess all patients with COVID-19 who were supported with ECMO at 40 institutions. This analysis includes 342 patients with confirmed COVID-19 who were cannulated for ECMO at 40 hospitals between March 17, 2020, when our first COVID-19 patient was placed on ECMO, and February 27, 2021. Data analyzed included patient characteristics, pre-COVID-19 risk factors and comorbidities, confirmation of COVID-19 diagnosis, features of ECMO support, specific medications utilized in an attempt to treat COVID-19, and short-term outcomes through hospital discharge.

Descriptive analyses by mortality group are shown in Table 1 and were performed using chi-square tests in categorical variables and Kruskal-Wallis rank sum tests and Welch's ANOVA in continuous variables. A logistic regression model was estimated to assess the effect of days between COVID-19 diagnosis and intubation, as well as days between intubation and ECMO initiation, while controlling for age, gender, presence of one or more comorbidities, use of prone positioning pre-ECMO, and pre-ECMO P/F ratio.

RESULTS:
During the five months of this study, 342 consecutive patients with COVID-19 were placed on ECMO and separated from ECMO: 209 (61.1%) died and 133 (38.9%) are alive.

Table 1 compares survivors and non-survivors. Of 306 patients receiving only veno-venous ECMO and separated from ECMO, 123 (40.2%) survive. Of 24 patients receiving veno-arterial ECMO and separated from ECMO, 7 (29.2%) survive.

Survivors had lower age (median: 47 versus 54 years, $p<0.001$) and shorter time from COVID diagnosis to intubation (median: 5 versus 10 days, $p<0.001$). Adjusting for several confounding factors, we estimate that an ECMO patient intubated on day 13 post COVID-19 diagnosis vs day 2 has a relative odds of survival of 0.63 (95% CI: 0. 41-0. 97, $p<0.05$). Age was also negatively associated with survival: relative to a 41-year-old we estimate that a 59-year-old patient has a relative odds of survival of 0.55 (95% CI: 0. 38-0.79, $p<0.01$).

CONCLUSIONS:
ECMO facilitates salvage and survival of select critically ill patients with COVID-19. Survivors tend to be younger and have shorter time from diagnosis to intubation. Survival of patients supported with only veno-venous ECMO is 40.2%.

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SECOND SCIENTIFIC SESSION: LESSONS LEARNED FROM COVID BREAKOUT

15. MULTI-INSTITUTIONAL ANALYSIS OF 342 CONSECUTIVE PATIENTS WITH COVID-19 TREATED WITH EXTRACORPOREAL MEMBRANE OXYGENATION (ECMO): SURVIVAL IS BETTER IN YOUNGER PATIENTS AND THOSE PLACED ON MECHANICAL VENTILATION SOONER

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Table 1. Overview of 342 Patients with COVID-19 treated with ECMO and no longer on ECMO, comparing the characteristics of the 133 survivors to the 209 non-survivors

	Category	Overall	Non-Survivors	Survivors	p-value
		N=342	N=209	N=133	
Days from COVID Diagnosis to Intubation, Mean (SD)		8.81 (7.11)	10.3 (7.34)	6.68 (6.23)	<0.001
Days from COVID Diagnosis to Intubation, Median [25th;75th]		9.00 [2.25;13.0]	10.0 [4.00;14.0]	5.00 [2.00;10.0]	<0.001
Days from Intubation to Cannulation, Mean (SD)		4.57 (4.41)	4.86 (4.73)	4.15 (3.88)	0.241
Days from Intubation to Cannulation, Median [25th;75th]		4.00 [1.00;7.00]	4.00 [1.00;7.00]	3.00 [1.00;5.75]	0.366
Days from COVID Diagnosis to Cannulation, Mean (SD)		12.4 (8.98)	13.7 (9.69)	10.6 (7.48)	0.001
Days from COVID Diagnosis to Cannulation, Median [25th;75th]		12.0 [6.00;17.0]	13.5 [8.00;18.8]	8.50 [5.00;15.8]	<0.001
Days on ECMO, Mean (SD)		21.9 (17.8)	23.3 (19.1)	19.8 (15.5)	0.06
Days on ECMO, Median [25th;75th]		18.0 [9.00;29.0]	20.0 [10.0;29.0]	14.0 [9.00;28.0]	0.055
Hours on ECMO, Mean (SD)		516 (428)	548 (458)	464 (372)	0.064
Hours on ECMO, Median [25th;75th]		409 [216;675]	472 [234;679]	319 [204;671]	0.056
Age, Mean (SD)		48.9 (12.1)	51.1 (11.7)	45.6 (12.0)	<0.001
Age, Median [25th;75th]		50.0 [41.0;59.0]	54.0 [44.0;59.0]	47.0 [35.0;55.0]	<0.001
Gender, N (%):	Female	100 (29.2%)	56 (26.8%)	44 (33.1%)	0.261
	Male	242 (70.8%)	153 (73.2%)	89 (66.9%)	
Asthma, N (%):	Yes	50 (14.9%)	32 (15.8%)	18 (13.5%)	0.672
Cancer, N (%):	Yes	9 (2.68%)	6 (2.96%)	3 (2.26%)	1
Chronic Renal Failure, N (%):	Yes	28 (8.46%)	17 (8.54%)	11 (8.33%)	1
Diabetes, N (%):	Yes	126 (37.6%)	84 (41.6%)	42 (31.6%)	0.083
Heart Disease, N (%):	Yes	36 (10.7%)	23 (11.4%)	13 (9.77%)	0.775
Hypertension, N (%):	Yes	161 (47.9%)	102 (50.2%)	59 (44.4%)	0.345
Obesity, N (%):	Yes	211 (62.2%)	128 (62.1%)	83 (62.4%)	1
One or More Comorbid Conditions, N (%):	Yes	285 (84.1%)	175 (85.0%)	110 (82.7%)	0.69
Proned Before ECMO, N (%):	Yes	226 (67.5%)	138 (68.3%)	88 (66.2%)	0.77
P/F Ratio Pre-ECMO, Mean (SD)		71.2 (33.6)	74.3 (39.0)	65.9 (21.1)	0.043
Tracheostomy Performed, N (%):	Yes	139 (40.6%)	77 (36.8%)	62 (46.6%)	0.093
Number of Circuit Changes, Median [25th;75th]		0.00 [0.00;1.00]	0.00 [0.00;1.00]	0.00 [0.00;1.00]	0.399
One or More Circuit Changes, N (%):	Yes	118 (35.9%)	75 (37.5%)	43 (33.3%)	0.515
CVVH or CRRT Used, N (%):	Yes	106 (32.1%)	68 (34.2%)	38 (29.0%)	0.389
ECMO Type, N (%):	Veno-arterial	24 (7.27%)	17 (8.50%)	7 (5.38%)	0.396
	Veno-venous	306 (92.7%)	183 (91.5%)	123 (94.6%)	
Anticoagulation Type, N (%):	Argatroban	16 (4.69%)	8 (3.85%)	8 (6.02%)	0.549
	Bivalirudin	77 (22.6%)	51 (24.5%)	26 (19.5%)	
	Heparin	246 (72.1%)	148 (71.2%)	98 (73.7%)	
	None	2 (0.59%)	1 (0.48%)	1 (0.75%)	
Anti-Viral Medication, N (%):	Yes	228 (68.1%)	145 (71.4%)	83 (62.9%)	0.128
Convalescent Plasma, N (%):	Yes	173 (54.7%)	105 (54.7%)	68 (54.8%)	1
Hydroxychloroquine, N (%):	Yes	54 (16.1%)	31 (15.3%)	23 (17.4%)	0.71
Interleukin-6 Blocker, N (%):	Yes	103 (30.9%)	55 (27.4%)	48 (36.4%)	0.106
Prostaglandin, N (%):	Yes	132 (40.6%)	86 (45.5%)	46 (35.9%)	0.205
Steroids, N (%):	Yes	267 (80.9%)	164 (82.0%)	103 (79.2%)	0.63

Table 1 provides detailed data about 342 patients with COVID-19 treated with ECMO and no longer on ECMO and compares the characteristics of the 133 survivors to the 209 non-survivors.

Figure 1: The predicted probability of survival by age and the predicted probability of survival by days between COVID-19 diagnosis and intubation

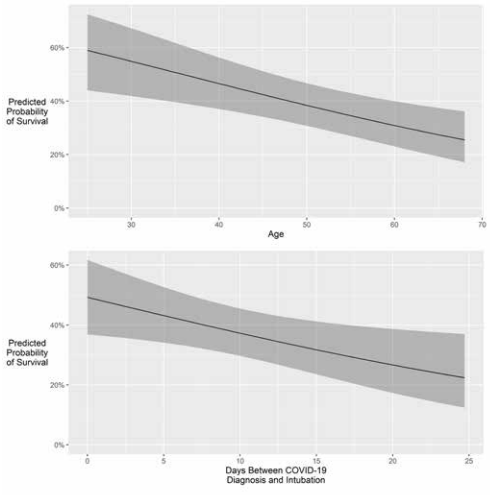

Figure 1 plots the predicted probability of survival by age and the predicted probability of survival by days between COVID-19 diagnosis and intubation.

SECOND SCIENTIFIC SESSION: LESSONS LEARNED FROM COVID BREAKOUT

16. INCIDENCE AND OUTCOMES OF PNEUMOTHORAX IN PATIENTS WITH ACUTE RESPIRATORY DISTRESS SYNDROME ON VENO-VENOUS EXTRACORPOREAL MEMBRANE OXYGENATION

AUTHORS
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OBJECTIVES:
Pneumothorax is associated with poor prognosis in patients with acute respiratory distress syndrome (ARDS). There is limited data on patients who are supported on veno-venous extracorporeal membrane oxygenation (VV-ECMO) and develop a pneumothorax. We evaluated the incidence, management, and outcomes of pneumothoraces in patients supported with VV-ECMO for ARDS.

METHODS:
We retrospectively reviewed all adult VV-ECMO patients supported for ARDS between 8/2014-8/2020 at our institution, excluding patients with recent lung resection and trauma. Clinical outcomes were compared between patients with and without pneumothorax. Patients with a pneumothorax were analyzed for factors associated with complications and worse outcomes.

RESULTS:
Two hundred eighty patients with ARDS on VV-ECMO were analyzed. Of those 213 did not have a pneumothorax and 67 did, with a total incidence of 87 pneumothoraces. Patients with a pneumothorax had similar pre-ECMO characteristics to those without, with the exception of a lower body mass index (BMI) (P<0.001), etiologies of ARDS (P<0.001), longer duration of ventilator support prior to ECMO (P=0.002), and higher Glascow Coma Score (GCS) (P=0.04). Patients with a pneumothorax had a longer duration of ECMO support (30 days [16-55] versus 12 [7-22], P<0.001), longer hospital length of stay (HLOS) (51 days [27-93] versus 29 [18-49], P<0.001), and decreased survival to decannulation (58.2% versus 77.5%, P=0.002) compared to patients without a pneumothorax. Controlling for age, BMI, GCS, and pre-ECMO ventilator days, the odds ratio of survival-to-decannulation was 0.38 (95% CI 0.20-0.73) in patients with a pneumothorax compared to those without. Of the 87 pneumothoraces, 8 resolved with observation and 79 had placement of chest tubes. There was no association between the use of pigtails versus large-bore tubes and the incidence of complications. There was a lower incidence of significant bleeding when chest tubes were placed by proceduralist services (2.4% versus 16.2%, P=0.03). Removal of the chest tube prior to ECMO decannulation compared to removal after decannulation was associated with need for replacement (14.3% versus 0%, P=0.01). Patients with bilateral pneumothoraces had similar survival to patients with a unilateral pneumothorax, though they had a trend towards increased duration of ECMO support (75 ± 84 days versus 39 ± 38, P=0.08) and HLOS (92 ± 86 days versus 56 ± 39, P=0.08).

CONCLUSIONS:
Patients who develop a pneumothorax and are supported with VV-ECMO for ARDS have longer duration on ECMO and decreased survival. Further studies are needed to assess factors associated with incidence of pneumothorax and chest tube complications in this patient population.

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SECOND SCIENTIFIC SESSION: LESSONS LEARNED FROM COVID BREAKOUT

16. INCIDENCE AND OUTCOMES OF PNEUMOTHORAX IN PATIENTS WITH ACUTE RESPIRATORY DISTRESS SYNDROME ON VENO-VENOUS EXTRACORPOREAL MEMBRANE OXYGENATION

CONTINUED

Patient Characteristics

	Overall (n=280)	No pneumothorax (n=213)	Pneumothorax (n=67)	*P* value
Age (years)	43 (32, 54)	43 (32, 54)	43 (36, 53)	0.54
Sex (male)	182 (65)	135 (63.4)	47 (70.2)	0.31
BMI (kg/m2)	32.4 (26.8, 39.2)	33.7 (27.3, 41)	27.8 (24.2, 34)	<0.001
Preexisting				
Asthma/COPD	60 (21.5)	46 (21.6)	14 (21.5)	0.99
Diabetes	55 (19.8)	43 (20.2)	12 (18.5)	0.76
Congestive heart	17 (6.1)	14 (6.6)	3 (4.6)	0.56
Cancer/malignancy	14 (5)	12 (5.6)	2 (3.1)	0.41
Liver	27 (9.7)	23 (10.8)	4 (6.2)	0.27
HIV	5 (1.8)	3 (1.4)	2 (3.1)	0.38
Etiology of ARDS				<0.001
Bacterial	53 (18.9)	35 (16.4)	18 (26.9)	---
Viral	95 (33.4)	61 (28.6)	34 (50.8)	---
Non-COVID	54 (19.3)	42 (19.7)	12 (17.9)	---
COVID	41 (14.6)	19 (8.9)	22 (32.8)	---
Aspiration	40 (14.3)	38 (17.8)	2 (3)	---
Post-op	27 (9.6)	24 (11.3)	3 (4.5)	---
Other	65 (23.2)	55 (25.8)	10 (14.9)	---
Pre-ECMO				
Ventilator days	1 (0, 4)	1 (0, 3)	2 (1, 6)	0.002
pH	7.22 (7.14, 7.30)	7.22 (7.13, 7.29)	7.26 (7.17, 7.33)	0.07
CO2 (mmHg)	56 (47, 68)	55 (45, 68)	59 (51, 75)	0.03
P/F ratio	68 (55, 83)	67 (54, 83)	70 (59, 84)	0.89
PIP (mmH2O)	37 (33, 42)	37 (33, 42)	37 (32, 44)	0.66
PEEP (mmH2O)	15 (14, 18)	15 (14, 18)	15 (12, 18)	0.13
MAP (mmH2O)	24 (21, 29)	25 (21, 29)	24 (21, 28)	0.34
Cardiac arrest	44 (15.8)	38 (17.8)	6 (9.1)	0.09
Creatinine (mg/dL)	1.44 (0.87, 2.44)	1.56 (0.92, 2.53)	1.11 (0.69, 1.92)	0.05
Lactate (mmol/L)	2.4 (1.6, 4.7)	2.4 (1.6, 4.9)	2.5 (1.7, 3.7)	0.02
Bilirubin (mg/dL)	1 (0.6, 1.6)	1 (0.6, 1.6)	1 (0.6, 1.5)	0.02
CRRT/iHD pre	31 (11.1)	27 (12.7)	4 (6)	0.12
GCS	10 (6, 11)	10 (5, 11)	11 (8, 11)	0.04
RESP score	3 (1, 5)	3 (1, 5)	2 (0, 4)	0.07

SECOND SCIENTIFIC SESSION: HOT TOPICS IN GENERAL THORACIC SURGERY BREAKOUT

17. PERIOPERATIVE OUTCOMES AND SURVIVAL AFTER PREOPERATIVE IMMUNOTHERAPY FOR NON-SMALL-CELL LUNG CANCER

AUTHORS
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OBJECTIVES:
Although preoperative immunotherapy (IT) is increasingly utilized for non-small-cell lung cancer (NSCLC), there remains a paucity of robust clinical data on its safety and long-term survival. Our objective was to evaluate the perioperative outcomes and survival associated with IT followed by surgery for patients with NSCLC.

METHODS:
Outcomes of patients with NSCLC who underwent lung resection after preoperative chemotherapy (PC) ± radiation or IT (with or without chemotherapy or chemoradiation) in the National Cancer Data Base (2010-2017) were evaluated using Kaplan-Meier analysis, multivariable logistic regression, multivariable Cox proportional hazards analysis and propensity score-matched analysis.

RESULTS:
From 2010-2017, 236 patients received IT and 10,715 patients received PC followed by surgery. The IT group was associated with a greater number of lymph nodes examined than the PC group (median 14 vs 11, P<0.001). There were no significant differences between the two groups with regard to margin positivity (7.0% [n=15] vs 7.5% [n=715], P=0.71), 30-day readmission (4.2% [n=10] vs 4.1% [n=440], P=0.93) and 30-day mortality (0.9% [n=1] vs 2.6% [n=253], P=0.25). The IT and PC groups had similar overall survival (5-year survival: IT - 63% [95% CI, 50 to 74] vs PC - 51% [95% CI, 50 to 52], log-rank P=0.06, multivariable adjusted hazard ratio 0.98 [95% CI, 0.51 to 1.90], P=0.96). A propensity score-matched analysis of 336 patients, well-matched by preoperative characteristics, showed no significant differences in short-term outcomes (Table) and overall survival (Figure) between the two groups.

CONCLUSIONS:
In this national analysis, preoperative immunotherapy followed by surgery for NSCLC was found to be safe and feasible with similar short-term outcomes and overall survival when compared to preoperative chemotherapy followed by surgery.

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SECOND SCIENTIFIC SESSION: HOT TOPICS IN GENERAL THORACIC SURGERY BREAKOUT

17. PERIOPERATIVE OUTCOMES AND SURVIVAL AFTER PREOPERATIVE IMMUNOTHERAPY FOR NON-SMALL-CELL LUNG CANCER

CONTINUED

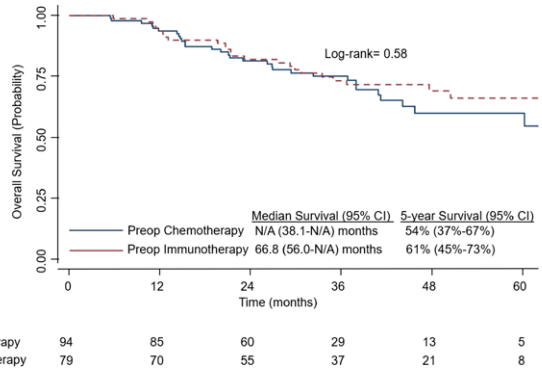
Table: Short-Term Outcomes for Patients With NSCLC who Received Preoperative Immunotherapy Versus Preoperative Chemotherapy: Propensity Score-Matched Analysis

Patient Characteristic	Preoperative Immunotherapy (n = 168)	Preoperative Chemotherapy (n = 168)	P-value
Complete Pathologic Response, n (%)	15 (8.9%)	15 (8.9%)	1.00
Nodal Upstaging, n (%)[1]	20 (11.9%)	25 (14.9%)	0.42
Nodal Downstaging, n (%)[2]			
N2 to N0	<10	<10	0.79
N2 to N0 or N1	10 (6.0%)	12 (7.1%)	0.66
Regional Lymph Nodes (LN) Examined			
Patients with LN Examined, n (%)	164 (97.6%)	162 (97.0%)	0.73
Median LN Examined (IQR)	17.0 (10.5, 26.0)	13.0 (8.5, 23.0)	0.01
Surgical Margins, n (%)			0.47
No residual tumor	155 (92.3%)	152 (90.5%)	
Residual tumor, NOS	<10	<10	
Microscopic residual tumor	<10	<10	
Margins not evaluable	<10	<10	
Length of Stay (median, IQR), days	4 (2, 6)	4 (3, 6)	0.20
30-day Readmission, n (%)	<10	<10	0.41
30-day mortality, n (%)			0.19
Survived past 30d post-surgery	77 (45.8%)	92 (54.8%)	
Died fewer than 30d post-surgery	<10	<10	
Unknown[3]	90 (53.6%)	74 (44.0%)	
90-day mortality, n (%)			0.22
Survived past 90d post-surgery	76 (45.2%)	92 (54.8%)	
Died fewer than 90d post-surgery	<10	<10	
Unknown[3]	90 (53.6%)	74 (44.0%)	

[1] Denominator for percentage calculating is the number or patients with cN0 disease (preoperative immunotherapy: n = 29; preoperative chemotherapy: n = 27)
[2] Denominator for percentage calculating is the number or patients with cN2 disease (preoperative immunotherapy: n = 28; preoperative chemotherapy: n = 25)
[3] Mortality data is unavailable for 2016 and contributes to the majority of unknown 30- and 90-day mortality values

This table describes short-term outcomes of propensity score-matched patients with NSCLC who received preoperative immunotherapy versus preoperative chemotherapy.

Overall Survival for Patients With NSCLC who Received Preoperative Immunotherapy or Preoperative Chemotherapy Followed by Surgical Resection: Propensity Score-Matched Analysis



This figure depicts the overall survival for propensity score-matched patients with NSCLC who received preoperative immunotherapy versus those who received preoperative chemotherapy.

SECOND SCIENTIFIC SESSION: HOT TOPICS IN GENERAL THORACIC SURGERY BREAKOUT

18. PULMONARY METASTASECTOMY FROM RENAL CELL CARCINOMA: PROGNOSTIC FACTORS AND LONG-TERM OUTCOMES

AUTHORS
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OBJECTIVES:
Treatment of pulmonary metastases from renal cell carcinoma (RCC) remains controversial because considered as a systemic disease. However, some studies revealed potential survival benefits of pulmonary metastasectomy (PM) in these patients. We evaluate our experience analyzing surgical results, postoperative outcomes, and prognostic factors in the surgical treatment of pulmonary metastases from RCC.

METHODS:
Using a prospective database, we retrospectively reviewed data from 174 patients who underwent PM for RCC between 2001 and 2019 in a single institution. There were 124 men with median age of 62 years (range, 29-80 years). Surgery included 140 wedge/segmentectomies (80.5%), 33 lobectomy/bilobectomy (18.9%), one pneumonectomy (0.6%). Twenty-seven patients (15.5%) received a redo-metastasectomy. A single metastasis or 2-3 metastases were removed in 63 patients (36.2%) each; in 111 patients (63.8%) 4 or more metastases were removed. Lymphadenectomy was performed in 112 patients (64.4%): 78/112 (69.6%) were pN0, and 34/106 (30.4%) were pN+.

RESULTS:
Complete resection was achieved in 158 patients (90.8%). Mortality was nil. We had only minor complications occurred in 28 patients (16.1%): 12 cases of anemia, 8 cases of air leak, 4 cases of pneumonia, 3 cases of arrhythmia, and 1 case of atelectasis. After a median follow-up of 2.8 years (range, 0.9-13.3 years), 125 patients (71.8%) were alive. Five and 10-year survival were 57% and 53%, respectively. Disease-free interval was <12 months in 46 patients (26.4%); between 12 and 36 months in 49 (28.1%), and >36 month in 79 (45.4%), respectively. DFI and complete resection did not influence survival rate. Number of resected metastases influenced long-term outcome (60% for less 3 metastases versus 32% for 4 or more, log-rank test: p=.02). Patients with nodal involvement had a poor survival (58% for N0 versus 29% for N+, log-rank test: p=.01). At multivariate analysis, both number of resected metastases and nodal involvement were independent prognostic factors [p=.03 (95% CI: 0,66-8,46) and p=.001 (CI: 0,57-6,35), respectively].

CONCLUSIONS:
PM may be a promising treatment for metastatic RCC allowing a good long-term survival rate. Nodal involvement and a number of resected metastases equal or more than 4 are predictors of poor survival.

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SECOND SCIENTIFIC SESSION: HOT TOPICS IN GENERAL THORACIC SURGERY BREAKOUT

19. SURGICAL REPAIR VS STENT FOR ESOPHAGEAL PERFORATION: A MULTI-INSTITUTIONAL COMPARISON AFTER SURGERY (N-ERAS) PROTOCOL FOR THORACIC CANCER RESECTIONS

AUTHORS
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AUTHOR INSTITUTION(S)
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OBJECTIVES:
Endoluminal esophageal stenting is increasingly utilized as an alternative to surgical repair for esophageal perforation (EP). Although small studies support the safety of stenting, multi-institutional studies are lacking. The purpose of this study was to compare the outcomes of surgical repair and esophageal stenting in patients with EP using a nationally representative database. We hypothesized that mortality between these approaches would not be different.

METHODS:
The Premier healthcare database (PHD) was used to identify adult inpatients with EP receiving either surgical repair or esophageal stenting using ICD 9 and ICD 10 procedure and CPT coding from 2009-2019. PHD is an administrative U.S. hospital-based database that contains detailed treatment information and includes over 12 million hospital admissions. Elixhauser Comorbidity Index (ECI) was also extracted. Patients receiving intervention ≤7 days of admission were included in the analysis. Patients receiving both stent and repair on the same day were excluded. The composite outcome of interest was death or discharge to hospice. Logistic regression was used to evaluate independent predictors of death or hospice, adjusting for comorbidities. A secondary outcome of hospital LOS was evaluated.

RESULTS:
2,543 patients with EP were identified who received repair (1,314, 51.7%) or stenting (1,229, 48.3%). Stenting increased from 7.0% in 2009 (9/128) to 78.1% in 2019 (250/320). Patients receiving repair were more likely to be female, white, and had fewer Elixhauser comorbidities (2.6 repair vs 3.3 stent, p<0.001). Unadjusted death rate was similar between the groups (119/1,314(9.1%) repair vs 122/1,229(9.9%) stent, p=0.454). Unadjusted death or discharge to hospice was more common after stent (134/1314(10.2%) repair vs. 199/1229(16.2%) stent, p<0.001), however, after adjusting for comorbidities, logistic regression suggested that death or hospice discharge was no different between approaches (stent vs. repair AOR: 1.074, 95% CI: 0.81-1.42, p=0.622 - table). Hospital LOS was shorter after stenting (stent vs repair coeff -4.09,p<0.001).

CONCLUSIONS:
In this study of patients with EP, the odds for death or discharge to hospice were similar for esophageal stenting compared to surgical repair. Stenting is increasingly being utilized and is associated with shorter hospital length of stay. Although further studies into selection criteria for stenting vs repair are appropriate, the results of this study suggest that esophageal stenting may be a reasonable alternative to surgical repair in selected patients.

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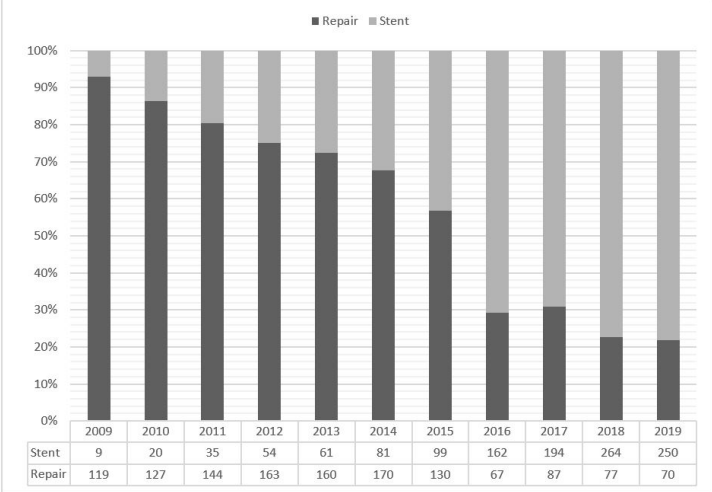
SECOND SCIENTIFIC SESSION: HOT TOPICS IN GENERAL THORACIC SURGERY BREAKOUT

19. SURGICAL REPAIR VS STENT FOR ESOPHAGEAL PERFORATION: A MULTI-INSTITUTIONAL COMPARISON AFTER SURGERY (N-ERAS) PROTOCOL FOR THORACIC CANCER RESECTIONS

CONTINUED

Relative rate of surgical repair and endoluminal stenting



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Stent	9	20	35	54	61	81	99	162	194	264	250
Repair	119	127	144	163	160	170	130	67	87	77	70

Relative rate of surgical repair and endoluminal stenting per year for esophageal perforation among patients with a diagnosis of esophageal perforation who received intervention within 7 days of hospital admission. Data tables shows absolute number of cases for each procedure.

Factors associated with death or discharge to hospice after esophageal perforation

	Odds Ratio	95% CI	p-value
Stent (vs Repair)	1.07	0.80 - 1.42	0.622
Age (yrs)	1.04	1.03 - 1.05	<0.001
Married (vs not)	0.82	0.63 - 1.07	0.153
Day of first procedure	1.06	0.98 - 1.14	0.110
Insurance			
MEDICARE	ref	-	-
MEDICAID	1.56	0.94 - 2.57	0.080
MANAGED CARE & COMMERCIAL	0.95	0.64 - 1.43	0.838
OTHER – inc. charity, self-pay, govt.	1.32	0.75 - 2.32	0.323
Comorbidities			
Number of Elixhauser comorbidities	0.93	0.82 - 1.06	0.321
Congestive heart failure	1.40	0.92 - 2.12	0.111
Cardiac arrhythmias	1.36	0.96 - 1.94	0.079
Pulmonary circulation disorders	1.69	0.97 - 2.94	0.061
Peripheral Vascular disorders	1.01	0.49 - 2.07	0.968
Other Neurologic disorders	1.78	0.97 - 3.29	0.062
Renal failure	1.13	0.65 - 1.94	0.657
Liver disease	2.89	1.83 - 4.55	<0.001
Metastatic Cancer	1.83	1.14 - 2.96	0.012
Solid tumor without metastasis	3.59	2.47 - 5.24	<0.001
Coagulopathy	2.64	1.54 - 4.52	<0.001
Weight loss	1.16	0.86 - 1.55	0.311
Fluid and electrolyte disorders	1.95	1.42 - 2.68	<0.001
Complicated hypertension	1.62	0.96 - 2.75	0.070

Multivariable logistic regression of factors associated with death or discharge to hospice among patients with a diagnosis of esophageal perforation who received intervention within 7 days of hospital admission.

THIRD SCIENTIFIC SESSION

20. NON-AORTIC VALVE CARDIAC SURGERY AFTER TRANSCATHETER AORTIC VALVE REPLACEMENT: SOCIETY OF THORACIC SURGEONS DATABASE ANALYSIS

AUTHORS
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COMMERCIAL RELATIONSHIPS
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OBJECTIVES:
Despite the rapid adoption of transcatheter aortic valve replacement (TAVR), the frequency, description and results of non-aortic valve cardiac surgery after TAVR are unknown. We sought to investigate the implications of this undescribed clinical scenario on patient outcomes.

METHODS:
Non-aortic valve cardiac surgery after TAVR from 2011 to 2019 was queried using the Society of Thoracic Surgeons (STS) Adult Cardiac Surgery Database. A total of 666 patients, including 47 (7.1%) unplanned TAVR valve explant (TAVR-explant) and 3 (0.5%) aborted procedures during non-aortic valve procedures, were identified. The primary outcome was 30-day mortality.

RESULTS:
These 666 procedures were performed by 459 surgeons (median case volume 1.0 per surgeon) from 308 centers (median 1.0 case per center), which represents 29% of STS Database participants. The case number increased over time from 4 in 2011 to 204 in 2019, largely attributable to the increasing number of coronary artery bypass grafting (CABG) (n=283; 42.5%) and mitral (n=258; 38.7%) procedures. The median age was 75.0, 41.0% demonstrated NYHA class III-IV symptoms, 24.0% of patients already had a permanent pacemaker and 51.4% had previous cardiac surgeries. Unplanned TAVR-explant was most frequently performed during aortic repair (n=26; 32.9% of aortic procedures), mostly attributable to aortic root repair (85.0% of aortic root procedures), followed by CABG (n=14; 5.0% of CABGs) and mitral procedure (n=9; 3.5% of open mitral procedures). The 30-day mortality of the entire cohort was 17.0% and postoperative in-hospital complications were highly common. Subgroups with particularly high mortality included patients with robot-assisted mitral surgery (41.7%), unplanned TAVR-explant (40.4%), open atrial transcatheter mitral valve replacement (30.3%) and aortic repair (29.8%). Among 390 patients who underwent operations with available STS predicted risk of mortality, the 30-day mortality with isolated CABG, isolated mitral repair/replacement and the entire group was 8.4%, 13.5% and 10.8% with corresponding observed-to-expected mortality (O/E) ratio of 1.8, 1.8 and 1.7, respectively.

CONCLUSIONS:
Non-aortic valve surgical intervention after TAVR remains rare but is increasing. While these procedures appeared mostly feasible despite the presence of TAVR device within the proximal aorta, the clinical impact of this clinical scenario was substantial and associated with a high mortality and higher O/E ratio. Implanters must be mindful of “lifetime management” strategy which should include careful assessment of concurrent non-aortic valve pathologies during TAVR candidate selection.

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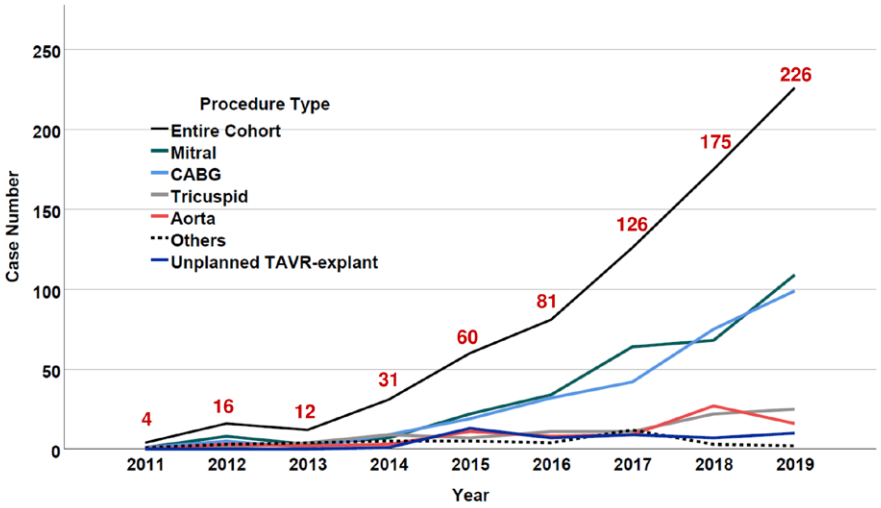
20. NON-AORTIC VALVE CARDIAC SURGERY AFTER TRANSCATHETER AORTIC VALVE REPLACEMENT: SOCIETY OF THORACIC SURGEONS DATABASE ANALYSIS

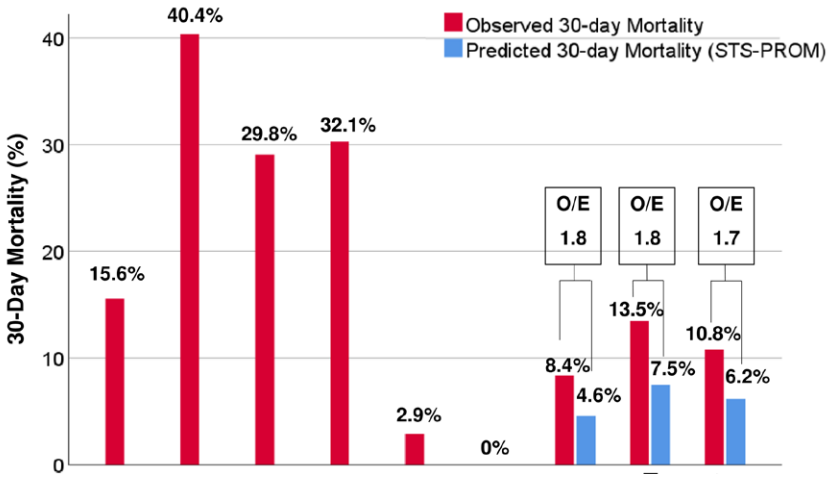
CONTINUED

Trend of non-aortic valve cardiac surgery procedure type.



Case volume of entire cohort (black bar), coronary artery bypass grafting (blue bar), mitral procedure (green bar), tricuspid procedure (gray bar), aortic repair (red bar), other procedures (dashed bar), unplanned transcatheter aortic bioprosthesis explant (TAVR-explant) (navy bar) by year. TAVR, transcatheter aortic valve replacement; CABG, coronary artery bypass grafting; TAVR-explant, transcatheter aortic bioprosthesis explant

The mortality rate stratified by procedure type and observed-to-expected mortality ratios (O/E ratios).



The mortality rate stratified by procedure type and observed-to-expected mortality ratios (O/E ratios) in patients with available Society of Thoracic Surgeons predicted risk of morality (STS-PROM) score. TAVR, transcatheter aortic valve replacement; STS-PROM, the Society of Thoracic Surgeons predicted risk of mortality; TMVR, transcatheter mitral valve replacement; CABG, coronary artery bypass grafting; O/E, observed-to-expected mortality ratio

THIRD SCIENTIFIC SESSION

21. ANALYSIS OF REVISIONAL SURGERY AFTER MYOTOMY FOR ACHALASIA WITH RECURRENT DYSPHAGIA

AUTHORS
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OBJECTIVES:
Recurrent dysphagia after initial myotomy occurs in approximately half of achalasia patients. The objective of this analysis was to evaluate the efficacy of revisional interventions for achalasia patients with recurrent dysphagia after myotomy.

METHODS:
This was a single-center retrospective study using a prospectively maintained database of patients from January 1, 2010, to April 30, 2019. Inclusion criteria listed patients who reported recurrent dysphagia after a previous endoscopic or surgical myotomy for achalasia followed by a revisional surgical procedure, reoperative endoscopic myotomy or plication. Causes of primary failure were categorized by multidisciplinary review as (1) incomplete myotomy; (2) tight fundoplication, or (3) fibrosis, scarring or stricture determined from operative notes, esophagram and/or endoscopy.

RESULTS:
From an interventional myotomy database of 706 achalasia patients over nine years, 68 patients underwent revisional procedures other than dilation or Botox after an initial myotomy. The primary indication for revision was an incomplete myotomy (25/68, 37%). The median time between index surgery and revision was 35 months (IQR 14-115). The majority of patients (40/68, 59%) underwent surgical myotomy (30/68, 44%) or POEM (10/68, 15%). Esophagectomy was performed in (21/68, 31%) of patients. Only seven (7/68, 10%) patients were treated with other procedures, such as wrap revision (6/68, 9%) or plication (1/68, 1%). Esophagectomy was associated with a higher complication rate (9/21, 42.9%) patients) than myotomy (2/40, 5%). The majority (83.8%) of patients reported improved dysphagia after revisional surgery with significant improvement in Eckardt score (7.25 ± 2.13 (IQR 6 -9) versus 2.91 ± 2.27 (IQR 1 -3), $p < 0.01$). The majority of patients 47/68 (69%) had an Eckardt score ≤ 3 after reintervention. Ninety-day mortality rate was 1/68 (1.5%).

CONCLUSIONS:
Reintervention with endoluminal myotomy or reoperative myotomy safely improves dysphagia symptoms and Eckardt scores in achalasia patients presenting with recurrent dysphagia after a myotomy. Esophagectomy is required when megaesophagus progresses or when reoperative intervention fails.

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21. ANALYSIS OF REVISIONAL SURGERY AFTER MYOTOMY FOR ACHALASIA WITH RECURRENT DYSPHAGIA

CONTINUED

Patient Characteristics

Variable	All Patients (n=68)
Type of achalasia at original surgery	
I	23 (33.82%)
II	21 (30.88%)
III	8 (11.76%)
Unspecified	16 (23.53%)
Number of previous procedures	
1	59 (86.76%)
2	8 (11.76%)
⩾3	1 (1.47%)
Last procedure before revisional surgery	
Laparoscopic myotomy	31 (45.59%)
Laparotomy myotomy	14 (20.59%)
Thoracotomy myotomy	11 (16.18%)
Thoracoscopic myotomy	1 (1.47%)
Robotic myotomy	4 (5.88%)
POEM	7 (10.29%)
Wrap type	
Dor	25 (36.76%)
Toupet	17 (25.00%)
Nissen	4 (5.88%)
Belsey Mark	1 (1.47%)
No wrap	21 (30.88%)
Cause of faliure	
Incomplete myotomy	45 (66%)
Fibrosis/Scarring/Stricture	14 (21%)
Tight wrap	9 (13%)
Time to recurrence	
Mean±SD	39.54±69.46
Interval time between last procedure and revisional surgery (months)	
Mean±SD	84.88±105.21

Operative Details and Outcomes based on Type of Reintervention

Variable	All Patients (n=68)		
	Myotomy (n=40)	Esophagectomy (n=21)	Others (n=7)
Maximum width of esophagus (cm)			
Mean±SD	4.27±1.50	6.34±2.15	5.00±1.06
Procedure			
Laparoscopic myotomy	21	/	/
Laparotomy myotomy	8	/	/
POEM	11	/	/
Ivor Lewis	/	15	/
Mckeown	/	5	/
Takedown of previous wrap	/	/	4
POPE	/	/	3
Others	/	1*	/
Type of wrap			
Dor	20	/	1
Toupet	7	/	0
No fundoplication	13	/	6
Blood loss			
Mean±SD	46.43±70.04	367.14±305.40	14.29±18.13
Days of hopital stay			
Mean±SD	3.54±2.83	13.81±11.82	2.43±1.13
Complications			
Intraoperative perforation	2	0	0
Postoperative leakage	1	1	0
Hemorrhage	0	1	0
Wound Infection	0	4	0
Others	0	3	0

*Procedure: total gastrectomy with intrathoracic roux-y esophagojejunostomy.

THIRD SCIENTIFIC SESSION

22. ASSOCIATION BETWEEN VENOUS HOMOGRAFTS AND ALLOSENSITIZATION AFTER THE NORWOOD PROCEDURE

AUTHORS
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OBJECTIVES:
Use of cryopreserved valved venous homografts during Stage I Norwood-Sano is associated with improved pulmonary artery growth when compared to polytetrafluoroethylene (PTFE) conduits. Patients with single ventricle congenital heart disease may require cardiac transplantation, and it is unknown if homografts result in significant antibody sensitization as demonstrated by elevated panel reactive antibody (PRA). Pre-sensitized heart transplant candidates have longer wait times, higher mortality on waiting list, and increased risk of rejection after transplantation. We hypothesize that single ventricle patients with a homograft placed during Stage I Norwood-Sano have higher PRA levels than those with a PTFE conduit.

METHODS:
This retrospective cohort study included infants who underwent Stage I Norwood-Sano for single ventricle anatomy between May 2013 and June 2019 using either a PTFE (Gore-Tex; W.L. Gore & Associates, Inc., Flagstaff, AZ) or valved venous homograft (Cryolife Inc., Kennesaw, GA) Sano conduit. Previously collected and stored serum samples for these patients prior to bidirectional Glenn operations were obtained from our institutional Pediatric Cardiac Intensive Care Unit's biorepository and sent for PRA analysis. Patients who did not have sufficient blood samples in the biorepository to run PRA analysis were excluded. Demographic, clinical outcome, and intervention data were extracted from electronic medical records and dichotomized by conduit material. PTFE and homograft patient characteristics and outcomes were described and compared using chi-square, Fisher's exact, Wilcoxon rank sum, and Student's t-test where appropriate. A p-value <0.05 was considered significant.

RESULTS:
Thirty-three patients with single ventricle anatomy comprised the study. Five patients used 7-8mm diameter homografts, including 1 saphenous vein and 4 femoral veins. PTFE conduit was used in the other 28 patients. The two groups were comparable in terms of their preoperative demographics and age at bidirectional Glenn (Table 1). Rates of pulmonary artery stenosis were also similar (p = 0.13). Exposure to other potential antigens including blood products during surgery and breastmilk were similar between the two groups as well (Packed Red Blood Cells p = 0.58, Cryoprecipitate p = 0.23, Platelets p = 0.67, Fresh Frozen Plasma p = 0.13, and Breastmilk p – 1.0). Patients receiving homograft conduits demonstrated significantly higher PRA compared to those who received a PTFE conduit (Figure 1, 77.4 ± 43.4 versus 14.5 ± 28.3, p = 0.0002).

CONCLUSIONS:
Use of cryopreserved valved venous homografts was associated with higher PRA levels in our center's single ventricle patients. Allosensitization should be considered a possible complication of using a venous homograft during the Norwood-Sano. Further studies are needed to evaluate how allosensitization from venous homografts used at the time of Stage I Norwood-Sano may complicate candidacy for and outcomes after cardiac transplantation.

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22. ASSOCIATION BETWEEN VENOUS HOMOGRAFTS AND ALLOSENSITIZATION AFTER THE NORWOOD PROCEDURE

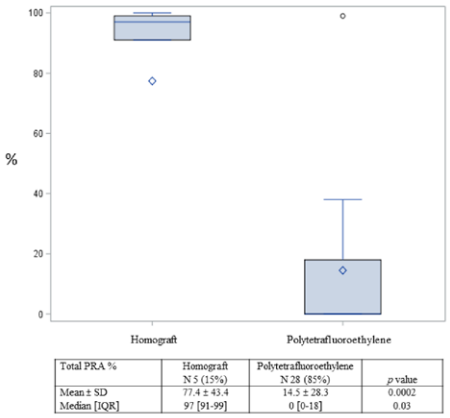
CONTINUED

Table 1: Demographics and clinical characteristics of patients according to graft type

	PTFE N 28 (85%)	Homograft N 5 (15%)	*p* value
Age at Norwood (days)	6 [5-7.5]	7 [7-78]	0.04
Fundamental diagnosis			0.14
Hypoplastic left heart syndrome	21 (75)	2 (40)	
Other congenital heart disease	7 (25)	3 (60)	
Time between Norwood and Glenn (days)	124 [110-147]	115 [99-232]	0.67
Age at Glenn (days)	130 [119-155]	310 [106-391]	0.56
Blood product exposure during surgery			
Packed Red Blood Cell (mls)	313.1 [175-644]	702 [37-768]	0.58
Cryoprecipitate (mls)	30 [15-45]	15 [0-30]	0.23
Platelet (mls)	200 [103-355]	181 [22-641]	0.67
Fresh Frozen Plasma (mls)	56 [0-140]	105 [105-195]	0.13
Had abnormal ventricular function pre-Glenn on ECHO	2 (7)	1 (20)	0.39
Unplanned catheterization before Stage 1 (yes)	1 (4)	1 (20)	0.28
Catheterization findings before Stage 2			
Pulmonary artery stenosis	18 (64)	1 (20)	0.13
Stenosis location (N=19)			-
Left pulmonary artery	2 (11)	0	
Left & right pulmonary artery	7 (39)	0	
Right pulmonary artery	9 (50)	1 (100)	
Stent placed (N=18)	3 (18)	0 (0)	1.0
Had artery hypoplasia	9 (32)	1 (20)	1.0
Hypoplasia location (N=10)			1.0
Left pulmonary artery	2 (22)	0	
Left & right pulmonary artery	2 (22)	0	
Right pulmonary artery	5 (56)	1 (100)	
Unplanned catheterization before Stage 2 (yes)	9 (32.1)	1 (20)	1.0
Unplanned re-operation(s) before Glenn (yes)	4 (14.3)	2 (40)	0.21
Hospital variables related to Norwood operation			
Received breastmilk	25 (89)	5 (100)	1.0
Cardiopulmonary bypass time (minutes)	140.8 ± 51.7	171.0 ± 88.1	0.29
ECMO (yes)	6 (21)	0 (0)	0.55
ECMO duration (N=6) (days)	4.5 [2-8]	-	-
Open chest (days)	2 [1-6]	1 [1-2]	0.06
Hospital length of stay (days)	50.3 ± 31.1	36.6 ± 28.1	0.36
First BNP (pg/mL) after their Norwood	2115 ± 2314	2328 ± 911	0.84
Last BNP (pg/mL) recorded before Glenn operation	794 ± 625	1728 ± 866	0.007
Max BNP (pg/mL) during Norwood hospitalization	2549 ± 2230	2545 ± 610	0.99

Mean ± SD; Median [IQR], N (%) are shown above.
Key: PTFE=Polytetrafluoroethylene; ECHO=Echocardiogram; ECMO= Extracorporeal membrane oxygenation; BNP=Brain natriuretic peptide
PTFE are a Gore-Tex a registered trademark of W.L. Gore & Associates, Inc., Flagstaff, Ariz and Homograft are by CryoLife Inc., Kennesaw, Ga

Total Panel Reactive Antibody (PRA) % by graft type



Total PRA %	Homograft N 5 (15%)	Polytetrafluoroethylene N 28 (85%)	*p* value
Mean ± SD	77.4 ± 43.4	14.5 ± 28.3	0.0002
Median [IQR]	97 [91-99]	0 [0-18]	0.03

The box-and-whisker plots represent the Total Panel Reactive Antibody (PRA) % for both the homograft group and the Polytetrafluoroethylene (PTFE) group. Note the significantly higher total PRA % for the Homograft group compared to the PTFE group.

THIRD SCIENTIFIC SESSION

23. ATRIAL FIBRILLATION: THE FACTS REVEAL OPPORTUNITIES!

AUTHORS
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OBJECTIVES:
Meta-analysis demonstrates concomitant Surgical Ablation for Atrial Fibrillation (SAAF) in patients with pre-operative Atrial Fibrillation (AF) improves peri-operative morbidity, mortality & long term quality of life. Unfortunately, national data reveal only 48.3% of cardiac surgery patients with pre-operative AF undergo concomitant SAAF. The purpose of this study was to identify opportunity for ensuing statewide quality improvement in utilization of SAAF.

METHODS:
Using a statewide database, all patients >18y undergoing conventional cardiac surgery from 1st July 2014 to 31st Match 2019 with pre-operative history of AF were identified. Important exclusions included emergent/salvage status and operation for infective endocarditis. 6992 patients met criteria. AF surgery was quantified and trends examined by duration of AF history, primary operative procedure, center of care and changes over time. Ablation procedures were classified into 3 categories of extent, isolated Pulmonary Vein Isolation (PVI), PVI with additional left atrial lesions and PVI with bi-atrial lesions. Propensity score matched comparison of peri-operative outcomes was undertaken for mortality and major morbidities including bleeding, re-operation, operative duration, infection rates, ventilator complications, stroke and requirement for permanent pacemaker.

RESULTS:
48.0% of patients analyzed underwent SAAF, increasing to 66.3% in those with persistent AF. 41.5% undergoing SAAF received only PVI, 32.5% underwent PVI with bi-atrial lesions. AF duration predicted extent of ablation; Bi-atrial procedures were less common in patients with paroxysmal AF than other durations p<0.0001. SAAF rate varied significantly by primary operative procedure, highest in mitral surgery 64.4%, lowest in coronary artery bypass grafting 36.3% p<0.0001. Bi-atrial procedures were more common in mitral surgery (34.5%) than other open atrial procedures (23.4%) or closed atrial procedures (4.2%) p<0.0001. SAAF utilization varied widely across 33 centers, figure 1. No correlation was observed between center volume or case mix and rate or extent of SAAF.

Propensity score matched analysis compared outcomes between SAAF and non-SAAF cohorts. Unmatched at baseline the non-SAAF cohort was significantly more comorbid. Following matching the model included 1856 matched pairs. Peri-operative mortality was 3.72% with SAAF vs 3.62% non-SAAF p=0.9312. Table 1 demonstrates all outcomes.

CONCLUSIONS:
This statewide collaborative analysis reveals significant variation in institutional approaches and areas discordant with the evidence base & current guidelines relating to concomitant treatment of AF at time of Cardiac Surgery. SAAF did not increase peri-operative mortality or morbidity and therefore should be considered routinely. Given the known benefits of SAAF, socialization of these data presents opportunity for both surgeon education and creates a platform for quality improvement.

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THIRD SCIENTIFIC SESSION

23. ATRIAL FIBRILLATION: THE FACTS REVEAL OPPORTUNITIES!

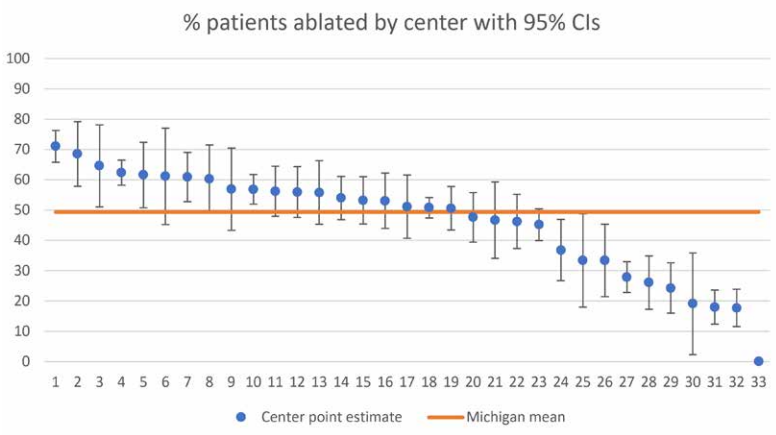
CONTINUED

Propensity matched outcomes

Outcome	Matched (n = 3712)		
	SAFA	Non-SAFA	P value
Mortality 30d / discharge % (n)	3.73% (69)	3.62% (67)	0.9312
Operation duration (mins) Mean ± SD	358.8 ± 102.5	349.9 ± 111.8	0.0111
Cardiopulmonary bypass duration (mins) Mean ± SD	139.2 ± 64.6	118.4 ± 62.9	<0.0001
Cross clamp duration (mins) Mean ± SD	101.3 ± 56.1	88.2 ± 49.4	<0.0001
Proportion receiving intra-operative blood products % (n)	30.57% (567)	29.20% (542)	0.3941
Number units of blood products transfused Mean ± SD	1.08 ± 2.52	1.03 ± 2.46	0.8607
Incidence of massive transfusion (>3units PRCs) % (n)	3.61% (67)	3.02% (56)	0.3426
Incidence of return to theatre for bleeding / tamponade % (n)	2.16% (40)	3.66% (68)	0.0091
Duration mechanical ventilation (Hours) Mean ± SD	30.3 ± 93.0	28.9 ± 87.9	0.4785
Proportion undergoing early extubation % (n)	34.64% (643)	40.32% (748)	0.0004
ICU length of stay (hours) Mean ± SD	93.51 ± 115.2	95.82 ± 123.4	0.5191
Renal dysfunction % (n)	4.69% (87)	4.26% (79)	0.5825
Pneumonia % (n)	3.07% (57)	3.13% (58)	1.0000
Sepsis % (n)	1.29% (24)	1.99% (37)	0.1237
Harvest site infection % (n)	0.38% (7)	0.49% (9)	0.8036
Deep sternal wound infection % (n)	0.43% (8)	0.54% (10)	0.8145
Superficial sternal wound infection % (n)	0.86% (16)	0.97% (18)	0.8642
Post-op stroke % (n)	1.56% (29)	1.45% (27)	0.8939
Post-op TIA % (n)	0.38% (7)	0.48% (9)	0.8036
Post-op phrenic palsy % (n)	0.05% (1)	0% (0)	N/A
Post-op pacemaker insertion % (n)	6.95% (129)	5.50% (102)	0.0787

Comparison of outcomes between propensity matched populations undergoing SAAF vs those who did not

Proportion of patients undergoing SAAF statewide by centre



THIRD SCIENTIFIC SESSION

24. INTRODUCTION OF A NON-NARCOTIC PAIN MANAGEMENT PROTOCOL AFTER THORACOSCOPIC LOBECTOMY SIGNIFICANTLY DECREASES OVERALL OPIOID USE AND PRESCRIPTION OF HOME OPIOIDS WHILE IMPROVING OVERALL PAIN CONTROL

AUTHORS
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OBJECTIVES:
Narcotic abuse and addiction continues to be a devastating problem in our communities, and up to 40% of patients begin their addiction with legally prescribed opioids following injury or surgery. A narcotic-free multimodal pain regimen was developed with the goal of decreasing opioid exposure, eliminating home narcotic prescriptions, and maintaining or improving overall pain control.

METHODS:
An IRB approved retrospective single-institution database study was conducted on all minimally invasive lobectomy patients before and after implementation of a narcotic-free protocol. Our multi-modal protocol included utilization of long acting nerve blocks, along with regularly scheduled anti-inflammatories, muscle relaxants, and neuropathic pain medications, with narcotics only used when other measures were not adequately controlling pain. Patients who received the narcotic-free protocol were compared with those prior to implementation of the protocol. We evaluated postoperative narcotic use, pain scores, narcotic use at set timepoints (postoperative day 0, 1-7, and total stay), discharge with narcotic prescription, and length of stay.

RESULTS:
A total of 313 lobectomy patients were analyzed from 2016 to 2020, 102 of whom received the narcotic-free protocol and 211 who were treated with typical postoperative narcotics. Patients on the narcotic-free protocol had significantly lower average milligram morphine equivalents (MME) used at all timepoints, percent of patients receiving oral narcotics, and percent of patients using PCA (Table 1). 56% of patients in the narcotic-free group received no oral narcotics at all, and 91% did not receive a PCA. Average pain scores were significantly lower in the narcotic-free protocol patients compared to the narcotic protocol patients (2.9 vs 4.0; p<0.0001). Statistically significant increases in average time with a pain score <6 (87.1% vs 77.1%; p<0.0001) and <3 (56.5% vs 42.0%; p<0.0001) were also found in the narcotic-free patients. With implementation of the protocol, 62% of patients are discharged without a narcotic prescription, compared to only 7% previously. Length of stay was 4.2 days in the narcotic-free group and 5.2 days in the narcotic group (p=0.1).

CONCLUSIONS:
Implementation of a narcotic-free protocol led to a significant decrease in the use of postoperative narcotic medications at all timepoints while actually improving overall management of pain. Additionally, a majority of patients are discharged with no home narcotic prescription, decreasing a potential source of community opioid spread.

Comparison of Average Morphine Equivalent Use (MME), PCA Narcotic Use, and Oral Narcotic Use Between Narcotic-Free and Narcotic Protocol Patients

		Narcotic-Free Protocol (n=102)	Narcotic Protocol (n=211)	P Value
Mean MME (mg)	POD 0	101	309	<0.0001
	POD 1-7	91	513	<0.0001
	Total Stay	195	1218	0.018
PCA Narcotic Use	POD 0	7.8% (8/102)	78.2% (165/211)	<0.0001
	POD 1-7	8.8% (9/102)	73.9% (156/211)	<0.0001
	Total Stay	8.8% (9/102)	81.0% (171/211)	<0.0001
Oral Narcotic Use	POD 0	10.8% (11/102)	30.8% (65/211)	<0.0001
	POD 1-7	41.2% (42/102)	94.8% (200/211)	<0.0001
	Total Stay	44.1% (45/102)	95.3% (201/211)	<0.0001

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THIRD SCIENTIFIC SESSION

25. THE NATURAL AND UNNATURAL HISTORY OF 231 PATIENTS WITH HETEROTAXY: A SINGLE CENTER 5-DECADE EXPERIENCE

AUTHORS
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OBJECTIVES:
Many patients with heterotaxy syndrome (HS) require single ventricle (SV) palliation and are at higher risk for poor outcome compared to non-heterotaxy patients. However, some HS patients are managed with a biventricular strategy. The long-term outcomes of HS patients managed with these two strategies is incompletely understood with little evidence in the literature.

METHODS:
Our institutional echocardiography database was queried for patients with the key words polysplenia and asplenia. Those with confirmed HS were then added to those HS patients within the institutional Fontan database from 1973 to 2021. Demographics including patient cardiac anatomy as well as surgical intervention details were collected. Comparisons were made between patients with SV physiology (either with or without Fontan) and those managed with biventricular physiology (BiV), with or without surgical intervention. Data are presented as median (interquartile range) for non-normally distributed data and mean ± standard deviation for normally distributed data.

RESULTS:
231 heterotaxy patients were stratified into polysplenia (46% left atrial isomerism) and asplenia (54% right atrial isomerism). 181 (78.4%) were SV having undergone Fontan, 19 (8.2%) were SV without Fontan, 20 (8.7%) were BiV with surgical intervention, and 11 (4.8%) were BiV without surgical intervention. Details of anatomy and surgical procedure history are shown in the Table. Median age at time of Fontan was 7.5 (IQR 8.8) years and 50.2% were male. Kaplan Meier analysis of survival demonstrated decreased survival among those managed with SV physiology (p=0.002). Overall 8 (3.5%) of patients underwent transplant at a median age of 17 (IQR 18.6) years. Independent risk factors associated with mortality included history of a Glenn (OR 7.14, 95% CI 2.72-18.9), need for permanent pacemaker (PPM) (OR 2.8, 95% CI 1.17-6.70), and asplenia HS subtype (OR 2.3, 95% CI 1.07-4.91). This lower survival among asplenia patients is reflected in the Kaplan Meier curve (P<0.001).

CONCLUSIONS:
Patients with HS asplenia subtype demonstrate lower overall survival when compared to their polysplenia counterparts. Those managed with SV physiology also demonstrated decreased survival compared to BiV. Need for PPM placement was associated with decreased survival. Overall BiV physiology with the polysplenia HS subtype was associated with improved survival compared to their SV and asplenia counterparts.

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THIRD SCIENTIFIC SESSION

25. THE NATURAL AND UNNATURAL HISTORY OF 231 PATIENTS WITH HETEROTAXY: A SINGLE CENTER 5-DECADE EXPERIENCE

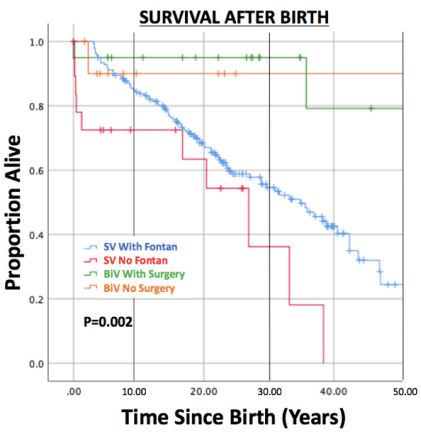
CONTINUED

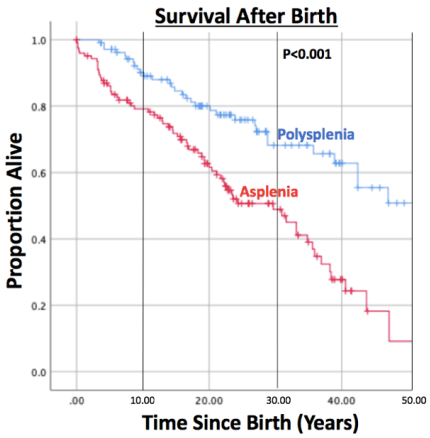
Demographics and Characteristics

	Total Cohort (n=231)	Polysplenia (n=107)	Asplenia (n=124)	p-value
Alive	132 (57.1%)	74 (69.2%)*	58 (46.8%)*	**0**
Female	115 (49.8%)	58 (54.2%)	57 (46%)	**0.132**
Underwent Fontan	181 (78.4%)	78 (72.9%)	103 (83.1%)	**0.044**
PPM	54 (23.4%)	33 (30.8%)*	21 (16.9%)*	**0.01**
Transplant	8 (3.5%)	4 (3.8%)	4 (3.2%)	**0.538**
Patient Anatomy				**0**
SV Fontan	181 (78.4%)	78 (72.9%)	103 (83.1%)	
SV No-Fontan	19 (8.2%)	3 (2.8%)*	16 (12.9%)*	
BIV with surgery	20 (8.7%)	18 (16.8%)*	2 (1.6%)*	
BIV without surgery	11 (4.8%)	8 (7.5%)	3 (2.4%)	

* indicates groups that are statistically significantly different on post-hoc testing, SV-Singe ventricle, BiV-Biventricle, PPM-Permanente Pacemaker

Survival Curves





THIRD SCIENTIFIC SESSION

26. HYPERTHERMIC INTRATHORACIC EXTRACORPOREAL CHEMOTHERAPY (HITEC) FOR PRIMARY AND SECONDARY PLEURAL MALIGNANCIES

AUTHORS
Daniel Miller[1], Christopher Parks[1], Patricia Rich[2], Ioana Bonta[3]

COMMERCIAL RELATIONSHIPS
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OBJECTIVES:
To evaluate the safety and efficacy of hyperthermic intrathoracic extracorporeal chemotherapy (HITEC) with cisplatin in patients who underwent cytoreductive surgery pleurectomy/decortication (PD) for primary (PPM) or secondary pleural malignancies (SPM).

METHODS:
Fifty patients who had unilateral chemoresistant SPM or PPM were studied prospectively over a 66-month period. The patients' primary sites of malignancy were under control for a median of 19 months (range, 12 - 60) prior to developing SPM. Median time of systemic chemotherapy for SPM was 15 months (range, 12 - 76). All 50 patients underwent a unilateral radical P/D, 60 minutes HITEC (1,500 - 1,700 cc/min) with 225 mg/m2 of cisplatin at 42°C. Cisplatin levels were drawn at time zero, 1 hour, 4 hours, and 24 hours after HITEC completion; surgical approach was a thoracotomy in 48 (96%).

RESULTS:
Median age was 56 years (range, 36 - 79); 29 patients (58%) were women. PPM (mesothelioma) was diagnosed in 15 patients. SPM was thymoma in 14, breast cancer in nine, lung cancer in six, colon cancer in two, renal cell in two, and thymic cancer and anal cancer in one each. Morbidity included prolonged air leak in 14 (28%), atrial fibrillation in 8 patients (16%), delayed empyema in three patients (6%) and acute respiratory distress syndrome in one (2%). There was no operative mortality. Median hospital stay was 8 days (range, 4 - 31). Serum cisplatin levels peaked at 4 hours after HITEC; no cisplatin levels were in the toxic range. Median dose of cisplatin was 403 mg (range, 250 - 536); no patient developed renal insufficiency. Median follow-up was 38 months (range, 3 - 60); 29 patients (58%) had no signs of malignant disease at last follow-up. Twenty-one patients developed recurrent disease, five local and 16 distant at a median 22 months (range, 6 - 36 months) after HITEC. Nine patients (18%) have died of metastatic disease at a median 16 months (6 - 30 months) after HITEC. Forty-six patients (95%) experienced improved quality of life as well as reduced pleuritic pain after cytoreduction and HITEC.

CONCLUSIONS:
Surgical cytoreduction of primary and secondary pleural malignancies followed by HITEC with cisplatin was well tolerated. No patient developed cisplatin-related toxicities. Longer follow-up is warranted to determine a survival and quality of life advantage as well as refinement of inclusion and exclusion criteria.

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THIRD SCIENTIFIC SESSION

27. "HIGH RISK" CABG VS VAD FOR ISCHEMIC CARDIOMYOPATHY WITH LOW EF: WHERE TO DRAW THE LINE?

AUTHORS
Katherine Whitehouse[1], Jaimin Trivedi[1], Joseph Sweeney[1], Hazaim Alwair[1], Siddarth Pahwa[1], Mark Slaughter[1]

AUTHOR INSTITUTION(S)
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OBJECTIVES:
Ischemic heart failure with reduced ejection fraction is associated with higher rates of morbidity and mortality in patients undergoing surgical revascularization. The role of coronary artery bypass grafting (CABG) versus chronic mechanical unloading in treating advanced ischemic heart disease has not been clearly established. The aim of this study is to compare the operative morbidity and mortality in patients with advanced ischemic cardiomyopathy who underwent CABG with or without mitral valve repair/replacement (MVRR) versus left ventricular assist device (LVAD) implantation.

METHODS:
2398 patients with EF < 25% from ischemic heart disease with a history of myocardial infarction (> 21 days) and chronic heart failure who underwent CABG +/- MVRR or LVAD implant from July 2017 to June 2019 were identified from the National STS Adult Cardiac Surgery Database. Four groups were compared: CABG, CABG + MVRR, LVAD, LVAD with prior CABG. Statistical analysis included Chi square (categorical variables) and Kruskal Wallis (continuous variables) for patient demographics and multivariate regression was performed comparing 30-day mortality between CABG and LVAD.

RESULTS:
Of the 2398 patients, 86% were male (n= 2055). The LVAD only group had significantly more African Americans, higher bilirubin, lower albumin, lower Hct, lower EF and larger LVEDD (Table1). Both the LVAD and LVAD +CABG groups had significantly more cardiogenic shock. Operative mortality at 30 days was highest in the LVAD groups (10% and 20% vs. 5% and 6%, p<0.01). Stroke, reoperative bleeding and renal failure were higher in the LVAD groups. Patients with a recent CABG that then had a LVAD had significant morbidity and mortality. After adjusting for preoperative risk factors there was no difference in 30-day mortality between CABG and LVAD (Figure 1).

CONCLUSIONS:
Patients with chronic ischemic heart failure who underwent LVAD implant were sicker and had increased morbidity and mortality compared to CABG or CABG with MVRR. However, after adjusting for preoperative characteristics, LVADs had similar 30-day outcomes. Prospective randomized trial of CABG vs LVAD should be considered for patients being considered for CABG with chronic heart failure, LVEDD > 6.5cm and an estimated mortality of >10%.

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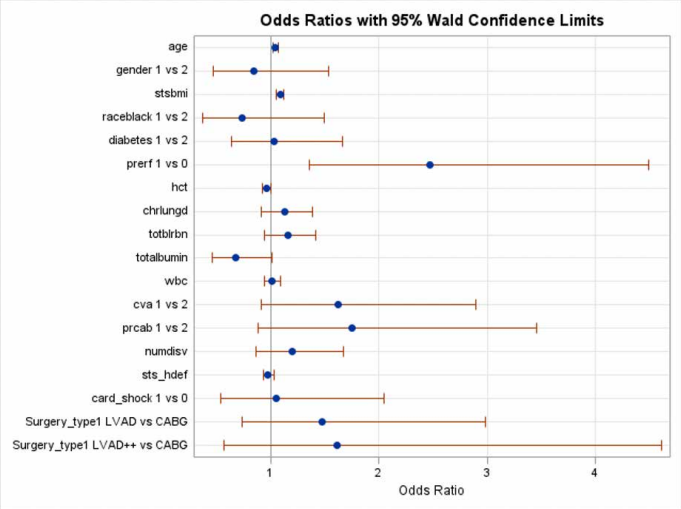
27. "HIGH RISK" CABG VS VAD FOR ISCHEMIC CARDIOMYOPATHY WITH LOW EF: WHERE TO DRAW THE LINE?

CONTINUED

Table 1: Preoperative Characteristics and Operative Mortality

	CABG Only n=1683	CAB+MVS n=29	LVAD n=569	LVAD++ n=117	p-value
Age	64 (57-71)	62 (57-70)	61 (53-68)	62 (56-68)	<.01
Gender F	14%	7%	17%	12%	0.09
Race AA	11%	4%	21%	23%	<.01
BMI	29 (26-33)	26 (24-29)	29 (25-34)	28 (24-33)	0.03
Diabetes	65%	45%	58%	65%	<.01
Hypertension	94%	76%	87%	90%	<.01
Dialysis	5%	0%	1%	5%	<.01
Creatinine	1.1 (0.9-1.4)	1.2 (1.1-1.4)	1.3 (1.0-1.6)	1.3 (1.0-1.6)	<.01
Liver Disease	5%	3%	6%	10%	0.14
Bilirubin	0.6 (0.4-0.8)	0.6 (0.5-1.1)	0.7 (0.5-1.1)	0.9 (0.5-1.4)	<.01
Albumin	3.8 (3.4-4.1)	3.9 (3.6-4.0)	3.6 (3.2-4.0)	3.5 (3.1-3.8)	<.01
WBC	7.5 (6.2-9.0)	7.4 (6.6-9.6)	7.6 (6.3-9.6)	7.8 (6.3-9.7)	0.04
Hematocrit	40 (36-44)	40 (37-42)	35 (31-39)	34 (30-38)	<.01
Chronic Lung Disease					
>/=moderate	15%	17%	20%	30%	<.01
Cerebrovascular Event	12%	17%	12%	18%	0.21
EF	23 (20-25)	23 (20-23)	18 (14-20)	18 (14-20)	<.01
LVED	58 (53-63)	58 (55-63)	65 (60-71)	65 (60-72)	<.01
LVSD	49 (44-55)	48 (43-56)	58 (52-66)	58 (52-63)	<.01
Prev CAB	2%	3%	30%	25%	<.01
Cardiogenic Shock	3%	0	39%	50%	<01
Outcomes					
Op Mortality	5%	3%	10%	21%	<.01
Reop Bleeding	3%	0	9%	19%	<.01
Stroke	1%	0	4%	9%	<.01
Renal Failure	4%	7%	10%	19%	<.01

Figure 1: Odds Ratios of Operative Mortality Related to Patient Characteristics



FRIDAY
SCIENTIFIC PAPERS

FOURTH SCIENTIFIC SESSION A – ADULT CARDIAC: MITRAL VALVE SYMPOSIUM BREAKOUT

28. LONGITUDINAL OUTCOMES OF MITRAL VALVE REPAIR AMONG HIGH-VOLUME AND LOW-VOLUME SURGEONS WITHIN A HIGH-VOLUME INSTITUTION

AUTHORS
Edward Percy[1], Paige Newell[1], Sameer Hirji[1], Morgan Harloff[1], Olena Cherkasky[1], Siobhan McGurk[1], Muntasir Chowdhury[2], Farhang Yazdchi[1], Daniel Rinewalt[1], Hari Mallidi[1], Ashraf Sabe[1], Prem Shekar[1], Tsuyoshi Kaneko[1]

AUTHOR INSTITUTION(S)
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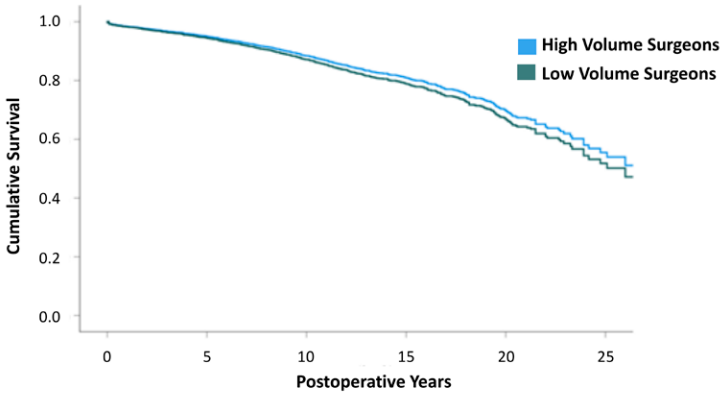
OBJECTIVES:
Volume-outcome relationships have been described for mitral valve repair at both the institutional and individual surgeon level. However, the interaction between overall institutional experience and individual surgeon outcomes is unknown. We hypothesized that the effects of low volumes on individual surgeon outcomes may be mitigated at experienced institutions. The purpose of this study was to evaluate outcomes of high-volume (HV) and low-volume (LV) mitral valve repair surgeons in the context of a high-volume mitral repair institution.

METHODS:
All mitral valve repair cases at a high-volume mitral center (mean 192 annual repairs) from 1992 to 2019 were retrospectively evaluated. Cases with concomitant procedures, other than tricuspid and atrial fibrillation procedures, were excluded. Surgeons who performed an average of at least 25 mitral repairs per year were considered HV, and fewer than 25 were considered LV, based on cut-offs from previous literature. The primary outcome was operative mortality, and secondary outcomes were procedure times, operative complications, long-term mortality, and reoperation. Risk-adjusted survival and reoperation were assessed using Cox proportional hazards models.

RESULTS:
A total of 2664 isolated mitral valve repair procedures from 19 surgeons met criteria. Five surgeons made up the HV group and 14 were included in the LV group. HV surgeons accounted for the majority, 2030 (76.2%), of cases. The mean patient ages in the HV and LV groups were 59.6 and 61.8 years, respectively ($p<0.001$). Baseline characteristics were similar, as was mean Society of Thoracic Surgeons Predicted Risk of Mortality score (1.3% vs. 0.7%, $p=0.525$). HV surgeons had significantly shorter mean aortic cross-clamp times (80min vs. 87min, $p<0.001$) compared to LV surgeons. However, operative mortality did not differ significantly between HV or LV surgeons (1.0% vs. 1.6%, $p=0.265$) and there were no differences in stroke, atrial fibrillation, length of stay, or reoperation. In the risk-adjusted analyses, surgeon volume group did not impact longitudinal survival or reoperation (Figure).

CONCLUSIONS:
We examined volume-outcome relationships for mitral valve repair within an experienced center. While LV surgeons had longer operative times, there were no differences in short-term outcomes or longitudinal rates of risk-adjusted survival or reoperation. Our findings suggest that previously established volume-outcome relationships for survival after mitral valve repair may be partially mitigated in experienced centers.

Risk Adjusted Survival by Surgeon Volume Group



Longitudinal risk-adjusted survival following mitral valve repair by high- or low-volume surgeons within a high-volume mitral repair institution.

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FOURTH SCIENTIFIC SESSION A – ADULT CARDIAC: MITRAL VALVE SYMPOSIUM BREAKOUT

29. THREE YEAR OUTCOMES FOR 4,219 MEDICARE PATIENTS UNDERGOING MITRAL VALVE REPAIR

AUTHORS
Vinod Thourani[1], James Edelman[2], Shannon Murphy[3], Sreekanth Vemulapalli[4], Matt Moore[3], Tom Nguyen[5], James Gammie[6]

COMMERCIAL RELATIONSHIPS
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OBJECTIVES:
Mitral valve repair (MVr) has become the standard therapy for degenerative mitral regurgitation (DMR), but late mortality, re-intervention rate, and re-admission data are limited. The objective of this study was to estimate outcomes for MVr for DMR to 3 years.

METHODS:
4,219 DMR patients over 65 years undergoing MVr within the MEDICARE 100% standard analytic file from 10/2015 to 12/2018 were evaluated. Outcomes were analyzed in all patients (Group 1, n=4,219) and with subgroup stratification: Group 2 (isolated MVr, n=2,433), Group 3 (MVr+left atrial appendage closure (LAAC), n=627), Group 4 (MVr+atrial fibrillation (AF) ablation±LAAC, n=540), and Group 5 (MVr+tricuspid valve (TV) repair±ablation±LAAC, n=619). Endocarditis, mitral stenosis, ESRD, and prior MV surgery patients were excluded. Surgical efficacy and safety outcomes through 3 years were estimated using multivariate Cox proportional hazards models.

RESULTS:
The average age for all patients was 71.9±5.2 years and predominantly male (56.1%). Concomitant procedures consisted of 27.8% LAAC, 17.6% ablation, and 14.7% TV surgery. All-cause mortality in Group 1 was 0.9% at 30 days, 2.6% at one year, and 4.6% at 3 years. There was higher mortality at 3 years in those with concomitant TV surgery and AF ablation (Figure 1A). MV re-intervention for all patients was 0.2% at 30 days, 1.2% at one year, and 2.1% at 3 years and was similar among groups (Figure 1B). In those requiring re-intervention, 78.2% had MV replacement and 21.8% re-repair. All-cause re-admission in all patients was 11.2% at 30 days, 28.4% at 1 year, and 51.9% at 3 years. Isolated DMR patients had the lowest all-cause re-admission rates (Figure 1C). Cardiac re-admission was 5.4% at 30 days, 11.6% at 1 year, and 17.8% at 3 years, and highest for those with concomitant TV surgery and AF ablation (Figure 1D). Acute kidney injury and stroke were the most common adverse events over 3 years for all patients (Figure 2). Those undergoing concomitant TV surgery and AF ablation had the highest rate of AKI, while MVr+AF ablation patients had the highest stroke rate at 3 years.

CONCLUSIONS:
3-year mortality in patients over 65 years undergoing MV repair for DMR is low. The rate of re-intervention remains low at ~2% at 3 years. Those undergoing concomitant TV surgery or AF ablation had higher rates of mortality and cardiac re-admission. The present study provides a benchmark as new transcatheter MVr procedures continue to emerge.

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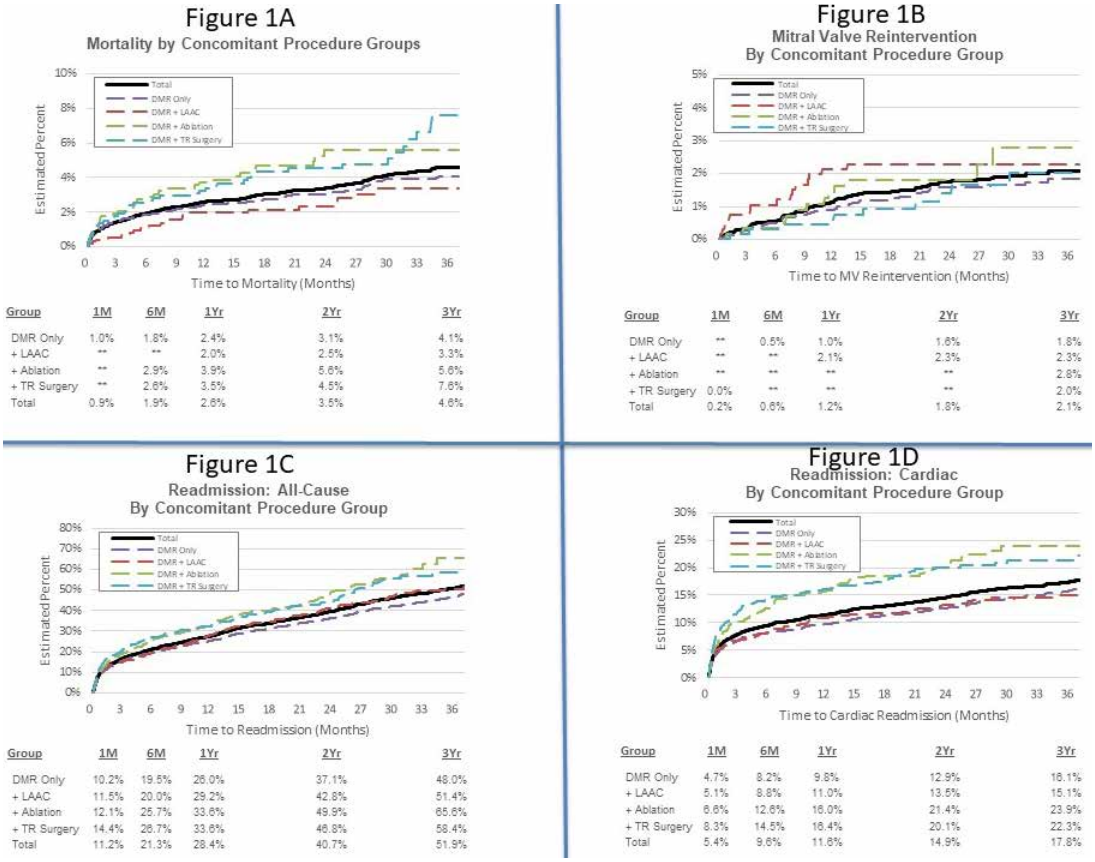
FOURTH SCIENTIFIC SESSION A – ADULT CARDIAC: MITRAL VALVE SYMPOSIUM BREAKOUT

29. THREE YEAR OUTCOMES FOR 4,219 MEDICARE PATIENTS UNDERGOING MITRAL VALVE REPAIR

CONTINUED

Figure 1. KM Curves for Outcomes



Group	1M	6M	1Yr	2Yr	3Yr
DMR Only	1.0%	1.8%	2.4%	3.1%	4.1%
+ LAAC	**	**	2.0%	2.5%	3.3%
+ Ablation	**	2.9%	3.9%	5.6%	5.6%
+ TR Surgery	**	2.6%	3.5%	4.5%	7.6%
Total	0.9%	1.9%	2.6%	3.5%	4.6%

Group	1M	6M	1Yr	2Yr	3Yr
DMR Only	**	0.5%	1.0%	1.6%	1.8%
+ LAAC	**	**	2.1%	2.3%	2.3%
+ Ablation	**	**	**	**	2.8%
+ TR Surgery	0.0%	**	**	**	2.0%
Total	0.2%	0.6%	1.2%	1.8%	2.1%

Group	1M	6M	1Yr	2Yr	3Yr
DMR Only	10.2%	19.5%	26.0%	37.1%	48.0%
+ LAAC	11.5%	20.0%	29.2%	42.8%	51.4%
+ Ablation	12.1%	25.7%	33.6%	49.9%	65.6%
+ TR Surgery	14.4%	26.7%	33.6%	46.8%	58.4%
Total	11.2%	21.3%	28.4%	40.7%	51.9%

Group	1M	6M	1Yr	2Yr	3Yr
DMR Only	4.7%	8.2%	9.8%	12.9%	16.1%
+ LAAC	5.1%	8.8%	11.0%	13.5%	15.1%
+ Ablation	6.6%	12.6%	16.0%	21.4%	23.9%
+ TR Surgery	8.3%	14.5%	16.4%	20.1%	22.3%
Total	5.4%	9.6%	11.6%	14.9%	17.8%

Figure 1A-D represent KM curves for All DMD Patients and Subgroups

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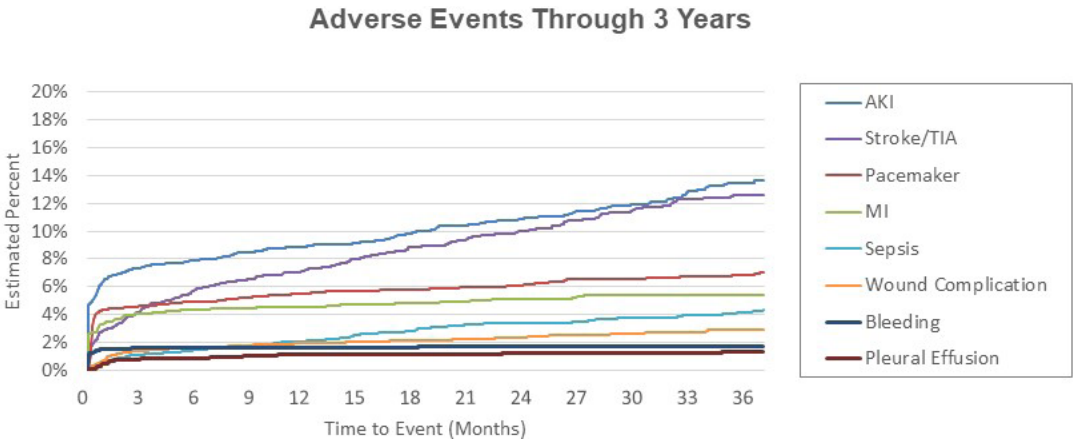
FOURTH SCIENTIFIC SESSION A – ADULT CARDIAC: MITRAL VALVE SYMPOSIUM BREAKOUT

29. THREE YEAR OUTCOMES FOR 4,219 MEDICARE PATIENTS UNDERGOING MITRAL VALVE REPAIR

CONTINUED

Figure 2. Major Complications following DMR Surgery



Adverse Event	TOTAL					DMR Only					DMR + LAAC					DMR + Ablation					DMR + TR Surgery				
	30D	6M	1Y	2Y	3Y	30D	6M	1Y	2Y	3Y	30D	6M	1Y	2Y	3Y	30D	6M	1Y	2Y	3Y	30D	6M	1Y	2Y	3Y
AKI	7.7	9.6	10.7	13.0	15.7	6.6	7.9	9.0	11.0	13.6	7.9	9.8	10.9	13.6	14.4	10.8	14.3	16.0	19.1	22.4	9.9	13.0	13.8	16.6	21.2
Bleeding	1.5	1.6	1.6	1.6	1.6	1.5	1.6	1.6	1.7	1.7	**	**	**	**	**	**	**	**	**	**	1.9	1.9	1.9	1.9	1.9
Myocardial Infarction (MI)	3.6	4.5	4.8	5.6	5.8	3.5	4.3	4.6	5.2	5.4	3.0	3.5	4.0	4.6	4.9	2.2	3.3	3.7	4.7	4.7	5.6	7.4	7.5	9.1	9.5
Pacemaker	5.0	5.8	6.7	7.6	8.4	4.4	4.9	5.6	6.2	7.1	3.9	4.2	5.2	6.0	6.9	5.0	7.1	9.1	10.6	11.9	9.2	10.9	11.7	13.4	13.9
Pleural Effusion	0.6	1.1	1.3	1.4	1.5	0.5	0.9	1.1	1.2	1.4	**	**	**	1.8	1.8	**	**	**	**	**	**	**	2.1	2.1	2.1
Sepsis	0.8	1.8	2.5	3.7	4.8	0.6	1.5	2.1	3.4	4.4	**	2.6	3.6	4.3	5.0	**	2.1	3.1	4.6	5.0	**	2.2	2.6	3.4	5.8
Stroke	2.7	6.0	7.6	10.5	13.4	2.9	5.9	7.3	10.2	12.6	2.5	6.3	8.9	11.5	14.8	2.4	6.8	8.6	11.9	18.9	2.2	5.2	6.6	9.7	12.3
Wound Complication	0.8	1.6	1.9	2.2	2.6	0.9	1.6	1.9	2.4	2.9	**	**	**	**	**	**	**	2.3	2.6	3.1	**	**	**	2.0	2.0

Note: Table includes risk-adjusted results for cumulative event rates through each time point post-procedure. ** Low cell count (<11) masked per Medicare data use agreement.

Figure 2. Adverse events following DMR Surgery

FOURTH SCIENTIFIC SESSION A – THORACIC: LUNG & CHEST WALL BREAKOUT

30. TRENDS IN THORACOTOMY LOBECTOMY OUTCOMES FOR LUNG CANCER OVER THE LAST TWO DECADES: MULTI-INSTITUTIONAL NATIONAL DATA STUDY

AUTHORS
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AUTHOR INSTITUTION(S)
[1]VCU Health, Richmond, VA; [2]UVA Medical Center, Charlottesville, VA

OBJECTIVES:
Background: Pulmonary lobectomy is considered the standard of care for the treatment of early-stage lung cancer. Adoption of thoracoscopic lobectomy has been increasing in the US, however, open lobectomy (OL) is still performed in 50% of cases. Post-operative care and specially enhanced recovery after surgery (ERAS) pathways have evolved and improved patient outcomes across the board in the last decade. The study aims to evaluate postoperative outcomes of OL over the last 15 years.

METHODS:
Method: Patients who underwent lobectomy for lung cancer between 2005-2019 were identified in the ACS-NSQIP database and divided into three groups; pre-ERAS (2005-2011), transitional period (2012-2015), and full ERAS implementation (2016-2019). Preoperative characteristics and postoperative outcomes were compared and multivariable logistic regression models with backward selection procedure were constructed to assess independent predictors of outcomes

RESULTS:
Results: During the study period, OL comprised 40% of lobectomies for lung cancer. A total of 10021 patients met inclusion criteria. 49% were male and on average 67 years old. Patients who belonged to the (2016-2019) period group had significantly higher comorbidities and ASA classification than patients from earlier periods. General surgeons performed <10% of OL in the 2016-2019 time period compared to over 30% during 2005-2011. Patients in the 2016-2019 period were less likely to experience unplanned intubation, surgical site infections, and sepsis. Mortality was also significantly lower than the previous groups (1.9% vs 2.0% and 2.8%, P=0.05). The rate of discharge to a facility as well as the length of hospital stays improved over the years. The primary surgeon specialty also served as an independent predictor for hospital LOS, unplanned intubation, and home discharge

CONCLUSIONS:
Conclusion: In a large surgical database, the outcomes of open lobectomy are improving over the years including postoperative mortality. An increasing number of these surgeries being performed by dedicated thoracic surgical specialists and improved ERAS pathways are helping improve patient outcomes.

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FOURTH SCIENTIFIC SESSION A – THORACIC: LUNG & CHEST WALL BREAKOUT

31. IMPACT OF CHEST WALL RESECTION ON MAJOR MORBIDITY AND MORTALITY FOLLOWING ANATOMIC LUNG RESECTION FOR NON-SMALL CELL CARCINOMA OF THE LUNG; A SOCIETY OF THORACIC SURGEONS GENERAL THORACIC DATABASE RISK ADJUSTMENT MODEL

AUTHORS
Christopher Towe[1], Elliot Servais[2], Maria Grau-Sepulveda[3], Andrzej Kosinski[4], Lisa Brown[5], Stephen Broderick[6], David Wormuth[7], Felix Fernandez[8], Benjamin Kozower[9], Daniel Raymond[10]

COMMERCIAL RELATIONSHIPS
C. Towe: Consultant/ Advisory Board: AtriCure, Medtronic, Zimmer Biomet; Research Grant: Zimmer Biomet; Other Research Support: Medtronic

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OBJECTIVES:
Lung cancer invading the chest wall is treated with concomitant lung and chest wall resection (CWR). It is unclear how concomitant CWR affects post-operative outcomes of lung resection for lung cancer. We hypothesized that CWR would be associated with increased risk of post-operative morbidity. The objective of this study is to determine the effect of CWR on adverse post-operative outcomes after lung cancer resection.

METHODS:
We performed a retrospective analysis of The Society of Thoracic Surgeons General Thoracic Surgery Database (STS-GTSD) from 2016-2019. Patients with superior sulcus tumors were excluded. Patient demographic and operative outcomes were compared between those with and without concomitant CWR. Chest wall resection was added to the STS lung resection and lobectomy risk models to determine the association with a composite adverse outcome, which included major morbidity and death. Differences in rate of CWR between institutions was also analyzed.

RESULTS:
Among 41,310 lung resections, 306 (0.74%) occurred with concomitant CWR. Notable differences in the populations include age, sex, FEV1, as well as other comorbidities. Patients receiving CWR were more likely to have the composite adverse outcome 64/306 (20.9%) vs 3128/41004 (7.6%) in non-CWR lung resections, p<0.001). Mortality was also increased among the CWR cohort (2.9% vs 1.1%, p=0.003). A multivariable model demonstrated CWR was associated with an increased risk of adverse composite outcome amongst all patients receiving lung cancer resection (OR 1.74, 95%CI, 1.29 to 2.34, p=0.0003) as well as the subgroup of patients undergoing lobectomy (OR 2.35, 95%CI, 1.72 to 3.22, p<.0001). Among 234 institutions with ≥10 lung resections during the study period, 115 institutions (49.1%) performed lung resections with CWR.

CONCLUSIONS:
Concomitant CWR adds risk of adverse outcomes after lung cancer resection and lobectomy. Because only a subset of intuitions performs CWR, quality assessments should control for CWR.

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FOURTH SCIENTIFIC SESSION A – THORACIC: LUNG & CHEST WALL BREAKOUT

31. IMPACT OF CHEST WALL RESECTION ON MAJOR MORBIDITY AND MORTALITY FOLLOWING ANATOMIC LUNG RESECTION FOR NON-SMALL CELL CARCINOMA OF THE LUNG; A SOCIETY OF THORACIC SURGEONS GENERAL THORACIC DATABASE RISK ADJUSTMENT MODEL

CONTINUED

Risk adjusted model of composite mortality or major morbidity

Effect	COMPOSITE Lung resection		COMPOSITE Lobectomy	
	OR (95% CI)	P-Value	OR (95% CI)	P-Value
Age,per year increase	1.01 (1.01, 1.02)	<.0001	1.01 (1, 1.01)	0.0029
Male	1.36 (1.26, 1.47)	<.0001	1.4 (1.28, 1.53)	<.0001
Year Surgery			1.03 (0.98, 1.08)	0.2012
BMI, per unit increase			0.97 (0.97, 0.98)	<.0001
BMI>=6.0 to <18.5	1.76 (1.46, 2.12)	<.0001		
BMI>=25.0 to <30.0	0.81 (0.74, 0.89)	<.0001		
BMI>=30.0 to <35.0	0.81 (0.72, 0.9)	0.0001		
BMI>=35.0 to <=99.9	0.8 (0.7, 0.92)	0.0015		
Hypertension	1.12 (1.02, 1.22)	0.0119	1.14 (1.03, 1.26)	0.0113
Steroids	1.3 (1.08, 1.57)	0.0054	1.24 (0.99, 1.55)	0.0622
Congestive Heart Failure	1.72 (1.45, 2.04)	<.0001	1.65 (1.35, 2.02)	<.0001
Coronary Artery Disease	1.05 (0.95, 1.15)	0.3391	1.03 (0.93, 1.15)	0.5614
Peripheral Vascular Disease	1.08 (0.96, 1.21)	0.1937	1.06 (0.92, 1.21)	0.4267
Reoperation	1.14 (0.98, 1.32)	0.0853	1.14 (0.94, 1.37)	0.1748
Induction Therapy	1.02 (0.88, 1.18)	0.8070		
Preop. Chemotherapy			1.19 (1, 1.42)	0.0481
Cerebrovascular Disease	1.26 (1.12, 1.42)	0.0002	1.22 (1.06, 1.4)	0.0053
Diabetes	0.99 (0.9, 1.09)	0.8256	1 (0.9, 1.12)	0.9411
Dialysis			1.48 (0.91, 2.43)	0.1155
RF-no dialysis			0.85 (0.55, 1.31)	0.4634
Renal Dysfunction	1.16 (0.89, 1.51)	0.2803		
% FEV1, 10% decrease	0.99 (0.99, 0.99)	<.0001	0.99 (0.99, 0.99)	<.0001
Open Procedure	1.74 (1.59, 1.91)	<.0001		
Smoking: Past	1.54 (1.34, 1.77)	<.0001	1.56 (1.33, 1.83)	<.0001
Smoking: Current	2.1 (1.81, 2.45)	<.0001	2.07 (1.74, 2.47)	<.0001
Zubrod 1	1.15 (1.06, 1.24)	0.0011	1.25 (1.14, 1.38)	<.0001
Zubrod 2,3,4,5	1.73 (1.46, 2.05)	<.0001	1.87 (1.53, 2.3)	<.0001
ASA 3	1.33 (1.15, 1.53)	0.0001	1.37 (1.16, 1.61)	0.0002
ASA 4,5	1.57 (1.3, 1.89)	<.0001	1.68 (1.36, 2.08)	<.0001
Path.Stage: II	1.03 (0.94, 1.14)	0.5010	1.08 (0.98, 1.21)	0.1315
Path.Stage: III	1.11 (0.99, 1.25)	0.0618	1.22 (1.07, 1.39)	0.0025
Path.Stage: IV	1.1 (0.82, 1.49)	0.5182	1.09 (0.76, 1.57)	0.6346
Procedure: Segmentectomy	1.37 (1.13, 1.67)	0.0014		
Procedure: Lobectomy	1.96 (1.72, 2.24)	<.0001		
Procedure: Sleeve	2.95 (2.14, 4.08)	<.0001		
Procedure: Bilobectomy	3.41 (2.72, 4.26)	<.0001		
Procedure: Pneumonectomy	3.46 (2.78, 4.31)	<.0001		
Chest Wall Resection	**1.74 (1.29, 2.34)**	**0.0003**	**2.35 (1.72, 3.22)**	**<.0001**

Multivariable model of demographic and operative characteristics on risk of composite adverse outcome (mortality and/or major morbidity) after lung resection and lobectomy among patients in the STS General Thoracic Surgery Database. Chest wall resection (CWR) was added to the covariates used in the existing STS risk model to demonstrate the association of CWR and adverse events. Data shown as Odds Ratio (OR) and 95% confidence interval (CI).

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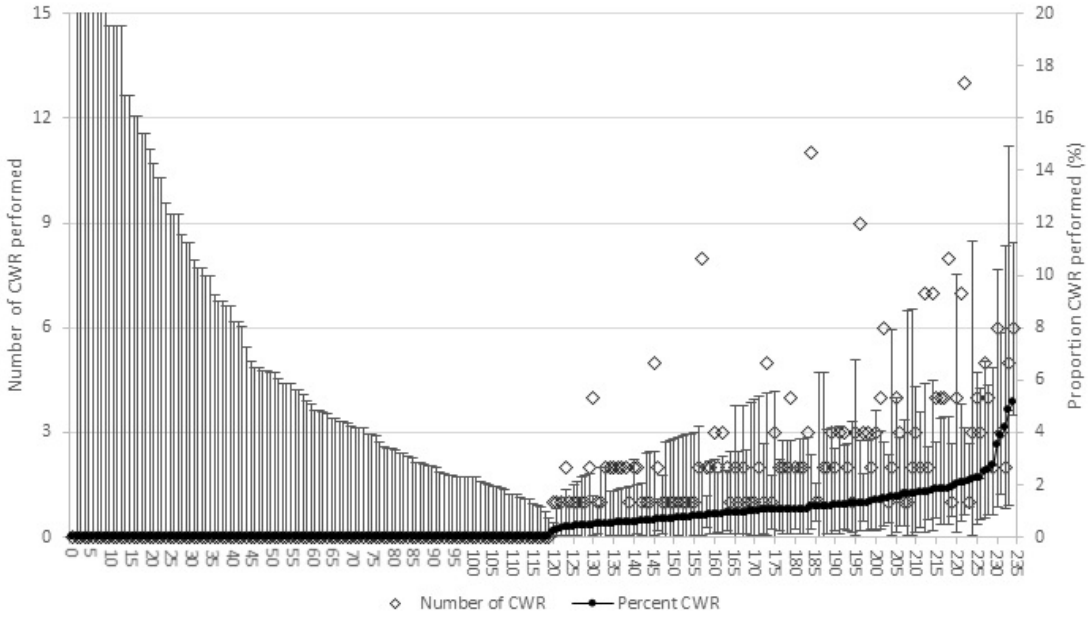
FOURTH SCIENTIFIC SESSION A – THORACIC: LUNG & CHEST WALL BREAKOUT

31. IMPACT OF CHEST WALL RESECTION ON MAJOR MORBIDITY AND MORTALITY FOLLOWING ANATOMIC LUNG RESECTION FOR NON-SMALL CELL CARCINOMA OF THE LUNG; A SOCIETY OF THORACIC SURGEONS GENERAL THORACIC DATABASE RISK ADJUSTMENT MODEL

CONTINUED

Variation in concomitant chest wall resection



Caterpillar graph of variation in number and proportion of non-pancoast concomitant lung resection and chest wall resection (CWR) among 235 institutions participating in the Society of Thoracic Surgeons General Thoracic Database with more than 10 lung resections during the study period. Data presented as rate of number of CWR (primary axis) or percentage of CWR relative to all lung resection and 95% confidence interval (secondary axis).

FOURTH SCIENTIFIC SESSION A – THORACIC: LUNG & CHEST WALL BREAKOUT

32. CHEST WALL RECONSTRUCTION UTILIZING BIOSYNTHETIC MATERIAL

AUTHORS
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COMMERCIAL RELATIONSHIPS
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OBJECTIVES:
Chest wall reconstruction (CWR) can be a challenge. The perfect material does not exist to restore chest wall stability. Synthetic materials have been the mainstay for reconstruction, but biological material use has increased. Recently, we initiated the use of a combined biosynthetic material (CBM) for CWR that is composed of ovine-derived extracellular matrix and monofilament polypropylene suture. The biological material from the ovine rumen reduces foreign body response, enable functional tissue remodeling and promote a natural repair. The interwoven polymer fibers provide a permanent reinforcement, along with improved handling and load-sharing capability to support normal CW function.

METHODS:
We respectively reviewed all patients who underwent CWR with a CBM patch from January 2020 through March 2021.

RESULTS:
Twenty-two patients underwent CWR with CBM. Median age was 38 years (range,18 - 66 years); 15 (68%) were men. Indication for CWR was status post tumor resection in 10, chest wall defect after pectus repair in 5, radiation necrosis in 5, and chest wall infection in 2. Infection was present in 7 patients (32%) at time of CWR. Median CW defect was 7 x 10 cm (range, 4 x 20 cm). Bioabsorbable bars were used in combination with a CBM patch in 15 patients (68%) and CBM alone in seven; 5 patients underwent myocutaneous advancement flaps. There were no operative deaths. Postoperative complications occurred in 5 patients (23%). Median hospital stay was 5 days (range, 3 - 14 days). Late complications occurred in 2 patients (9%). No patient developed paradoxical motion, chest wall instability, or required CBM patch removal at a median follow-up of 8 months (range, 1 - 13 months).

CONCLUSIONS:
This novel biosynthetic material (CBM) combines the benefits of biologic material and polymer reinforcement to provide a more natural CWR compared to mesh products made of synthetic polymer material alone. Early results are promising, especially in infected cases that require CWR, in this first series reported in the literature.

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FOURTH SCIENTIFIC SESSION A – THORACIC: LUNG & CHEST WALL BREAKOUT

33. ROBOTIC RESECTION FOR PRIMARY CHEST WALL TUMOR

AUTHORS
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REGULATORY DISCLOSURE
This presentation describes the off-label use of the Veran thoracic navigation system to intra-operatively identify the chest wall tumor in the absence of palpable or visual landmarks.

OBJECTIVES:
Open chest wall resection is associated with substantial morbidity, prolonged hospital length of stay, and functional debility. We present a minimally invasive robotic chest wall resection in a patient with a primary chest wall tumor.

METHODS:
Operative Technique: The lesion was unable to be palpated due to its location and thus, utilizing a Veran (trademark) system, a calibrated CT was obtained preoperatively and used to identify and mark the affected rib with methylene blue injected subpleurally. The chest was then entered and four robotic ports were placed. The blue dye was identified marking the margins of the rib around the tumor. Using a combination of blunt and energy dissection, the planned chest wall segment was freed. The rib was then divided using the Gigli saw under robotic guidance. The specimen was oriented and removed via a 2 cm utility incision.

RESULTS:
The patient underwent an uneventful robotic chest wall resection. The tumor was a langerhans cell histiocytosis on permanent pathology. All margins were clear. He did not require a blood transfusion. HIs postoperative course was unremarkable. The patient's hospital stay was 2 days long.

CONCLUSIONS:
In this case, we describe our technique for intraoperative localization and robotic resection of an osteolytic chest wall tumor located deep to the scapula, in an obese patient. The visibility provided by the robotic approach allows for detailed dissection and flexibility of the robotic instruments aids with preservation of the overlying musculature with rapid post-operative recovery and minimal discomfort.

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FOURTH SCIENTIFIC SESSION A – THORACIC: LUNG & CHEST WALL BREAKOUT

34. SAFETY OF ABSORBABLE SUTURE FOR STERNAL CLOSURE AFTER RESECTION OF MEDIASTINAL TUMORS: A COMPARATIVE STUDY

AUTHORS
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AUTHOR INSTITUTION(S)
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OBJECTIVES:
We evaluate the outcomes of sternal closure in patients undergoing resection of mediastinal tumors by median sternotomy comparing the use of absorbable suture and stainless steel wire.

METHODS:
Our prospective database was retrospectively analyzed to identify patients who underwent resection of mediastinal tumors by median sternotomy followed by primary sternal closure. Clinical and surgical records were reviewed to evaluate the incidence of sternal wound complications (SWC), sternal dehiscence, and/or other related complications. Patients with previous sternotomy for cardiac surgery were excluded. We compared Group I (82 patients,) in which sternal closure was achieved with standard sternal wires, with Group II (112 patients), in which sternal approximation was carried out by absorbable sutures (Polydioxanone 1, PDS) analyzing risk factors by univariate and multivariate analysis.

RESULTS:
Overall incidence of SWC was 5.1% (n=10). The incidence of SWC was considerably higher in Group I (9.7%, n=8) when compared to Group II (1.8%, n=2) ($p < 0.001$). Wound infection was significantly higher in Group I (5/82, 6.1%) than in Group II (1/112, 0.9%) (p=0.003). Mechanical sternal dehiscence without infection occurred in 3 patients in Group I and one patient in Group II ($p < 0.01$). This one was successfully repaired by means of steel wires. Sternal revision was performed in all complicated patients of Group I (8/8) vs 1 patient of Group II (1/2) ($p < 0.001$). Logistic regression analysis, found independent risk factors for the development of sternal dehiscence: body mass index (odds ratio: 1.91; $p < 0.01$) and diabetes (OR: 2.1; $p < 0.003$).

CONCLUSIONS:
Absorbable sutures provided superior results in sternal osteosynthesis following midline sternotomy for thymectomy in terms of both sternal stability and wound infection. Steel wires remain the first choice in all complicated cases.

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FOURTH SCIENTIFIC SESSION A – CONGENITAL BREAKOUT

35. EARLY AND LATE OUTCOMES OF THE WARDEN PROCEDURE

AUTHORS
Jessey Mathew[1], Joseph Dearani[1], Gabriel Graham[1], Heidi Connolly[1], Katherine King[1], Hartzell Schaff[1], Elizabeth Stephens[1]

AUTHOR INSTITUTION(S)
[1]Mayo Clinic, Rochester, MN

OBJECTIVES:
Operative repair of patients with partial anomalous pulmonary venous connection (PAPVC) remains challenging due to risks of sinus node dysfunction and baffle obstruction. When at least one of the anomalous veins enters high in the superior vena cava (SVC), the Warden procedure may be the best option for reconstruction, but this repair is performed infrequently. To better understand the early and late outcomes, we reviewed patients who underwent repair of PAPVC to the SVC.

METHODS:
From January 1993 to December 2019, 245 patients with PAPVC underwent surgical repair at our institution. Among these, 74 patients (30%) had a Warden procedure performed. Data regarding their pre-operative clinical status, echocardiography, operative procedures, as well as early and late outcomes were obtained. Descriptive statistics were used to present preoperative clinical characteristics, Kaplan Meier analysis was used to assess survival, and cumulative incidence was used to assess reoperation

RESULTS:
The median (interquartile range) age was 37 (21, 56) years and 32% were males. Preoperatively 13 patients (18%) had atrial arrhythmias. The standard Warden repair was performed in 23 (31%) patients, and in 51 (69%) patients the technique was modified to include an interposition graft. The atrial septum was intact in 17 (23%) patients. Additional procedures included tricuspid valve repair in 12 (16%), Maze procedure in 6 (8%), and pulmonary valve replacement in 2 (3%). Transient postoperative arrhythmias included sinus node dysfunction in 8 patients (11%), which resolved with temporary pacing and new onset atrial fibrillation occurred in 7 patients (20%); none of the patients required permanent pacemakers. There was one postoperative mortality in a 63-year-old patient who developed pneumonia and acute renal failure. The median (95%CI) follow-up was 3.8 (1.2-7.3) years. Survival at 1, 5 and 10 years were 97%, 91% and 91% respectively. During late follow-up, 4 patients (4.4%) developed superior vena cava obstruction that was managed with stenting, and 2 patients developed mild pulmonary venous baffle or obstruction that did not require intervention. Cumulative incidence of reintervention for SVC obstruction was 4.4%, 6.9% and 11% at 1, 5, 10 years postoperative.

CONCLUSIONS:
Surgical repair of PAPVC with the Warden procedure can be performed with satisfactory early and late survival, and importantly, this technique appears to eliminate the need for permanent pacing due to SA node dysfunction. Late SVC obstruction is uncommon and can be managed non-operatively in most patients.

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FOURTH SCIENTIFIC SESSION A – CONGENITAL BREAKOUT

35. EARLY AND LATE OUTCOMES OF THE WARDEN PROCEDURE

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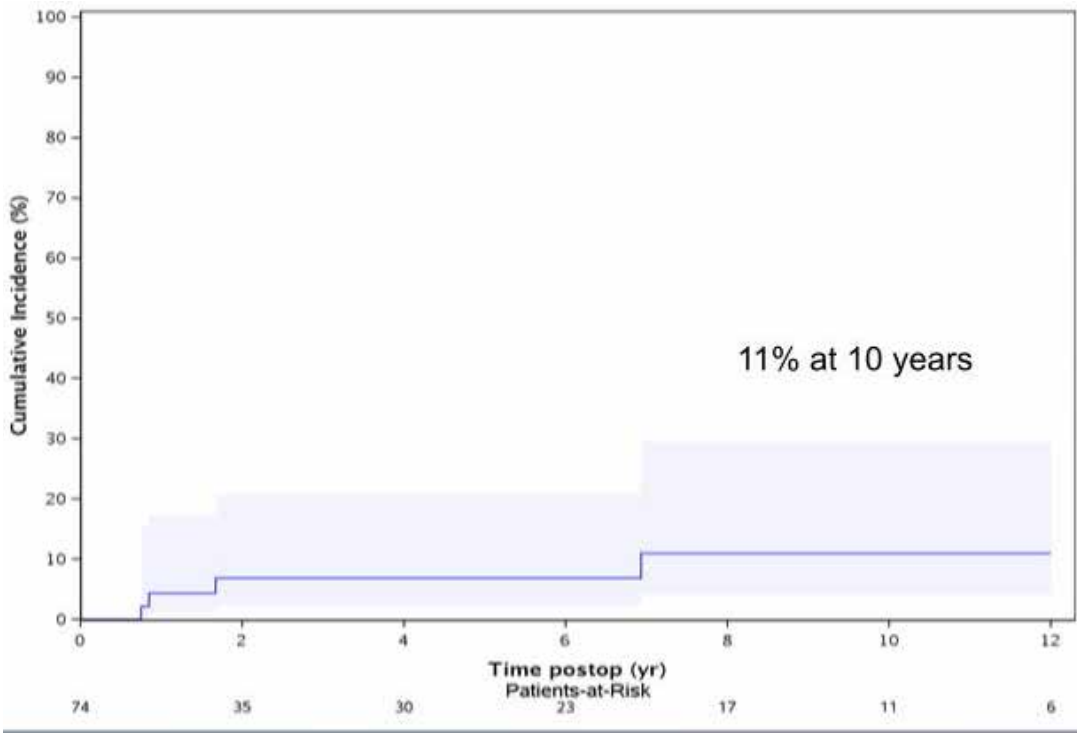

Reoperation Cumulative Index for Superior Vena Cava/ Pulmonary Vein Obstruction

FOURTH SCIENTIFIC SESSION A – CONGENITAL BREAKOUT

36. PARTIAL ANOMALOUS PULMONARY VENOUS CONNECTION WITH INTACT ATRIAL SEPTUM: EARLY AND LATE OUTCOMES

AUTHORS
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OBJECTIVES:
Isolated partial anomalous pulmonary venous connection (PAPVC) with an intact atrial septum is a very rare congenital anomaly. We report 45 cases of PAPVC with an intact atrial septum.

METHODS:
From January 1993 to December 2018, 293 patients with PAPVR underwent surgical repair. Of these, 45 patients (15.3%) had an intact atrial septum. The median (interquartile range) age was 36 (24) years with 49% being males. Direct reimplantation, intra cardiac baffling, and caval division (Warden) technique was used in 17 (38%), 16 (36%), and 12 (27%) patients, respectively. Postoperative hemodynamics were assessed using echocardiography. Descriptive statistics were used to assess the data and Kaplan Meier analysis was used to assess survival.

RESULTS:
Anomalous veins were right-sided in 27 patients (60%), left-sided in 16 patients (36%) and bilateral in 2 patients (4%). The insertion sites were the superior vena cava (SVC) 23 (52%), innominate vein via the vertical vein 13 (27%), inferior vena cava(IVC) 6 (14%), coronary sinus 2 (5%) and right atrium 1 (2%). Scimitar syndrome was noted in 8 patients (18%). There was no postoperative mortality or residual defects. Post-operative echocardiography excluded any obstruction at the pulmonary or systemic vein level. Post-operative complications included atrial fibrillation in 9 patients (20%) and pneumothorax requiring chest tube insertion in 5 patients (11%). All patients maintained normal sinus rhythm at discharge. One patient had junctional rhythm with supraventricular tachycardia in the immediate postoperative period, which resolved gradually. Survival at 1, 5, and 10 years was 100%, 95%, and 95%, respectively. Two patients (4%) underwent pulmonary vein dilatation after a median of 5.2 years with an IQR of (3.0, 7.3) years.

CONCLUSIONS:
Surgical repair of PAPVC with intact atrial septum can be performed with excellent early and late outcomes. The overall incidence of late systemic or pulmonary vein stenosis is low.

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FOURTH SCIENTIFIC SESSION A – CONGENITAL BREAKOUT

37. LONG-TERM RESULTS OF TOTAL ANOMALOUS PULMONARY VENOUS CONNECTION REPAIR AND RISK FACTORS FOR REINTERVENTION AND MORTALITY

AUTHORS
Christian Jacobsen[1], Kevin Beers[2], Stewart Miller[3], David Lehenbauer[4], Elaine Maldonado[5], S. Adil Husain[6], John Calhoon[5]

AUTHOR INSTITUTION(S)
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OBJECTIVES:
Management of total anomalous pulmonary venous connections (TAPVC), including evaluation of reintervention and mortality risk have been studied to further improve outcomes. Our institution previously reported factors associated with mortality, recurrent obstruction, and reintervention in the current surgical era. The purpose of this study was to revisit the cohort of patients from the two most recent decades; specifically, re-evaluate factors associated with early obstruction, reintervention and mortality risk, as well as late outcomes.

METHODS:
A retrospective chart review was performed, identifying 81 patients undergoing TAPVC repair from January 2002 to January 2018 at our institution. Individual demographic and operative variables were evaluated. Post-operative gradients were measured by trans-esophageal echocardiogram (TEE). Reintervention and, or mortality were primary endpoints. Reintervention was defined as interventional or surgical anastomotic revision.

RESULTS:
Eighty-one patients were included in the study. Follow-up ranged from 0 to 6,291 days (17.2 years), with a mean of 1,263 days (3.5 years). Both mortality and reintervention rates were 19.8%. In re-interventions performed, 80% occurred within 1.2 years, while 94% of mortalities were within 4.1 months. Increasing cardiopulmonary bypass times (CPB) (p=0.0001), use of deep hypothermic circulatory arrest (p=0.0001), and the presence of obstruction at the time of surgery (p=0.025) were predictors of mortality, while intracardiac TAPVC type (p=0.033) was protective. Risk of reintervention was higher with increasing CPB times (p=0.015), single ventricle anatomy (p=0.02), and a post-repair gradient >2mmHg on TEE (p=0.009).

CONCLUSIONS:
Evaluation of a larger cohort with longer follow-up demonstrated the relationship of anatomic complexity and symptoms at presentation to increased mortality risk after TAPVC repair. The presence of a single ventricle, or a post-operative confluence gradient >2mmHg were risk factors for reintervention. These findings support those found in our initial study.

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FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

38. HEPARIN-INDUCED THROMBOCYTOPENIA AFTER CARDIAC SURGERY – A STATEWIDE REVIEW OF COSTS, OUTCOMES, AND READMISSIONS

AUTHORS
Lekha Yesantharao[1], Eric Etchill[2], Joseph Canner[1], Diane Alejo[1], Chun Choi[2], Jennifer Lawton[3], Marc Sussman[1], Stefano Schena[3]

AUTHOR INSTITUTION(S)
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OBJECTIVES:
Heparin-induced thrombocytopenia (HIT) is a rare antibody-mediated complication of heparin administration observed after cardiac surgery. Despite elevated mortality following its initial occurrence, there is minimal information about costs associated with HIT and even less characterization of rehospitalizations for those who survive. The aim of this study was to assess state-wide trends of incidence, hospital length of stay (LOS), and resource consumption associated with HIT.

METHODS:
A retrospective cohort study identifying adult (≥ 20 years) patients with diagnoses of HIT during index admissions for cardiac surgery was performed using the Health Services Cost Review Commission's (HSCRC) database from 2012-2020. Patient demographics, LOS, costs during the index admission and subsequent readmissions, and mortality were assessed. A 3:1 propensity matched cohort based on sex, ethnicity, and a Severity of Illness (SOI) score was analyzed. We hypothesized that patients diagnosed with HIT would be associated with higher costs, readmissions, and worse outcomes.

RESULTS:
Of the 33,583 cardiac surgery patients in the HSCRC database, 184 (0.55%) were diagnosed with HIT. There was a significant difference in age distribution of patients with and without HIT. Among patients with HIT, 18.5% (n=34) were 80+, while only 8.9% (n=2973) of patients without HIT were 80+ years old (p<0.001). HIT patients had significantly greater SOI scores, with 57.6% (n=106) categorized as 4 (most severe) compared to 16.1% (n=5389) of patients without HIT (p<0.001). HIT was associated with a significantly longer median index LOS (21 vs 7 days, p<0.001), a greater number of 30-day readmissions (0.43 vs 0.34, p=0.041), greater mortality at 13.6% (n=25) versus 2.3% (n=757, p<0.001) and greater cost of index admission ($161,626 vs $58,584, p<0.001). After propensity matching, trends were preserved; HIT patients were older (p=0.011), had a longer LOS (p<0.001), were more severely ill (p<0.001), had higher mortality (p<0.001), and higher costs during index admission (p<0.001). In subsequent readmissions, HIT patients had significantly higher median costs related to facilities ($8,702 vs $4,822, p<0.001), surgery ($3,165 vs $1,474, p<0.001), imaging/testing ($3,528 vs $2,268, p<0.001), physical medicine/rehabilitation ($1,575 vs $725, p<0.001), and greater readmission costs overall ($19,756 vs $13,210, p<0.001).

CONCLUSIONS:
In addition to higher mortality, cardiac surgery patients with HIT were associated with significantly higher costs during their index admission as well as higher costs related to readmissions. Strategies to minimize the risk of HIT could yield better outcomes and reduced costs, notably important in a state with an All-Payer model championing value-based care and the reduction of unnecessary hospitalizations.

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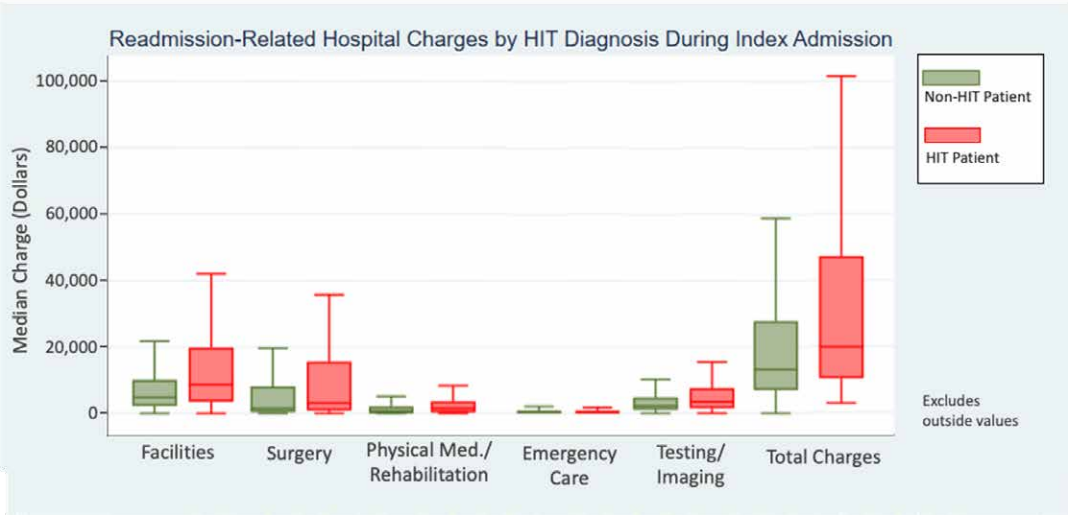
FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

38. HEPARIN-INDUCED THROMBOCYTOPENIA AFTER CARDIAC SURGERY – A STATEWIDE REVIEW OF COSTS, OUTCOMES, AND READMISSIONS

CONTINUED

Readmission-Related Hospital Charges by HIT Diagnosis During Index Admission



Displays various readmission-related hospital charges stratified by whether the patient was diagnosed with HIT during index admission or not.

FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

39. A RETROSPECTIVE LONGITUDINAL ANALYSIS OF TEG-DIRECTED TRANSFUSION IN ISOLATED CABG, ISOLATED VALVE, AND MULTIPLE CARDIAC PROCEDURES: IMPACT ON TRANSFUSION EXPOSURE AND IMPROVED PATIENT OUTCOMES

AUTHORS
Roberta Redfern[1], Gabriel Naimy[1], Michael Kuehne[1], Kevin Fleming[1], Nathan Bobulski[1], Michael Moront[1]

COMMERCIAL RELATIONSHIPS
M. Moront: Speakers Bureau/Honoraria: Hemonetics

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OBJECTIVES:
Cardiac procedures requiring cardiopulmonary bypass often require transfusion of blood products perioperatively. Thrombelastography (TEG) point-of-care testing is used in our institution to guide transfusion therapy in the operating room and perioperative period. The goal of this study was to quantify the effect of TEG on primary blood product usage, postoperative bleeding-associated reoperations, complications, and mortality in cardiothoracic surgery.

METHODS:
A retrospective analysis of patients who underwent isolated CABG or valve procedures, or multiple concurrent or aortic procedures between 2008 and 2019 was performed. Variables including preoperative laboratory values and operative characteristics were retrospectively collected. Total patient blood product exposure, exposure by product type, return to the operating room for exploration of bleeding, complications, and mortality were analyzed to quantify the impact of TEG by procedure type.

RESULTS:
In total, 5514 patients were included 4375 in the TEG period. Isolated CABG made up 52.1% of the cohort, followed by 31.6% multiple procedures, and 16.2% isolated valves. Mean units transfused perioperatively was reduced after the introduction of TEG, by 67% in CABG cases, 64% in valve cases, and by 58% in multiple procedure cases. Absolute exposure to transfusion during the hospitalization was reduced by 31%, 30%, and 24% in CABG, valve, and multiple procedure cases, respectively. Multivariate linear regression model demonstrated that TEG was the strongest predictor of the number of units transfused perioperatively ($p<0.001$). Reoperations were significantly reduced in all procedure types with TEG, particularly in isolated valve procedures (9.2% vs 3.1%). On logistic regression, TEG period was the strongest predictor of reoperation, where pre-TEG case were more likely to require re-exploration (OR 2.43 95% CI 1.79 – 3.31). Total length of stay was significantly reduced in all procedure types by an average of one day. Specific complications of interest were reduced in the TEG period. Six-month mortality was unchanged in the cohort from the pre-TEG to TEG periods.

CONCLUSIONS:
Blood product administration during cardiac surgery was significantly reduced with the use of TEG; overall exposure to allogenic blood products was reduced in all procedure types. In addition, re-operation rates were reduced by approximately 60% overall. The use of TEG or blood product guidance improved rates of transfusions, length of stay, and patient outcomes in a large longitudinal cohort.

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FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

40. TRANSAPICAL VENTRICULAR REMODELING FOR PATIENTS WITH HYPERTROPHIC CARDIOMYOPATHY AND SYSTOLIC CAVITY OBLITERATION

AUTHORS
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OBJECTIVES:
Some patients with hypertrophic cardiomyopathy (HCM) present with reduced left ventricular (LV) stroke volume and elongated systolic cavity obliteration due to symmetric LV hypertrophy (Figure 1). This HCM phenotype is morphologically different from the classic apical HCM and has not been widely recognized as amenable to operation. In the present report, we detail our experience with transapical septal myectomy to enlarge the LV volume and relieve cavity obliteration in this unique subgroup of HCM patients.

METHODS:
We analyzed 35 patients with HCM who had extended symmetrical LV hypertrophy and underwent transapical septal myectomy to enlarge the LV cavity from February 2001 to September 2020. Symptom status following myectomy was obtained using a questionnaire-based survey through telephone interviews.

RESULTS:
The median (interquartile range (IQR)) age of this cohort was 50 (36-60) years. At the time of evaluation, 83% (n=29) of the patients were in New York Heart Association class III/IV; chief complaints were exertional dyspnea (n=35, 100%) and chest tightness (n=24, 69%). Among the 12 patients who had preoperative stress tests, the peak oxygen consumption was only 54% (44-59%) of predicted. Patients presented with hyperdynamic LV function (median (IQR) ejection fraction, 73% (68-75%)), but the median stroke volume index was only 41 (31-45) ml/m2 (n=26) on transthoracic echocardiography. Left atrial sizes in this cohort were enlarged (left atrial volume index, 40 (34-50) mL/m2), despite only 10% of patients with moderate or greater mitral valve regurgitation (MR). All patients underwent transapical septal myectomy to enlarge the LV cavity size. There was no postoperative (within 30 days) mortality. No patient had more than mild MR postoperatively. During a median (IQR) follow-up of 3.4 (0.7-6.9) years, the estimated survival rates were 97%, 89%, and 84% at 1-, 3-, and 5-year respectively. Among the 15 patients contacted through recent telephone interviews, 14 (93%) reported improvement in their heart function and 11 (73%) rated their general state of health as good or excellent.

CONCLUSIONS:
Transapical myectomy to enlarge LV cavity volume can be performed safely with good early survival and functional results. This procedure is an important alternative to cardiac transplantation for HCM patients with systolic cavity obliteration and progressive heart failure.

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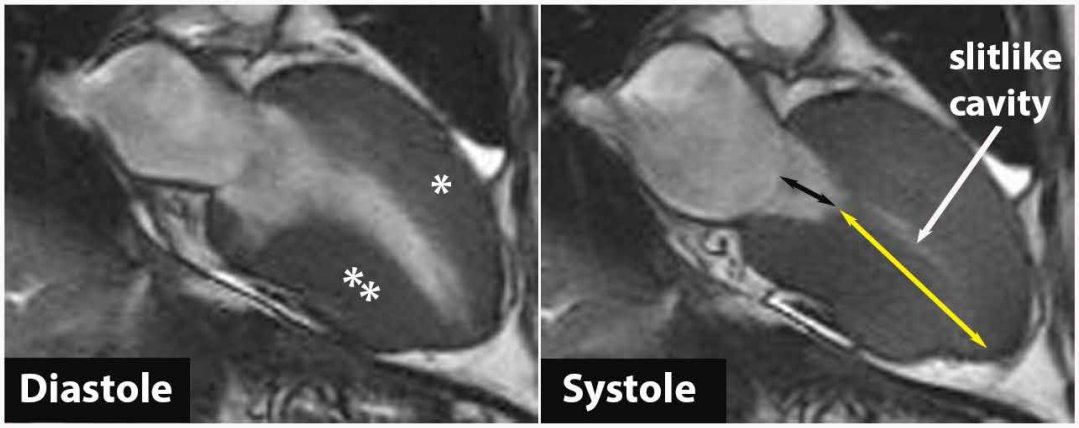
FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

40. TRANSAPICAL VENTRICULAR REMODELING FOR PATIENTS WITH HYPERTROPHIC CARDIOMYOPATHY AND SYSTOLIC CAVITY OBLITERATION

CONTINUED

Figure 1. Preoperative cardiac magnetic resonance imaging during diastole and systole



The left ventricular cavity appears small with diffuse hypertrophy involving both the interventricular septum (**) and the posterior wall (*) in the distal region. The papillary muscles might be prominently hypertrophied as well. At the end of symmetric contraction, there is elongated complete systolic cavity obliteration from the level of the papillary muscles to the apex. The double-headed arrows indicate the length of cavity obliteration (yellow) and the height of residual cavity (black).

FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

41. OUTCOMES, COST, AND READMISSIONS AFTER SURGICAL AORTIC AND MITRAL VALVE REPLACEMENT AT SAFETY NET VERSUS NON-SAFETY NET HOSPITALS IN THE UNITED STATES

AUTHORS
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OBJECTIVES:
Safety net hospitals (SNHs) provide essential services, including complex cardiac surgery, to vulnerable patients with high medical and socioeconomic complexity. We hypothesized that SNHs would have comparable outcomes, costs, and readmissions after isolated surgical aortic valve replacement (AVR) and mitral valve replacement (MVR) to non-SNHs when comparing matched populations in a nationwide sample.

METHODS:
The National Readmissions Database was queried for patients undergoing isolated surgical AVR or MVR between 2016 and 2018. Safety net burden was defined as the percentage of all admissions who were uninsured or Medicaid, with hospitals in the top quartile defined as SNHs. We used propensity score matching to control for confounding baseline patient characteristics and compare outcomes between patients who underwent surgery at SNHs versus non-SNHs.

RESULTS:
A weighted total of 109,744 AVR patients (n=17,925 at SNHs [16%]) and 31,474 MVR patients (n=5,516 at SNHs [18%]) were included. SNH patients were younger (mean age 64 vs 65 years; p<0.001) with higher rates of heart failure (44.0% vs 40.7%; p<0.001) and diabetes (28.0% vs 25.6%; p<0.001). SNH patients were also more likely to be from the lowest income quartile (28.4% vs 21.9%; p<0.001) and more frequently required urgent or emergency surgery (27.2% vs 20.9%; p<0.001). Observed in-hospital mortality was similar between groups (AVR: 2.2% vs 2.1%, p=0.418; MVR: 4.8% vs 4.3%, p=0.091), however, patients who underwent AVR at SNHs had higher rates of acute kidney injury (16.7% vs 16.0%; p=0.036) and stroke (2.2% vs 1.9%; p=0.003). SNH patients also had longer postoperative length of stay (AVR: 9.4 vs 8.3 days; MVR: 13.3 vs 12.3 days; both p<0.001), were more likely to be discharged home without services (AVR: 50.3% vs 37.0%; MVR: 39.6% vs 29.8%; both p<0.001), and incurred higher total costs (AVR: $59,000 vs $51,000; MVR: $74,000 vs $67,000; both p<0.001). After propensity score matching, the rates of in-hospital mortality, major morbidity, and readmissions at SNHs were comparable to non-SNHs; however, the observed differences in increased postoperative length of stay (AVR: 9.3 vs 9.0 days, p=0.001; MVR: 13.2 vs 12.6 days, p=0.048), increased proportion discharged home without services (AVR: 50.0% vs 36.2%; MVR: 40.2% vs 30.6%; both p<0.001), and increased total costs (AVR: $59,000 vs $53,000; MVR: $73,000 vs $66,000; both p<0.001) at SNHs persisted **(Table)**.

CONCLUSIONS:
Surgical AVR and MVR is performed at SNHs with comparable outcomes to non-SNHs. These results support efforts to expand access to these procedures for underserved populations, however, investment in discharge and home health resources to mitigate costs at SNHs is warranted.

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FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

41. OUTCOMES, COST, AND READMISSIONS AFTER SURGICAL AORTIC AND MITRAL VALVE REPLACEMENT AT SAFETY NET VERSUS NON-SAFETY NET HOSPITALS IN THE UNITED STATES

CONTINUED

Adjusted Postoperative Outcomes after Propensity Score Matching

	AVR (n=21,102)			MVR (n=6,326)		
Variable	SNH (n=10,551)	nSNH (n=10,551)	*P*	SNH (n=3,163)	nSNH (n=3,163)	*P*
In-hospital mortality	2.1%	2.2%	.668	4.4%	4.0%	.493
Acute kidney injury	16.3%	17.0%	.230	24.5%	24.7%	.861
Stroke	2.1%	2.2%	.600	2.8%	2.5%	.434
Respiratory failure	9.3%	10.8%	<.001	11.6%	13.5%	.025
LOS, days	9.3 ± 8.9	9.0 ± 7.9	.001	13.2 ± 12.2	12.6 ± 10.3	.048
Total costs	$58,952 ± 41,927	$53,220 ± 40,785	<.001	$73,476 ± 59,649	$65,863 ± 48,260	<.001
Discharged home	83.1%	82.4%	.140	76.3%	75.2%	.305
With home health services	33.2%	46.2%	<.001	36.1%	44.6%	<.001
Without home health services	50.0%	36.2%	<.001	40.2%	30.6%	<.001
Readmission within 30 days	10.8%	11.5%	.137	15.9%	16.4%	.632
Readmission within 90 days	15.2%	15.6%	.391	22.9%	24.1%	.247

FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

42. IMPACT OF HEART TRANSPLANT ALLOCATION CHANGES ON HOSPITAL RESOURCE UTILIZATION

AUTHORS
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OBJECTIVES:
The 2018 change in the heart transplant allocation system has resulted in fewer patients bridged with implantable ventricular assist devices (VAD) and greater use of temporary mechanical circulatory support (MCS). However, the full impact on resource utilization and hospital cost is unknown. We hypothesized that the new heart transplant allocation change has increase length of stay and cost.

METHODS:
Using a regional Society of Thoracic Surgeons Database, we reviewed all patients undergoing heart transplant from 2012-2020, stratified before and after the allocation changes into Early Era (1/2012-9/2018) and Late Era (11/2018-6/2020). Costs were derived from Universal Billing-04 forms and cost-to-charge ratios, adjusted for medical inflation and presented in 2020 dollars. Eras were compared by univariate analyses as well as multivariable hierarchical generalized linear regression accounting for clustering at the hospital level.

RESULTS:
A total of 515 patients underwent heart transplant, with 391 Early and 124 Late Era patients. Patients across eras were generally similar with no difference in age and gender distributions, though a greater burden of lung and valvular disease was present in the Late Era. Fewer patients in the new allocation system were bridged with implanted VADs (67% vs 31%, p<0.0001) and more with temporary MCS (4% vs 46%, p<0.0001). There was no difference in early mortality (6% vs 4%, p=0.33) or major morbidity (57% vs 61%, p=0.40). While median postoperative length of stay was similar, preoperative length of stay was significantly longer (1 vs 8.5 days, p<0.0001). Despite these changes, median total hospital cost was no different between eras ($131,678 vs $129,769, p=0.20). Figure 1 demonstrates similar distributions of total cost across eras, with high variability. On multivariable regression, preoperative ECMO was associated with higher cost (+$211,735), Late Era with lower cost (-$48,215), while neither durable VAD, IABP, nor percutaneous VAD were significantly associated with cost differences (Table 1).

CONCLUSIONS:
The new heart transplant allocation system has resulted in different bridging techniques for heart failure patients, with greater reliance on temporary MCS. Although this is associated with a large (+7.5 days) increase in preoperative length of stay, there is no strong evidence to suggest a commensurate increase in total hospital cost.

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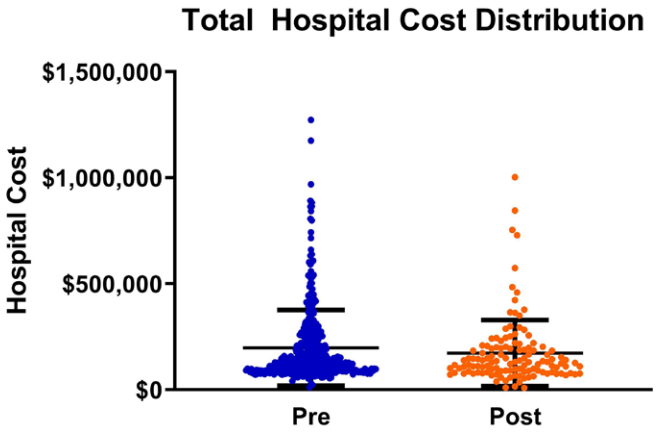
FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

42. IMPACT OF HEART TRANSPLANT ALLOCATION CHANGES ON HOSPITAL RESOURCE UTILIZATION

CONTINUED

Distribution of total cost for the transplant index hospitalization



Adjusted hierarchical regression results for total hospital cost of index transplantation episode

Total Cost	Estimate	95% CI	P-value
New Allocation System	-$48,215	-88,310 to -8,120	0.002
Prior Durable LVAD	-$4,068	-37,626 to 29,492	0.84
Preoperative IABP	+$11,809	-44,341 to 67,959	0.84
Preoperative Percutaneous VAD	+$126,456	-11,084 to 263,996	0.84
Preoperative ECMO	+$211,735	125,292 to 298,178	0.003

FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

43. INTRAAORTIC BALLOON PUMP CAN BE SAFELY USED AFTER ACUTE TYPE A AORTIC DISSECTION REPAIR

AUTHORS
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AUTHOR INSTITUTION(S)
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OBJECTIVES:
There is limited data available for the use of circulatory support, extracorporeal membrane oxygenation (ECMO) and intraaortic balloon pump (IABP), for cardiogenic shock in patients undergoing surgery for acute type A aortic dissection (ATAAD). We retrospectively reviewed the outcomes after ECMO and IABP use in this population.

METHODS:
We retrospectively reviewed 589 patients who underwent repair of acute type A aortic dissection during 1999 and 2018 and identified patients who required intraoperative ECMO or IABP support to wean off the cardiopulmonary bypass due to cardiogenic shock.

RESULTS:
26 patients required intraoperative circulatory support after ATAAD repair (7 ECMO, 19 IABP). Median age was 66-years (IQR 56-74) and left ventricular ejection fraction was 50% (IQR 40-60%; not available in 3 patients). On admission, 11 (42%) had coronary malperfusion, 4 (15%) had visceral malperfusion, 6 had aortic rupture, and 9 (35%) were intubated. 7 (27%) received preoperative CPR. Median clamp time was 107-min (IQR 88-160) and circulatory arrest time was 25-min (IQR 19-31). Concomitant procedures included 9 CABGs (35%), 3 root replacements (12%), 1 total arch replacement (4%), and 12 delayed closures (46%). Overall in-hospital mortality was seen in 17 (66%) patients (6 of 7 patients [86%] with ECMO, 11 of 19 patients [58%] with IABP), of which, 3 were intraoperative deaths. There were no IABP-specific complications (i.e. aortic rupture, and worsening of aortic regurgitation) except for 1 arterial embolization.

CONCLUSIONS:
Outcomes after ECMO support in ATAAD were discouraging. IABP was safe to be used in patients after repair of ATAAD. There may be a role for IABP following ATAAD repair to allow patients to recover from cardiogenic shock.

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FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

44. EXTRACORPOREAL MEMBRANE OXYGENATION FOR SEVERE SARS-COV-2 ACUTE RESPIRATORY DISTRESS SYNDROME: OUTCOMES FROM A SINGLE INSTITUTION THROUGH MULTIPLE WAVES

AUTHORS
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OBJECTIVES:
Extracorporeal membrane oxygenation (ECMO) for acute respiratory distress syndrome (ARDS) has shown variable results in SARS-CoV-2 pneumonia (i.e., COVID-19) with evidence to suggest benefit from novel modalities. We sought to compare our institutional outcomes with various ECMO modalities through multiple waves of the COVID-19 pandemic.

METHODS:
All patients who received ECMO for severe COVID-19 ARDS between March 1, 2020 and March 1, 2021 were reviewed. Groups consisted of patients who received conventional venovenous ECMO (i.e., VV ECMO) and those who received right ventricular assist device with ECMO (i.e., RVAD/ECMO). Early (i.e., Era 1) and late pandemic (i.e., Era 2) RVAD/ECMO patients were compared separately.

RESULTS:
Fifty-one patients received ECMO for severe COVID-19 ARDS of which 13 (25.5%) patients received VV ECMO and 38 (74.5%) RVAD/ECMO. Mean age was 52.9 years old, body mass index (BMI) 35.1 kg/m2, 41.2% female, and 49% Caucasian with a high incidence of diabetes (43.1%), hypertension (62.7%), and chronic lung disease (45.1%). The most common pre-cannulation treatments included steroids (78.4%), convalescent plasma (68.6%), proning (92.2%) and empiric antibiotics (66.7%). 43.1% of patients were transfers from a referral center with a mean 6.1 days from admission to intubation and 7.0 days from admission to cannulation. Patients were intubated a mean 1.5 days prior to cannulation. Cannulation length varied widely with a mean 36.2 days for VV ECMO and 33.2 days for RVAD/ECMO. Overall survival to decannulation was 52.9% with a notably higher rate among RVAD/ECMO patients (57.9%) compared VV ECMO (38.5%). In-hospital mortality was 43.1% (39.5% RVAD/ECMO, 53.8% VV ECMO). There was a high incidence of post-cannulation infection (overall 80.4%, 84.6% VV ECMO, 78.9% RVAD/ECMO), and bleeding events (overall 74.5%, 92.3% VV ECMO, 68.5% RVAD/ECMO). The cumulative incidence of death was lower for RVAD/ECMO patients with Era 2 demonstrating a notably higher incidence compared to Era 1. Multivariate analysis found higher BMI (33.0 vs 37.7 kg/m2, p=0.032) and treatment with remdesivir (41.4 vs 72.7%, p=0.026) were associated with in-hospital mortality. Competing risk regression comparing VV ECMO to RVAD/ECMO demonstrated BMI (HR 1.09, p=0.042), renal replacement therapy (HR 5.80, p=0.008) and steroids (HR 0.09, p=0.003) to be significant factors affecting mortality.

CONCLUSIONS:
ECMO for COVID-19 ARDS is a useful treatment strategy but carries significant morbidity and mortality. Notable difference exist between ECMO modality and at various time points through the pandemic. RVAD/ECMO has shown consistent benefit over VV ECMO, but perhaps with declining efficacy in an evolving pandemic.

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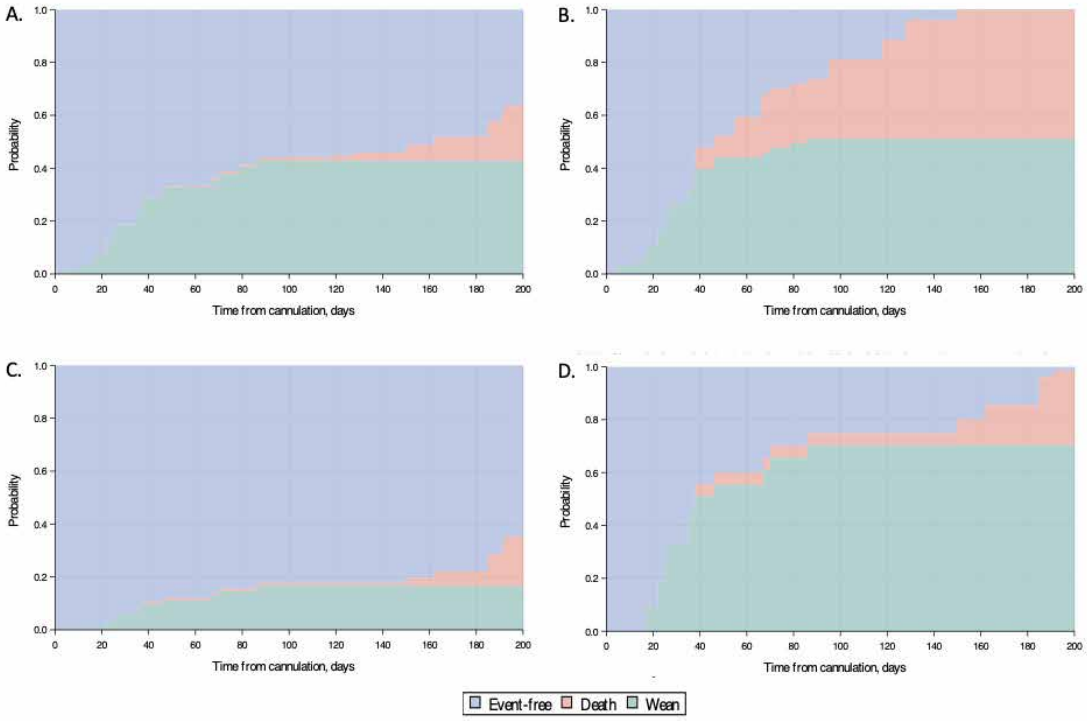
FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

44. EXTRACORPOREAL MEMBRANE OXYGENATION FOR SEVERE SARS-COV-2 ACUTE RESPIRATORY DISTRESS SYNDROME: OUTCOMES FROM A SINGLE INSTITUTION THROUGH MULTIPLE WAVES

CONTINUED

Cumulative incidence of mortality in COVID-19 ECMO patients



Cumulative incidence of mortality, event-free survival, and ECMO wean for various COVID-19 ECMO groups. A. RVAD/ECMO, B. VV ECMO, C. RVAD/ECMO - Era 1, D. RVAD/ECMO - Era 2. RVAD, right ventricular assist device; ECMO, extracorporeal membrane oxygenation; VV, venovenous.

FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

45. THE COST OF POVERTY: HEALTHCARE UTILIZATION IS GREATER IN SOCIOECONOMICALLY DEPRIVED PATIENTS UNDERGOING ISOLATED CABG

AUTHORS
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OBJECTIVES:
Consistent evidence shows socioeconomically disadvantaged patients have higher preoperative risk and worse clinical outcomes after cardiac surgery. High risk patients often have longer hospital stays and are more likely to be discharged to long-term care/rehabilitation facilities; however, less is known about the relationship between disadvantaged status and spending. In this observational cohort analysis, we sought to evaluate whether socioeconomically disadvantaged patients had greater healthcare spending during 90-day episodes of care following isolated CABG surgery.

METHODS:
Using a deterministic matching approach, a patient-level linkage of 8,728 isolated CABG procedures from January 1st, 2012 to December 31st, 2018 from the Michigan Society of Thoracic and Cardiovascular Surgeons Quality Collaborative registry were linked to the Medicare fee-for-service claims and 90-day episode structures from the Michigan Value Collaborative. Patients were considered socioeconomically deprived if they were in the top decile of the area deprivation index (ADI), a publicly-available composite measure of census block-level education, employment, housing quality, and poverty. We compared overall price-standardized 90-day episode spending for deprived against non-deprived patients and compared 90-day spending for component spending categories: index hospitalization, professional services, post-acute care (inpatient rehabilitation, skilled nursing facility, home health, and outpatient facility), and readmissions. Multivariable regression was used to adjust comparisons for demographic and clinical covariates found in the clinical registry data.

RESULTS:
A total of 841 (9.6%) patients were categorized as being in the top ADI decile. Mean 90-day episode spending was $55,258 overall (standard deviation, SD=$26,252) and was higher for socioeconomically deprived patients ($62,132 vs. $54,525, p=0.0003). Component episode spending for the overall sample and stratified by socioeconomic deprivation can be found in the Figure. Adjusting for patient factors, socioeconomically deprived patients had higher overall 90-day spending (adjusted difference = $3,426, p = 0.0003), and significantly higher component spending for index hospitalizations (adjusted difference = $1,466, p = 0.0015), professional services (adjusted difference = $446, p = 0.0003) and readmissions (adjusted difference = $1,276, p = 0.0053). As shown in the Table, inpatient rehabilitation was the only statistically significant difference in postacute care spending by socioeconomic deprivation status (adjusted difference = $514, p = 0.0065).

CONCLUSIONS:
Healthcare resource utilization was significantly higher for CABG patients living in socioeconomically deprived areas, over and above other demographic and clinical factors. Our findings illustrate the need to invest resources in economically deprived communities up front, so as to improve the value of cardiac surgical care for patients and hospital systems alike.

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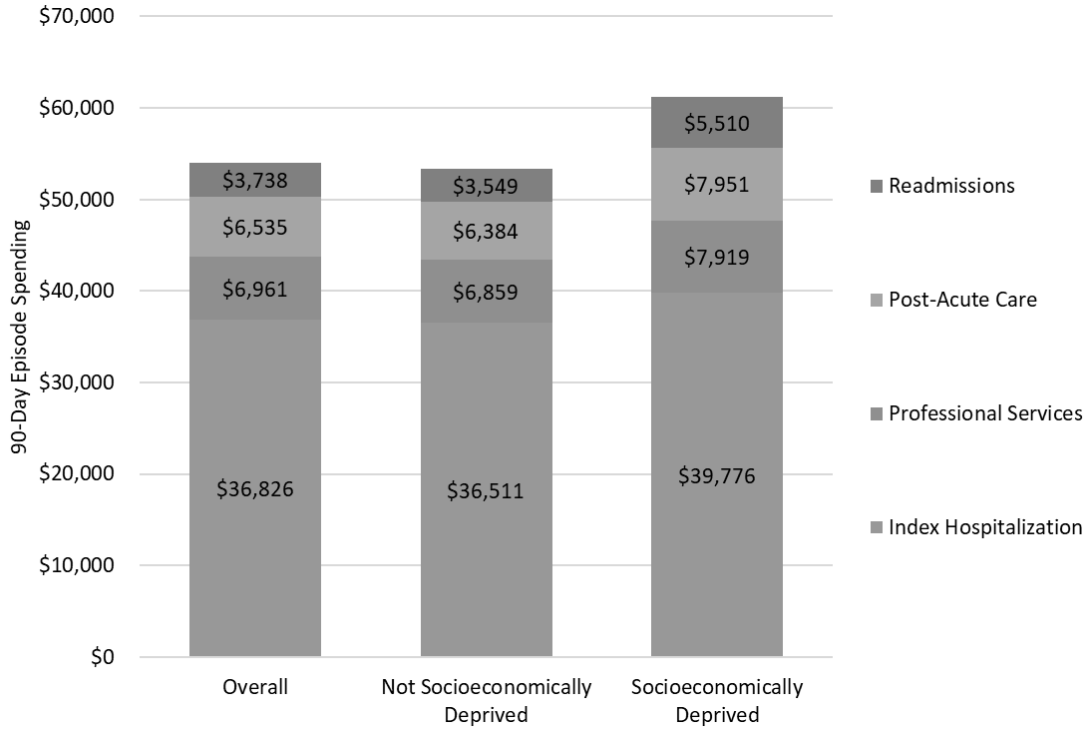
FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

45. THE COST OF POVERTY: HEALTHCARE UTILIZATION IS GREATER IN SOCIOECONOMICALLY DEPRIVED PATIENTS UNDERGOING ISOLATED CABG

CONTINUED

Figure



Ninety-day episode of care spending for patients undergoing isolated CABG procedures for the overall sample and stratified by socioeconomic deprivation status.

Table

	Overall	Top ADI Decile			
		No	Yes	Adjusted difference (95%	p-value
90-Day Price Standardized Episode Spending					
Overall, mean(SD)	$55,258 ($26,252)	$54,525 ($25,383)	$62,132 ($32,540)	$3,426 ($1,576 - $5,274)	0.0003
Index Hospitalization, mean(SD)	$36,826 ($12,849)	$36,511 ($12,415)	$39,776 ($16,081)	$1,465 ($561 - $2,6370)	0.0015
Professional Services, mean(SD)	$6,961 ($3,448)	$6,859 ($3,333)	$7,919 ($4,263)	$446 ($203 - $690)	0.0003
Post-Acute Care (mean,SD)					
Inpatient Rehabilitation	$1,496 ($4,909)	$1,394 ($4,737)	$2,459 ($6,217)	$514 ($144 - $884)	0.0065
Skilled Nursing Facility	$2,334 ($5,940)	$2,275 ($5,807)	$2,879 ($7,041)	$9 (-$431 - $449)	0.9665
Home Health	$1,937 ($1,442)	$1,929 ($1,420)	$2,021 ($1,630)	$8 (-$102 - $118)	0.882
Outpatient Facility	$768 ($3,220)	$786 ($3,300)	$592 ($2,333)	-$178 (-$425 - $69)	0.1587
Readmissions (mean,SD)	$3,738 ($11,831)	$3,549 ($11,497)	$5,510 ($14,485)	$1,276 ($378 - $2,174)	0.0053

Crude and adjusted 90-day healthcare utilization for patients in top ADI decile vs. not in top ADI decile (n=8,728)

FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

46. CLINICAL OUTCOMES OF VALVE SPARING ROOT REPLACEMENT VERSUS CONVENTIONAL BENTALL FOR BICUSPID VALVE AORTIC PATHOLOGY

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OBJECTIVES:
This study compared valve sparing root replacement (VSRR) with conventional aortic root replacement with stentless composite valve conduit (ROOT) in patients with bicuspid valve root aortopathy.

METHODS:
From 2005 to February 2020, 251 patients underwent either VSRR (n=79) or ROOT (n=172) using a Freestyle subcoronary valve suspended in a Vasalva graft. Primary outcomes were mortality and reoperation. Multivariate analysis was performed to identify risk factors for mortality and reoperation.

RESULTS:
VSRR patients were younger at 42.5 ± 12 versus 58.9 ± 12 years, p<0.001. Median LVEF was 58% (55-60), p=1.0. ROOT patients had a higher incidence of ascending aortic aneurysm (150, 87% vs 53, 67%, p<0.01). VSRR patients had longer cardiopulmonary bypass (234 ± 39 vs 185 ± 41 minutes, p<0.01) and aortic cross clamp (208 ± 34 vs 161 ± 33 minutes, p<0.01) times. ROOT patients had longer intensive care unit length of stay (55 (IQR 26-95) vs 38 (IQR 21-70) hours, p=0.02) and more often needed intra-aortic balloon pump (20, 12% vs 2, 4%, p=0.05). During latest echocardiographic follow-up, VSRR patients had a higher incidence of aortic insufficiency (7, 10.8% vs 2, 1.8%, p<0.01) and a higher mean transvalvular gradient (9 (IQR 6-14) vs 5 (IQR 3-7) mmHg, <0.01). Ten-year survival was 94% and 82% for VSRR and ROOT respectively, p=0.08. Ten-year cumulative incidence of aortic valve replacement was 4% and 7% for VSRR and ROOT respectively, p=0.76. (Figure 1) Stroke was found to be an independent risk factor for early mortality (p<0.01), while prior cardiac surgery (p=0.04) and diabetes (p=0.02) were risk factors for late mortality.

CONCLUSIONS:
VSRR and ROOT can be performed for bicuspid root aortopathy with excellent operative outcomes and a low incidence of recurrent aortic valve replacement. Valve pathology and patient age are important considerations for the appropriate intervention in patients with bicuspid valve and root pathology.

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FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

46. CLINICAL OUTCOMES OF VALVE SPARING ROOT REPLACEMENT VERSUS CONVENTIONAL BENTALL FOR BICUSPID VALVE AORTIC PATHOLOGY

CONTINUED

Figure 1

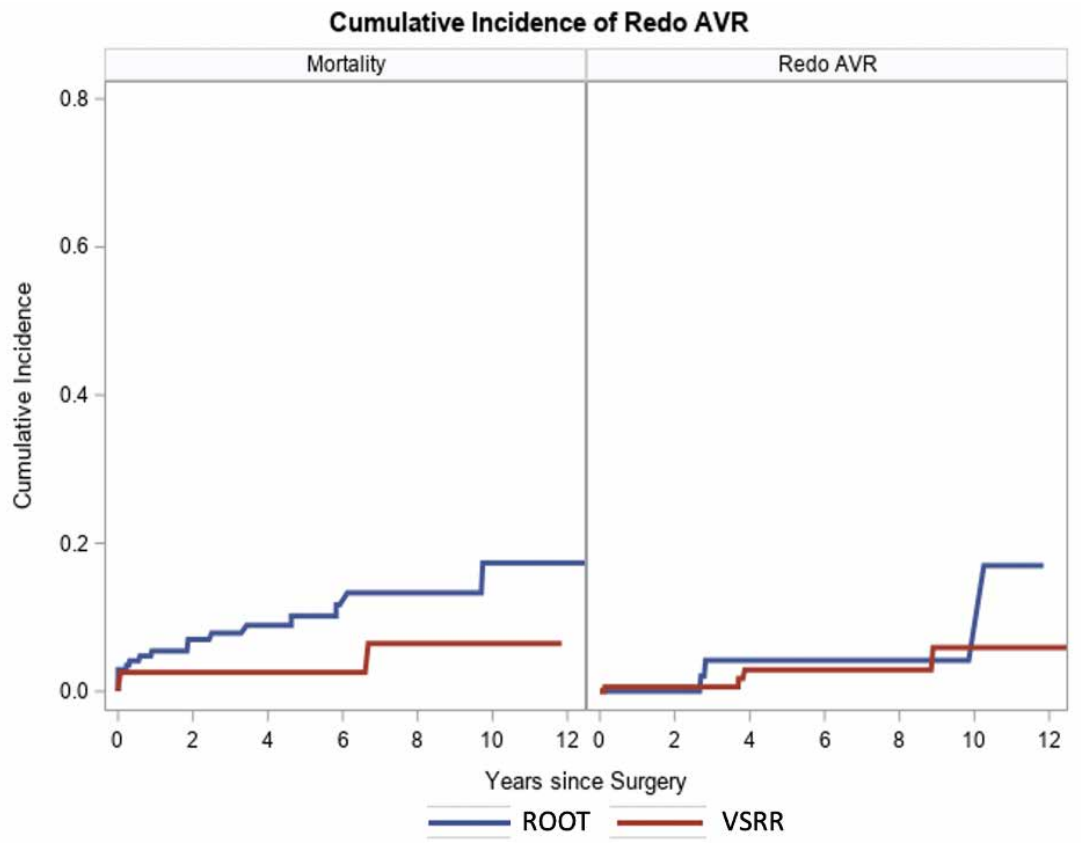

Figure 1: Competing risk analysis of mortality versus redo-AVR (Aortic valve Replacement) in the VSRR vs ROOT groups.

FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

47. AUTOLOGOUS BLOOD TRANSFUSION IS ASSOCIATED WITH IMPROVED COAGULOPATHY AFTER TYPE A REPAIR

AUTHORS
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OBJECTIVES:
Coagulopathy is a common complication of acute type A aortic dissections. The purpose of this study is to evaluate the effectiveness of using autologous whole blood as a blood conservation technique to reduce blood transfusion in acute type A aortic dissection surgery.

METHODS:
We retrospectively reviewed acute type A dissection cases with profound hypothermic circulatory arrest between 2015 and 2020, excluding patients presenting in extremis. Patients were categorized in 2 groups: those who received autologous blood transfusion and those who did not. Perioperative transfusion requirements and clinical outcomes were compared between the 2 groups.

RESULTS:
A total of 145 acute type A aortic dissection cases were analyzed. Of those 87 patients (60%) received autologous whole blood and 58 did not. Mean age was 59.4 years and 40% were female. Patients with and without autologous blood were similar on most preoperative and operative characteristics, except the autologous blood group had higher preoperative hematocrit (P=0.017), lower prevalence of chronic pulmonary disease (P=0.026; Table), and higher prevalence of aortic total arch replacement (P=0.037; Table). Patients with autologous blood received significantly fewer intraoperative red blood cell (RBC) units (1 [0-3] vs 3 [1-6], P<0.001). Chest tube output within the first 24 hours was similar for patients with and without autologous blood (484 [344-740] vs 518 [381-754], P=0.327). Postoperatively, 21% of those with and 29% of those without autologous blood received RBC transfusion (P=0.235). Coagulation index was significantly higher for those with autologous blood (1.3 [-0.7-2.8] vs -0.8 [-5.5-0.3], P=0.013). Fewer patients with autologous blood received postoperative platelets compared to those without autologous blood (10% vs 24%, P=0.026). There were no differences between patients with and without autologous blood on the rate of open chest after the operation (20% vs 31%, P=0.113), ventilation time (1 [1-2] vs 1.5 [1-3] days, P=0.147), length of ICU stay (4 [2-7] days vs 5 [3-10], P=0.093) and hospital stay (11 [7-20] days vs 13.5 [8-20], P=0.237), and in-hospital mortality (1% vs 3%, P=0.564).

CONCLUSIONS:
The use of autologous whole blood during the repair of acute type A aortic dissection is safe, effective and is associated with reduced intraoperative RBC transfusion and reduced coagulopathy. Further randomized studies are required to explore the potential impact of autologous blood transfusion on coagulopathy during type A repair.

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FOURTH SCIENTIFIC SESSION B – ADULT CARDIAC RAPID FIRE BREAKOUT

47. AUTOLOGOUS BLOOD TRANSFUSION IS ASSOCIATED WITH IMPROVED COAGULOPATHY AFTER TYPE A REPAIR

CONTINUED

Table. Patient and operative characteristics

	No Autologous Blood (*n*=58)	Autologous Blood (*n*=87)	*P* value
Age, years	58.9 ± 13.4	59.7 ± 12.1	0.714
Female	28 (48)	30 (35)	0.097
Caucasian	26 (45)	37 (43)	0.784
Body mass index	29.4 (25.4-34.3)	27.8 (23.6-33.2)	0.158
Diabetes	11 (19)	11 (13)	0.299
Hypertension	48 (83)	71 (82)	0.860
Chronic pulmonary disease	14 (24)	9 (10)	0.026
Chronic kidney disease	6 (10)	7 (8)	0.635
Peripheral artery disease	2 (3)	5 (6)	0.702
Previous stroke	5 (9)	5 (6)	0.521
History of aortic aneurysm	9 (16)	14 (16)	0.926
Coronary artery disease	3 (5)	10 (12)	0.192
Preoperative EF, %	55 (55-63.8)	55 (55-55)	0.122
Preoperative hematocrit	36.0 ± 5.2	38.2 ± 5.3	0.017
Aortic hemi-arch	47 (81)	57 (66)	0.042
Aortic total arch	6 (10)	21 (24)	0.037
Frozen elephant trunk	4 (7)	7 (8)	>0.999
Aortic root replacement	4 (7)	12 (14)	0.194
CPB time, mins	209 (175-254)	197 (166-236)	0.219
Cross-clamp time, mins	83.0 (55.3-111.3)	81.5 (58.8-120.0)	0.925
Lowest intraoperative nasal temperature	20.3 ± 2.7	20.8 ± 2.8	0.229

FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

48. DELAYED ESOPHAGEAL RECONSTRUCTION: INDICATIONS, TECHNIQUES, AND OUTCOMES

AUTHORS
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OBJECTIVES:
Accepted conduits for esophageal reconstruction include colon interposition, gastric advancement, or small bowel advancement when esophagectomy is performed. Esophageal reconstruction may necessarily be delayed in some patients, resulting in a period of esophageal discontinuity. The purpose of this study was to evaluate the indications, techniques, and outcomes of patients who underwent delayed esophageal reconstruction at our institution.

METHODS:
A retrospective chart review was performed for all esophagectomy patients who underwent delayed esophageal reconstruction at our institution from 2006 to 2020. Data collected included demographics, indication for esophagectomy, type of esophageal discontinuity procedure performed, length of time between esophagectomy and reconstruction, type and technique of reconstruction performed, length of follow up, change in BMI from the time of initial injury to the last follow up, and overall outcome.

RESULTS:
Fifteen patients with a median age of 58 years (range, 29–70 years) were identified who fit inclusion criteria. Etiology leading to loss of foregut continuity in our patients were postoperative complications in 6 (40%), strangulated bowel in 2 (13%), iatrogenic in 4 (27%), post-traumatic in 2 (13%), and cancer in 1 (7%). Over half of the patients (8, 53%) presented to us in septic shock. Median duration of esophageal discontinuity was 277 days (range, 105–1045 days). Eleven patients (73%) underwent a substernal colon interposition; 2 patients (13%) underwent substernal gastric advancement; and 2 patients (13%) underwent small bowel advancement in the posterior mediastinum with jejunum via Roux-en-Y. Complications were noted in 7 (47%) patients (Figure 1). Mean loss of body mass index from the time of initial insult to last follow up was 8.5 (SD, 6.7). Median length of post-operative follow up was 3.6 months (range, 1–130 months). Overall, 11 (73%) patients had a good outcome, while 3 (20%) patients had a fair outcome; there was one operative death (7%) (Table 1).

CONCLUSIONS:
Reasons for delaying reconstruction in patients undergoing esophagectomy are varied. Delayed esophageal reconstruction can be performed with acceptable outcomes, although many of these patients experience a significant loss of BMI and require lengthy recoveries.

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FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

48. DELAYED ESOPHAGEAL RECONSTRUCTION: INDICATIONS, TECHNIQUES, AND OUTCOMES

CONTINUED

Reconstructive Complications

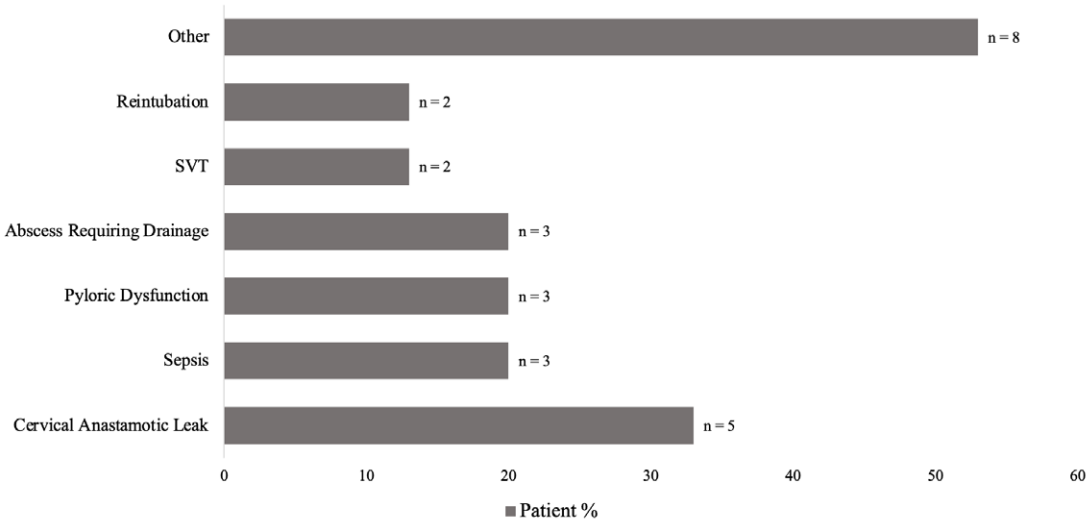

Figure 1: "Other" reconstructive complications (n=1) included cervical anastomotic stenosis, empyema, j-tube fistula, incisional hernia, pneumonia, pyloric fistula, wound dehiscence, and recurrent laryngeal nerve injury.

Long-Term Outcomes Criteria

Long-Term Outcomes	Criteria
Good	Minimal complaints if any, satisfied with their outcome, no need for multiple interventions or readmissions; may have required an additional evaluation or one additional intervention but problem transient or resolved; referred back to primary physician/referral
Fair	Required at least two interventions or one re-admission; needed evaluation for symptoms and required more than one treatment for same but problems eventually resolved, and no long-term complications identified
Poor	Required multiple interventions; chronic complaints/problems identified or failure to thrive; serious debilitating complications or prolonged hospitalization; multiple re-admissions; death directly related to surgery

Table 1: Quality outcome metrics defined

FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

49. ANALYSIS OF ADJUVANT TREATMENT FOR LOCALIZED PRIMARY PULMONARY SARCOMA

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OBJECTIVES:
Data on optimal adjuvant therapy for patients with primary pulmonary sarcoma are limited. The objective of this study is to determine the potential benefits of adjuvant therapy in patients who undergo complete resection for localized primary pulmonary sarcoma.

METHODS:
Overall survival of patients with localized primary pulmonary sarcoma who underwent complete resection in the National Cancer Data Base from 2004 to 2016, stratified by adjuvant therapy regimen, was evaluated using Kaplan-Meier and Cox proportional hazards analysis. Patients treated with induction therapy and those who died within 30 days of surgery were excluded from the analysis.

RESULTS:
Of 231 patients who had localized primary pulmonary sarcoma during the study period, 194 patients (84.0%) underwent complete R0 resection with a 5-year survival of 54.6%. Adjuvant therapy was administered to 14.4% of patients (n = 28), including chemotherapy alone (n = 17), chemoradiation (n = 0), radiation alone (n = 11) and no adjuvant treatment (n = 166). In unadjusted analysis, compared with surgery alone, adjuvant chemotherapy and adjuvant radiation were associated with no significant difference in survival (Table 1). In addition, multivariable Cox modeling demonstrated that treatment with adjuvant chemotherapy (hazard ratio [HR], 1.65; 95% CI, 0.31 to 8.75) or adjuvant radiation (HR, 1.29; 95% CI, 0.3 to 5.59) was associated with no significant difference in survival when compared with no adjuvant therapy.

CONCLUSIONS:
In this national analysis, surgery followed by adjuvant chemotherapy or adjuvant radiation was found to be associated with no additional survival benefit when compared to surgery alone in treatment of primary pulmonary sarcoma.

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FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

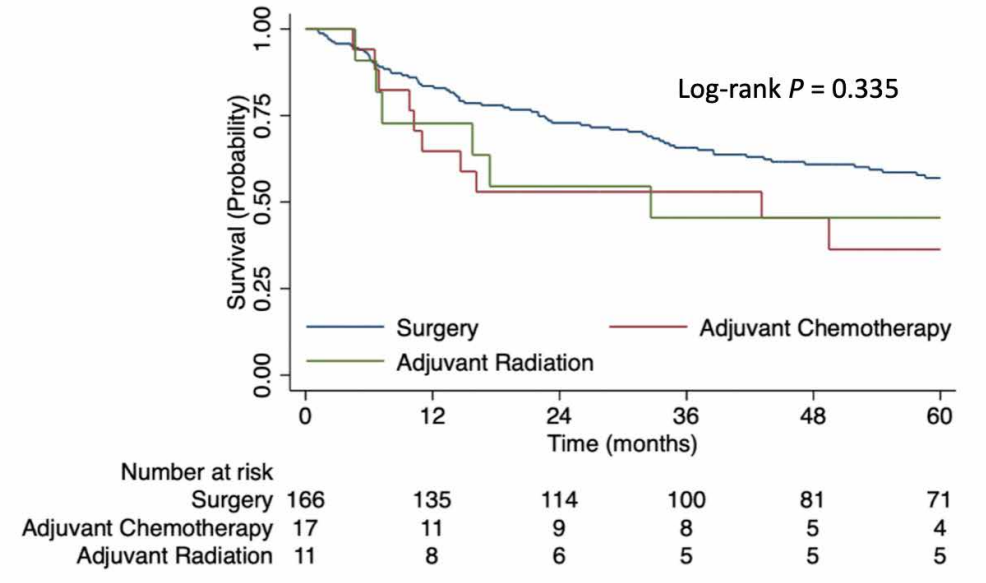
49. ANALYSIS OF ADJUVANT TREATMENT FOR LOCALIZED PRIMARY PULMONARY SARCOMA

CONTINUED

Unadjusted and Multivariable-Adjusted Analyses

Unadjusted Analysis						
Staging	*Surgery*	*Adjuvant Chemotherapy*		*Adjuvant Radiation*		*P Value*
Localized	57.0% (48.7%-64.4%)	36.3% (13.4%-60.1%)		45.5% (16.7%-70.7%)		0.335
Multivariable Cox Proportional Model						
Staging	*Adjuvant Chemotherapy VS Surgery (ref) Hazard Ratio*	*95%CI*	*P Value*	*Adjuvant Radiation VS Surgery (ref) Hazard Ratio*	*95%CI*	*P Value*
Localized	1.65	0.31-8.75	0.556	1.29	0.30-5.59	0.736

Unadjusted and Multivariable-Adjusted Analyses



FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

50. AROUTINE IMPLEMENTATION OF PATIENT REPORTED OUTCOME ASSESSMENT INTO THORACIC SURGERY PRACTICE

AUTHORS
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OBJECTIVES:
The importance and utility of patient reported outcomes (PRO) assessment has been widely validated and accepted. The purpose of this study was to examine the success of routine PRO assessment in an academic-based thoracic surgery practice.

METHODS:
PRO were measured using the NIH-sponsored Patient Reported Outcomes Measurement Information System (PROMIS) on all thoracic surgery patients before or during office visits beginning in April 2018 through January 2021. Questionnaires for pain intensity, physical function, and dyspnea scores were administered electronically via a web-based platform either at home or at the time of office visit via tablet devices. All office visits during this time frame were analyzed. Survey completion rates and time to completion were measured.

RESULTS:
A total of 9,748 thoracic surgery office visits occurred during this time frame. PRO data was obtained on 6,899 visits, in a total of 3,551 patients. The mean number of questions per survey was 22.4 (±2.2). Overall questionnaire completion rate was 65.7%. Completion rates over time are shown in the figure. A significant decline in survey completion was noted in April 2020 after which adjustments were made to allow for questionnaire completion via a mobile health platform. Other impediments to questionnaire completion were technical difficulties with clinic tablet devices, adjustment of clinic workflow, and education of clinic staff. Overall questionnaire completion rates on a monthly basis ranged from 20% (April 2020) to 90% (October 2018). Mean T-scores in all patients were as follows: dyspnea 41.6 (±12.3), physical function 42.7 (±10.5), and pain intensity 52.8 (±10.3).

CONCLUSIONS:
PRO surveys can be administered effectively and efficiently in a thoracic surgery clinic setting. Valuable information can be obtained with minimal disruption of clinical activities. Widespread incorporation and implementation should be considered.

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50. AROUTINE IMPLEMENTATION OF PATIENT REPORTED OUTCOME ASSESSMENT INTO THORACIC SURGERY PRACTICE

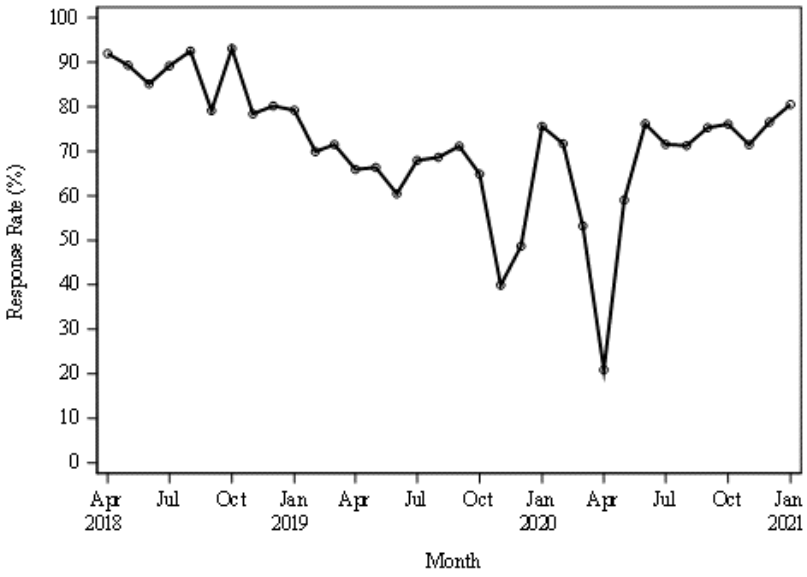
CONTINUED

Table

	Total surveys, n	Mean t-score (SD)	T-score range	Mean number of questions answered (SD)	Range of questions answered
Complete Questionnaire	6303	--	--	22.4 (2.2)	11.0-24.0
Dyspnea	6756	41.6 (12.3)	27.7-75.9	8.4 (2.2)	1.0-10.0
Pain Interference	6395	52.8 (10.3)	41.1-76.3	6.0 (0.0)	6.0-6.0
Physical Function	6318	42.7 (10.5)	20.3-60.1	8.0 (0.0)	8.0-8.0

Questionnaire Characteristics

Figure



PROMIS questionnaire completion rates in thoracic surgery clinic, April 2018 through January 2021

FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

51. TRANSLATION OF LEGISLATION: EFFECT ANALYSIS OF MICHIGAN OPIOID LAW ON CLINICAL PRACTICE

AUTHORS
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OBJECTIVES:
Almost 450,000 Americans died from an opioid overdose between 1999-2018. To combat this, the State of Michigan implemented the Michigan Opioid Laws (MOL) on July 1, 2018 to create tighter, more consistent opioid prescribing regulations. This retrospective study evaluated the influence of the MOL legislation on prescribing patterns following thoracic surgery.

METHODS:
Charts of patients undergoing lobectomy, paraesophageal hiatal hernia repair, hiatal hernia fundoplication, or esophagectomy between July 1, 2017 and July 1, 2019 were reviewed. Pre- and post-MOL legislation data were analyzed. Analgesic type and dosages were converted to morphine equivalents. Number of refills, number of pills in refills, and alternative medications were documented. Patients using opioids for >30 days prior to surgery were excluded from this analysis.

RESULTS:
511 patients were included in the analysis - 235 patients pre-MOL and 276 patients post-MOL. The average number of opioids prescribed to patients at discharge pre-MOL was 27.1 pills compared with 20.8 pills after ($p < 0.01$). Pre-MOL implementation 11.9% of patients received refills while only 5.1% received refills post-MOL, pushing the average number of refills per patient down from 0.21 to 0.07 ($p < 0.001$). Average morphine equivalents and percent of patients receiving opioids showed no statistical difference.

CONCLUSIONS:
Analysis suggests that the MOL impacted clinical practice by reducing the number of narcotic pills and the number of refills prescribed per patient, consistent with the 7 day supply of opioids within a 7 day period prescribing limitation. The MOL did not deter providers from prescribing opioids acutely suggesting the MOL allows for prescribing freedom while giving legislative structure encouraging time-conscious tapering. Subgroup analysis suggests that the MOL may have had an anticipatory effect on physicians' prescribing patterns well before the implementation date. The MOL has impacted clinical practice and may serve as a good model for other states to emulate.

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FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

52. LONG-TERM OUTCOMES AFTER ESOPHAGECTOMY IN OCTOGENARIANS

AUTHORS
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OBJECTIVES:
Despite an increasing number of elderly patients diagnosed with esophageal cancer, advanced age is often used as a discriminating factor when considering candidacy for resection. As implications of esophagectomy persist well beyond the immediate postoperative period, we sought to evaluate long-term outcomes in octogenarians treated with esophagectomy.

METHODS:
All patients who underwent esophagectomy for cancer of the esophagus or esophago-gastric junction (2007-2017) were identified from our institutional Society of Thoracic Surgeons database. Demographic and clinical data including comorbidities, preoperative functional and nutritional status, date of operation, procedure type, and TNM staging was collected. Additional long-term outcomes data was also collected. Patients were stratified by age greater than or lesser than 80, and primary outcomes of interest were overall survival, 90-day mortality, and 1-year mortality. Long-term survival was assessed with Kaplan-Meier analysis and risk-adjusted analysis of long term survival was performed using a Cox-Proportional Hazards model.

RESULTS:
398 patients underwent esophagectomy for malignant disease during the study period and 19 (4.8%) were greater than 80 years old at the time of operation. No significant differences in demographics, comorbidities, or functional status were identified between octogenarians and younger patients. Despite equivalent clinical staging, fewer octogenarians received neoadjuvant therapy (Table). Pathologic downstaging was less common in octogenarians (28% vs. 60%, $p<0.01$), who also had more advanced pathologic disease stage (Table). Postoperative complication rates were equivalent. There were no differences in 90-day (90% vs. 95%), 1-year (83% vs. 87%), or long-term survival (median 2.4 vs. 3.1 years, $p = 0.85$, Figure) between younger and octogenarian patients, respectively. On risk-adjusted analysis, clinical stage and functional status were significant predictors of long-term survival, but octogenarian status was not (Table).

CONCLUSIONS:
Carefully selected octogenarians with good performance status who undergo esophagectomy achieve similar long-term outcomes as their younger counterparts. In this population, decreased utilization of neoadjuvant therapy results in more advanced pathologic staging. However, avoidance of chemoradiation's adverse effects may explain their similar outcomes as compared to non-octogenarian patients. Advanced age, in the absence of poor performance status and other comorbidities, should not be used as a sole discriminating factor when considering patients for esophagectomy.

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FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

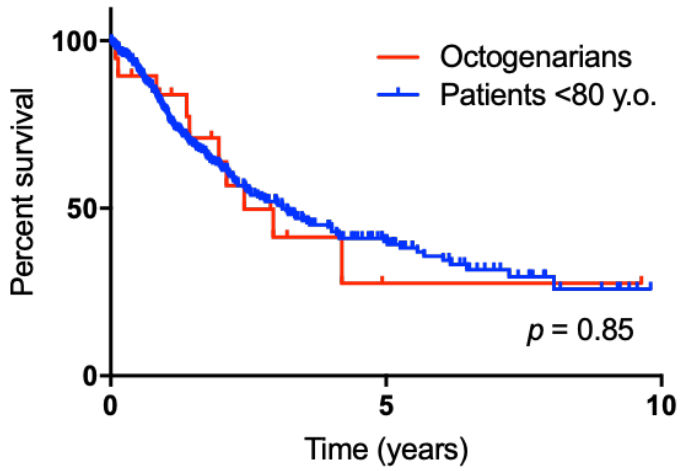
52. LONG-TERM OUTCOMES AFTER ESOPHAGECTOMY IN OCTOGENARIANS

CONTINUED

Table 1. Comparison of patient characteristics and survival time hazard ratio stratified by age, functional status, disease stage, and therapy

Variable	Non-octogenarians Age <80 y.o	Octogenarians Age ≥ 80 y.o.	*p*-value	HR	*p*-value: HR
Median age (years)	62.0 ± 9.8	81.9 ± 1.4	<0.01	0.96	0.91
	Incidence n (%)				
Male sex	316 (83.4)	18 (94.7)	0.33	1.10	0.70
Zubrod score			0.14	1.34	0.02
0	97 (25.6)	10 (52.6)			
1	248 (65.4)	9 (47.4)			
2	27 (7.1)	0 (0.0)			
3	6 (1.6)	0 (0.0)			
4	1 (0.3)	0 (0.0)			
Clinical Stage			0.55	1.46	<0.01
cStage 0	15 (4.3)	0 (0.0)			
cStage I	59 (16.9)	6 (33.3)			
cStage II	65 (18.6)	3 (16.7)			
cStage III	199 (57.0)	9 (50.0)			
cStage IV	11 (3.2)	0 (0.0)			
Neoadjuvant chemoXRT	207 (54.6)	5 (26.3)	0.02	1.15	0.51
Operative Approach			0.36	0.71	0.28
Transthoracic	337 (88.9)	16 (84.2)			
Three-hole	29 (7.7)	3 (15.8)			
Transhiatal	13 (3.4)	0 (0.0)			
Pathologic stage			0.02		
pStage 0	67 (19.5)	1 (5.3)			
pStage I	115 (33.5)	8 (42.1)			
pStage II	91 (26.5)	3 (15.8)			
pStage III	63 (18.4)	4 (21.0)			
pStage IV	7 (2.0)	3 (15.8)			

Figure 1. Comparison of survival between patient groups



FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

53. THORACIC SURGICAL EVALUATION IN PATIENTS UNDERGOING STEREOTACTIC BODY RADIATION THERAPY FOR EARLY-STAGE NON-SMALL CELL LUNG CANCER

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OBJECTIVES:
Anatomic resection is standard for stage I non-small cell lung cancer (NSCLC), with stereotactic body radiation therapy (SBRT) recommended for non-surgical candidates. The judgement of inoperability should be made in a multidisciplinary fashion, including evaluation by a thoracic surgeon, as stipulated by guidelines published by the National Comprehensive Cancer Network. We sought to determine the proportion of NSCLC patients treated with SBRT who had thoracic surgical evaluation (TSUe). Time-to-treatment, receipt of diagnostic staging procedures, and healthcare costs were compared to patients who were not evaluated surgically.

METHODS:
Continuously insured beneficiaries undergoing SBRT between January 1, 2014 and June 30, 2018 with a new NSCLC diagnosis were identified in the IBM MarketScan Commercial and Medicare Supplemental Claims database. Exclusion criteria were adjuvant therapy (chemo- or radiotherapy to distant sites) with diagnosis of non-lung primary cancer or nodal metastases. TSUe was defined as outpatient encounter with a thoracic surgeon or multispecialty group. Time-to-treatment was assessed using multivariable negative binomial regression. Total costs in the six months prior to treatment were assessed using generalized linear models with gamma distribution and a log link. Models adjusted for demographic and clinical factors including urban/rural location, underlying lung disease, smoking history, and cardiopulmonary disease.

RESULTS:
Of 1894 patients identified, 36.3% (n=687) underwent TSUe. Compared to patients without TSUe, these patients were younger (median age 75 vs. 78 years), more likely to be in a preferred provider organization (PPO) (50.1% vs. 36.0%), and more likely to undergo invasive biopsy/staging procedures (90.0% versus 82.0%) or pulmonary function testing (80.6% vs. 69.5%). Patients who underwent TSUe had median time of 64 days to treatment (IQR 43–98d), compared to 44 days (IQR: 29–70d) for those who did not. After multivariable adjustment, time-to-treatment was 43% longer (incident rate ratio [IRR] 1.43, 95% CI: 1.32-1.54, p<0.001) with TSUe. Patients undergoing TSUe also incurred 30% higher costs (adjusted cost ratio [CR]: 1.30, 95% CI: 1.20-1.41, p<0.001) compared to those who did not.

CONCLUSIONS:
Among patients with early-stage NSCLC who undergo SBRT as primary treatment, a minority are evaluated by a thoracic surgeon as per national guidelines. This evaluation is associated with a longer time to treatment initiation, more invasive diagnostic procedures, and higher health care costs. Optimizing the multi-disciplinary evaluation of early-stage lung cancer patients to expedite work-up and treatment in a cost-efficient manner appears needed.

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FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

54. COMPLETION PNEUMONECTOMY FOR NON-SMALL CELL LUNG CANCER: DOES INDUCTION TREATMENT INFLUENCE POSTOPERATIVE OUTCOMES? STEREOTACTIC BODY RADIATION THERAPY FOR EARLY-STAGE NON-SMALL CELL LUNG CANCER

AUTHORS
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OBJECTIVES:
Completion pneumonectomy (CP) is associated with high morbidity and mortality. We reviewed our experience with this operation to evaluate if induction treatment (IT) may affect postoperative outcomes and analyze factors influencing long-term results.

METHODS:
Between January 1998 and December 2020, 69 consecutive patients with non-small cell lung cancer (NSCLC) underwent CP. There were 50 males, median age 63 years (range, 19-83 years). Right CP was carried out in 47 patients, and left in 22. Twenty-three patients (33.3%) received IT (chemotherapy in 15, chemo-radiotherapy in 7, and radiation in 1). Twenty-five patients (36.2%) had an extended resection, and 5 (7.2%) had a tracheal sleeve CP.

RESULTS:
Thirty-day mortality was 7.2% (5/69). Morbidity was 14.7%. Major complications occurred in 5 patients (7.2%): 1 cardiac dislocation, 1 diaphragmatic hernia, 1 TIA, and 2 immediate bronchopleural fistulas which were re-operated on. Minor complications occurred in 21 cases (30.4%): pulmonary in 12, cardiac in 7, and neurological in 2. Median ICU stay was 1 day (range, 0-37 days). Median hospital stay was 8 days (range, 5-56 days). IT did not influence postoperative morbidity and mortality. Nineteen patients (27.5%) had pathological stage I, 36 (52.2%) had stage II, and 14 (20.3%) had stage III. Overall 5-year survival was 51.7%. Factors influencing survival (Log-rank test) were IT (p=0.01), extension of resection (p= 0.04), histology (p=0.01), pathological stage (p= 0.03), T and N factors (p= 0.2, respectively). Thirty-one patients (50.8%) are currently alive and 26 (42.6%) without disease. At univariate analysis IT (p=0.0008), histology (<0.001), stage (p=0.03), and T (p=0.01) had a statistical significance on survival. Factors affecting survival at multivariate analysis included IT (p=0.02) and histology (p=0.03).

CONCLUSIONS:
In our experience, CP had a low mortality, acceptable morbidity, and good long-term survival which justifies this surgical procedure. Postoperative complications were not influenced by IT. Long-term survival was adversely influenced by the absence of IT, extended resection, squamous cell carcinoma, and advanced stages.

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FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

55. ROBOTIC-ASSISTED TRANSTHORACIC DIAPHRAGMATIC PLICATION: A 3 YEAR CASE SERIES

AUTHORS
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REGULATORY DISCLOSURE
This presentation describes the off-label use of the Ti-KNOT device which is designed to secure laparoscopic knots when approximating soft tissue. We use this device in some of our robotic-assisted diaphragmatic plication procedures utilizing a thoracic approach.

OBJECTIVES:
Diaphragmatic dysfunction can manifest as dyspnea, dyspnea on exertion, exercise intolerance, or difficulty sleeping supine. The diagnosis is suspected with an abnormal chest radiography and confirmed with a sniff test demonstrating paralysis. Although asymptomatic patients may be safely observed, symptomatic patients may benefit from diaphragmatic plication. A variety of surgical approaches and techniques exist to plicate the diaphragm. We recently modified our approach from open thoracotomy to a robotic transthoracic approach. We report on our outcomes with a historical comparison.

METHODS:
We conducted a single-institution retrospective review of all patients who underwent transthoracic diaphragmatic plications from 2014 to 2021. In 2017, we began using the robotic approach and noted a few early recurrences. Patients who underwent plication with open thoracotomy were used as a comparison group. The primary outcome of interest was recurrence of diaphragmatic dysfunction. Secondary outcomes included subjective postoperative improvement of dyspnea, length of stay (LOS), readmission, average operative time, estimated blood loss (EBL), and duration of chest tube placement. Descriptive statistics were calculated and described as median (interquartile range) or number (percentage). All analyses were performed with Stata version 16 (StataCorp).

RESULTS:
27 patients underwent robotic assisted transthoracic diaphragmatic plications. None required conversion to an open thoracotomy. 23 of 25 patients reported clinical improvement postoperatively (2 missing). 3 patients experienced recurrent diaphragmatic dysfunction. 22 patients underwent open plication. 21 patients endorsed clinical improvement postoperatively and 2 patients experienced recurrence. Median operative time was shorter for thoracotomy ($p<.001$). There was less blood loss ($p=0.001$), shorter chest tube duration ($p=0.01$), and shorter LOS for robotic operations ($p<.001$). There was no statistical difference in patient demographics, intraoperative complications, and readmission or recurrence rates (Table 1).

CONCLUSIONS:
Our study demonstrated no statistical difference in recurrence rates between robotic and open interventions. Robotic operative times were longer but had reduced LOS, EBL, and chest tube duration. Three patients experienced short-term recurrence after robotic approach, each using an extracorporeal knot placement using knot crimping device. Possible reasons for recurrence include early vigorous post-operative activity, suture technique, poor tissue compliance, knot securing device failure, or device misuse. Given concern regarding these recurrences, we have adapted our technique to include supplemental instrument knot tying. In conclusion, while further work is needed to assess long term outcomes, our case series demonstrates the safety and efficacy of robotic-assisted transthoracic diaphragmatic plications.

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FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

55. ROBOTIC-ASSISTED TRANSTHORACIC DIAPHRAGMATIC PLICATION: A 3 YEAR CASE SERIES

CONTINUED

Table 1

Characteristics	Robotic (n=27)	Open (n=22)	p-value
Gender			0.22
Male	21 (78%)	13 (59%)	
Female	6 (22%)	9 (41%)	
Median age (IQR)	64 (54,69)	62 (54,68)	0.61
Median BMI (IQR)	30.2 (28,32.6)	32.4 (29.3,36)	0.21
Smoking status			0.57
Never	15 (56%)	10 (45%)	
Former	12 (44%)	12 (55%)	
Etiology of dysfunction			0.20
Idiopathic	11 (42%)	15 (68%)	
Iatrogenic	12 (46%)	7 (32%)	
Traumatic	1 (4%)	0 (0%)	
Other	2 (7%)	0 (0%)	
Missing	1 (4%)	0 (0%)	
Median preoperative symptom duration (IQR), months	10 (6,24)	24 (6,72)	0.24
Laterality			1.00
Left	11 (41%)	9 (41%)	
Right	16 (59%)	13 (59%)	
Median operative time (IQR), minutes	190 (160,211)	102 (93,130)	<0.001
Median estimated blood loss (IQR), mL	30 (25,50)	87.5 (50,100)	0.001
Median length of stay (IQR), days	3 (2,3)	4 (3,4)	<0.001
Subjective postoperative clinical improvement			1.00
Yes	19 (70%)	17 (77%)	
No	2 (7%)	1 (5%)	
Partial	4 (15%)	4 (18%)	
Missing	2 (7%)	0 (0%)	
Intraoperative complications			
Yes	0 (0%)	0 (0%)	
No	27 (100%)	22 (100%)	
Readmission			0.64
Yes	2 (7%)	3 (14%)	
No	25 (93%)	18 (82%)	
Missing	0 (0%)	1 (5%)	
Recurrence			1.00
Yes	3 (11%)	2 (9%)	
No	23 (85%)	19 (86%)	
Missing	1 (4%)	1 (5%)	

IQR, interquartile range
BMI, body mass index (kg/m^2)

Demographics and clinical characteristics comparing robotic-assisted transthoracic plications with thoracotomies for open plications

FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

56. DISCHARGING PATIENTS BY POSTOPERATIVE DAY ONE AFTER ROBOTIC ANATOMIC PULMONARY RESECTION

AUTHORS
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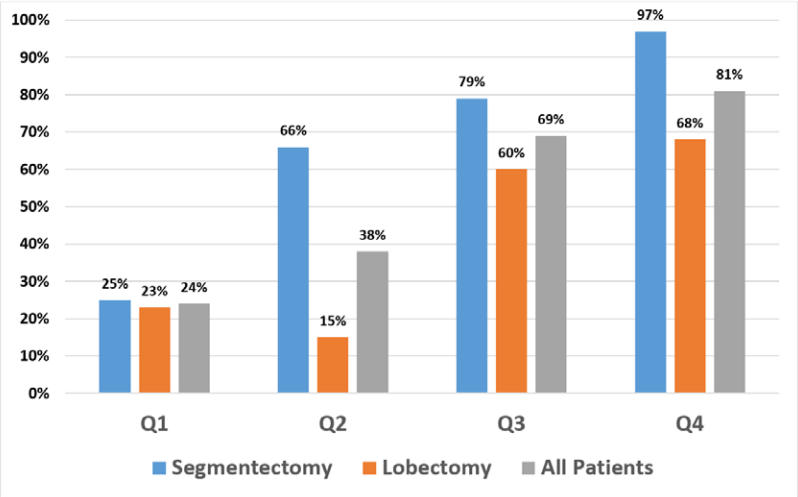
OBJECTIVES:
Our objective is to assess feasibility, safety, and to describe outcomes for patients discharged by postoperative day one (POD1) after robotic segmentectomy and lobectomy.

METHODS:
A retrospective analysis of a prospectively collected database of a quality improvement initiative by a single surgeon. Independent predictors of discharge by POD1 were evaluated using a multivariate logistic regression model.

RESULTS:
From January 2018 to July 2020, 253 patients underwent robotic anatomic pulmonary resection of which 134 (53%) discharged by POD1, 67% post segmentectomy and 41% post lobectomy. Discharge by POD1 improved with experience and was achieved in 97% of patients post-segmentectomy and 68% post-lobectomy in the final quartile. Thirty-one (12%) patients were discharged home with a chest tube, including 7 (2.8%) on POD1. On multivariate analysis, higher diffusing capacity for carbon monoxide (DLCO), and left upper lobe segmentectomy were independent predictors of discharge by POD1. Conversely, worse baseline performance status, right upper lobectomy, and perioperative complications were predictors or discharge after POD1. There were 10 (4.0%) minor morbidities, 6 (2.4%) major morbidities and no 30 or 90-day mortalities. There were 4 readmissions (1.6%), of which one (0.4%) was after POD1 discharge. Patient satisfaction remained high throughout the study period.

CONCLUSIONS:
With experience and communication, select patients can be discharged home on POD1 after robotic segmentectomy and lobectomy with excellent outcomes and high satisfaction. Discharge by POD1 discharge was predicted by higher DLCO and left upper lobe segmentectomy and inversely correlated with worse baseline performance status, perioperative complications, and right upper lobectomy.

Figure 1



Percentage of Patients Post Robotic Segmentectomy or Lobectomy, Discharged by Postoperative Day One by Quartile of Patient Volume

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FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

57. INTRAOPERATIVE MANIPULATION DOES NOT IMPACT LONG-TERM OUTCOMES FOR PATIENTS UNDERGOING LOBECTOMY FOR NON-SMALL CELL LUNG CANCER

AUTHORS
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OBJECTIVES:
It is currently unknown whether intraoperative tumor manipulation during lobectomy for non-small cell lung cancer (NSCLC) impacts long term outcomes by shedding tumor cells into the circulation. By truncating all vascular supply to the tumor as an initial step, intraoperative wedge resection prior to proceeding with lobectomy possibly decreases the chance for microscopic metastases due to intraoperative manipulation. The impact of this approach on long term outcomes is unknown.

METHODS:
527 patients who underwent lobectomy for non-small cell lung cancer between 2015-2018 were analyzed from a single institution. Patients with Stage IV disease, multiple primary tumors, low grade neuroendocrine pathology, or who received neoadjuvant therapy were excluded. Patients who underwent intraoperative wedge resection prior to lobectomy were compared to those who proceeded directly to lobectomy after preoperative biopsy. Variables including, age, gender, FEV1, smoking status, ASA level, tumor histology, pathologic stage, and whether a patient proceeded directly to surgery were analyzed with univariate and multivariate analyses to assess potential impact on recurrence free and overall survival.

RESULTS:
Overall, 249/527 patients underwent planned diagnostic wedge resection at the time of lobectomy. Diagnostic wedge resection as an initial step did not impact recurrence free survival (RFS) or overall survival (OS) with mean OS and RFS being 59.1 [56,62] and 58.6 [55.3,61.8] months versus 54.3 [52,57] and 55.4 [52.8/58.1] months for those that underwent preoperative biopsy (p=.249 and 0.787). Multivariate analysis revealed that FEV1 (% predicted) and pathologic stage were independently associated with recurrence free survival, while age, ASA, FEV1, and pathologic stage were associated with overall survival. A subgroup analysis of stage I patients showed no difference in long term outcomes based on approach.

CONCLUSIONS:
Intraoperative manipulation associated with lobectomy does not appear to impact long term outcomes for patients undergoing surgical resection for NSCLC. Truncating all vascular supply to the tumor as an initial surgical step was not associated with improved long-term outcomes.

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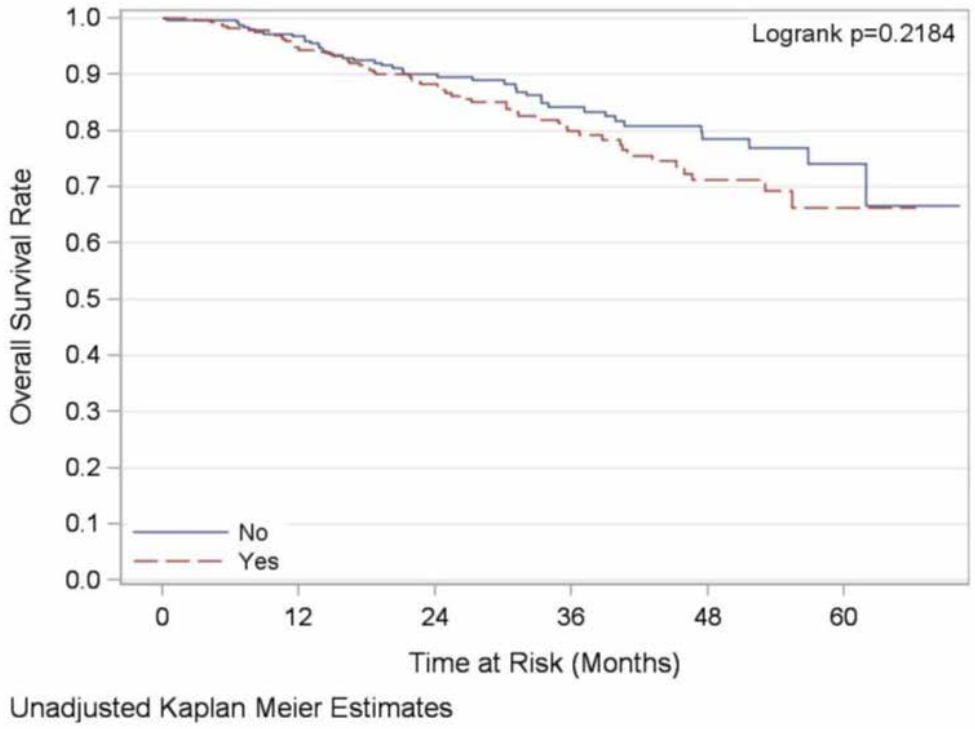
FOURTH SCIENTIFIC SESSION B – THORACIC RAPID FIRE BREAKOUT

57. INTRAOPERATIVE MANIPULATION DOES NOT IMPACT LONG-TERM OUTCOMES FOR PATIENTS UNDERGOING LOBECTOMY FOR NON-SMALL CELL LUNG CANCER

CONTINUED

Overall Survival Based on Surgical Approach



Unadjusted Kaplan Meier estimates for patients who underwent lobectomy with an established preoperative diagnosis from a percutaneous biopsy (Yes) compared to those who underwent intraoperative wedge resection prior to proceeding with lobectomy (No).

FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

58. NINE-YEAR EXPERIENCE WITH THE ARTERIAL SWITCH OPERATION WITH CLOSED CORONARY TRANSFER

AUTHORS
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AUTHOR INSTITUTION(S)
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OBJECTIVES:
Coronary artery transfer is a critical step of the arterial switch operation (ASO) for transposition of the great arteries (TGA). Transfer may be challenging in the setting of complex coronary anatomy. Strategies for coronary artery transfer include open transfer before neo-aortic anastomosis or closed transfer after neo-aortic anastomosis. There is limited data on outcomes after ASO in which a single strategy for coronary transfer is universally used. This study reports outcomes following ASO with closed coronary transfer at a single institution.

METHODS:
A retrospective analysis was performed of all patients undergoing ASO for TGA from November 2006 to September 2015. Closed coronary transfer was universally employed. Patients were stratified into simple versus complex coronary anatomy groups. Outcomes examined were mortality, coronary re-intervention, aortic insufficiency, arrhythmias and postoperative complications.

RESULTS:
Ninety-six consecutive patients underwent ASO for TGA within the study period. No patient was excluded from analysis. Median follow-up time was 5.7 years (range 17 days to 12.3 years). Thirty-six percent of patients (n=35/96) had complex coronary anatomy due to single coronary ostium (n=9), multiple coronary ostia in a single sinus (n=2), severe commissural malalignment (n=21), intramural coronary (n=4), commissural coronary origin (n=7), and sinus node or conus artery with a distinct ostium (n=2). Complex coronary anatomy was associated with significantly longer cardiopulmonary bypass and aortic cross-clamp time (227 vs. 196 min, p=0.009; 119 vs. 96 min, p<0.001, respectively). One patient with complex coronary anatomy required coronary revision during the index operation. There was one in-hospital mortality (patient with simple coronary anatomy) and one mortality during follow-up (patient with complex coronary anatomy). On multivariable analysis, urgent operation was the only independent predictor of mortality after ASO (HR 26.4, 95% CI 1.6–424.2, p=0.021). Complex coronary anatomy did not contribute to mortality (HR 1.8, 95% CI 0.11–28.8, p=0.678). There were no ischemic events or coronary interventions in follow-up. The incidence of moderate or greater aortic insufficiency was 2.1% (n=2/96) at hospital discharge and 1.5% (n=1/62) in follow-up. One patient required aortic valve repair at age 7 years for congenitally bicuspid neo-aortic valve with moderate aortic insufficiency.

CONCLUSIONS:
Closed coronary transfer during ASO has excellent short and mid-term results. Despite variable and often complex coronary anatomy, coronary ischemic events following ASO are avoidable. Closed coronary transfer has a low risk of aortic valve injury or insufficiency.

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FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

58. NINE-YEAR EXPERIENCE WITH THE ARTERIAL SWITCH OPERATION WITH CLOSED CORONARY TRANSFER

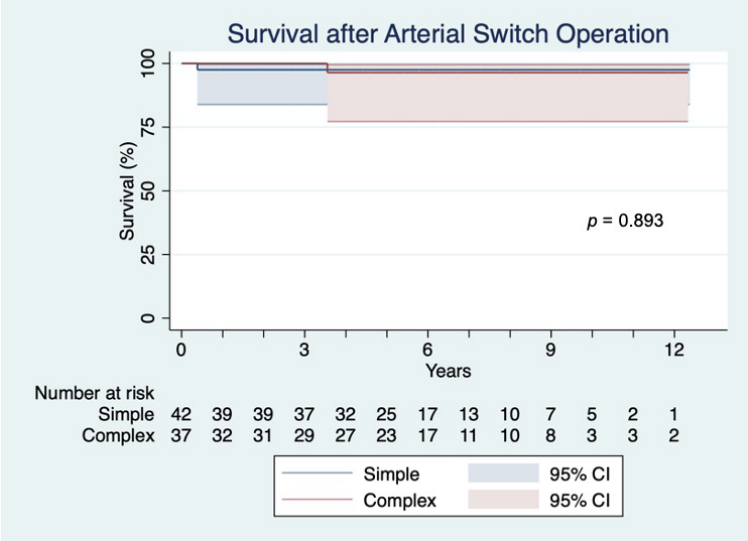
CONTINUED

Table 1.

	All Patients (n=96)
Coronary Pattern[a] – no. (%)	
Two coronary ostia	
1LCx; 2R (usual)	60 (62.50)
1L; 2CxR	19 (19.79)
1R; 2LCx	1 (1.04)
1LR; 2Cx	3 (3.12)
Single coronary ostium	
1LCxR	4 (4.17)
2LCxR	5 (5.21)
Two coronary ostia in single sinus	
1L; 1RCx	1 (1.04)
2R; 2LCx	2 (2.08)
Other	
1L; 1R; 2Cx	1 (1.04)
Other complex coronary anatomy – no. (%)	
Severe commissural malalignment	21 (21.88)
Intramural coronary	4 (4.17)
Commissural coronary origin	7 (7.29)
Sinoatrial node or conus artery with distinct ostium	2 (2.08)
[a] Coronary artery patterns are described according to the Leiden convention	

Coronary anatomy of patients undergoing arterial switch opera

Figure 1.



Kaplan-Meier survival analysis of outcomes following arterial switch operation in patients with simple versus complex coronary anatomy.

FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

59. IMPACT OF INSTITUTIONAL CHANGE IN SHUNT TYPE FROM SANO BACK TO BLALOCK-TAUSSIG-THOMAS ON POST-OPERATIVE COURSE AND INTERMEDIATE FOLLOW UP IN NEONATES UNDERGOING THE NORWOOD OPERATION

AUTHORS
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OBJECTIVES:
The primary objective of our study is to compare the post-operative course and short-term outcomes between neonates who underwent the Norwood operation (NO) with either a Sano shunt (SS) or more contemporarily, a BTT shunt.

METHODS:
This is a retrospective study of all neonates with HLHS who underwent NO between Jan2011-Jun2019, with >1-year follow-up (except for interstage mortality). The two groups were matched for the following baseline characteristics: hybrid procedure prior to NO, cardiac morphology, size of ascending aorta, restrictive atrial septum, gestational age, birth weight, additional congenital heart disease, genetic syndromes, tricuspid regurgitation (TR) and RV function. Post-operative outcomes assessed included delayed chest closure, ECMO requirement, shunt thrombosis, Pediatric Logistic Organ Dysfunction 2 (PELOD 2), highest serum lactate level, time for lactate levels normalization, and hospital length of stay. Follow-up outcomes analyzed included interstage mortality, ventricular function and tricuspid regurgitation pre-Glenn, at 6 months and at 1 year of age; also, need for reintervention, readmissions within 1 year, and cardiac transplant status.

RESULTS:
Of the 53 neonates who underwent Norwood operation, 21(39.6%) had BTT shunt and 32 (60.4%) had SS as source of pulmonary blood flow. In the immediate post-operative period, there were no differences between the groups in ECMO requirement, shunt thrombosis, highest lactate levels, lactate normalization time, or PEDLOD 2 scores on post-operative days 1 through 5. Incidence of delayed chest closure was lower in the BTT group (19% vs 50% p = 0.04) (Table 1). During follow-up, there was a higher incidence of shunt and pulmonary artery interventions in the SS group (p=0.01). Although by 6 months follow-up there was no difference between groups in ventricular function or the presence of significant tricuspid regurgitation, by 1 year there was significant differences in both these categories in favor of the BT shunt group (p <0.01). Hospital length of stay, re-admission rate, interstage mortality, and need for transplantation were similar between the groups at 1 year. (Table 1)

CONCLUSIONS:
In our experience, the Norwood-BT is not associated with perioperative instability or inferior outcomes. Better ventricular preservation with less tricuspid regurgitation at 1 year follow-up in Norwood-BTT patients may in fact translate into better transplant free survival.

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FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

59. IMPACT OF INSTITUTIONAL CHANGE IN SHUNT TYPE FROM SANO BACK TO BLALOCK-TAUSSIG-THOMAS ON POST-OPERATIVE COURSE AND INTERMEDIATE FOLLOW UP IN NEONATES UNDERGOING THE NORWOOD OPERATION

CONTINUED

Baseline characteristics			
Characteristics	**BTT group**	**Sano group**	**P value**
Hybrid procedure	4/21 (19%)	7/32 (21.9%)	0.545
Aortic and mitral atresia	7/21 (33.3%)	13/32 (40.6%)	0.405
Aortic and mitral stenosis	11/21 (52.4%)	12/32 (37.5%)	0.316
Aortic atresia and mitral stenosis	2/21 (9.5%)	6/32 (18.8%)	0.306
Aortic stenosis and mitral atresia	1/21 (4.8%)	1/32 (3.1%)	0.640
Ascending aorta ≤ 2mm	6/21 (28.6%)	14/32 (43.8%)	0.205
Intact atrial septum	2/21 (9.5%)	5/32 (15.6%)	0.42
Gestational age < 37 weeks	1/21 (4.8%)	4/32 (12.5%)	0.333
Additional congenital heart disease	5/21 (23.8%)	9/32 (28.1%)	0.492
Genetic syndrome	1/21 (4.8%)	1/32 (3.1%)	0.640
Ventricular dysfunction preoperatively	6/21 (28.6%)	5/32 (15.6%)	0.214
Tricuspid regurgitation preoperatively	3/21 (14.3%)	3/32 (9.4%)	0.447
Birthweight <2.5 kg	3/21 (14.3%)	2/32 (6.3%)	0.304
Outcomes			
ECMO need postoperatively	1/21 (4.8%)	2/32 (6.3%)	0.656
Delayed chest closure	***5/21 (23.8%)***	***16/32 (50%)***	***0.042***
Cardiac arrest	3/21 (14.3%)	6/32 (18.8%)	0.488
Shunt thrombosis	1/21 (4.8%)	2/32 (6.3%)	0.656
Maximum lactate levels (mean ± SD)	5.9 ± 2.6	5.3 ± 2.2	0.316
12-hour lactate level (mean ± SD)	3.2 ± 2.5	2.8 ± 1.1	0.470
Time taken for lactate to normalize (mean ± SD)	18.7 ± 11.2 hours	18.7 ± 9.8 hours	0.980
Duration of hospitalization (mean ± SD)	50.1 ± 50.1 days	54.3 ± 40.9 days	0.739
Interstage mortality	3/21 (14.3%)	3/32 (9.4%)	0.447
Readmissions	4/21 (19%)	11/32 (34.4%)	0.185
Shunt interventions	***3/21 (14.3%)***	***15/32 (46.9%)***	***0.014***
PA interventions	***6/21 (28.6%)***	***20/32 (62.5%)***	***0.016***
RV dysfunction pre-Glenn	1/20 (5%)	3/30 (10%)	0.472
Tricuspid regurgitation pre-Glenn	8/20 (40%)	10/30 (33%)	0.426
RV dysfunction at 6 months	3/20 (15%)	11/30 (36.7%)	0.087
Tricuspid regurgitation at 6 months	9/20 (45%)	21/30 (70%)	0.071
RV dysfunction at 1-year	***1/16 (6.3%)***	***15/29 (51.7%)***	***0.002***
Tricuspid regurgitation at 1-year	***3/16 (18.8%)***	***23/29 (79.3%)***	***0.000***

FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

60. SURGICAL STRATEGIES TO ADDRESS RE-OPERATIVE COMPLEX LEFT VENTRICULAR OUTFLOW TRACT OBSTRUCTION IN PATIENTS POST-REPAIR OF CONGENITAL HEART DISEASE

AUTHORS
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OBJECTIVES:
Patients requiring complex re-operations on left ventricular outflow tract (LVOT) after previous congenital repair of left ventricular outflow tract obstruction (LVOTO) constitute a challenging and high-risk group. Despite the increasing prevalence of this population, limited information is available to guide decision-making and inform prognosis. We aimed to chronicle our experience with these patients to highlight the management challenges, describe technical pearls, and provide benchmark outcomes.

METHODS:
Retrospective chart review was performed on all patients having re-operative surgery to address the LVOT following repair of previous LVOTO at our institution between 2016 -2019. Data abstracted included preoperative characteristics, past cardiac surgical history, operative details, and postoperative outcomes. Pre-operative and post-operative LVOT gradients were abstracted from echo reports. Technical challenges encountered at index LVOT procedure and the surgical maneuvers leveraged to address these were catalogued. Summary statistics appropriate for the normality and type of data were utilized to describe the population. Paired t-tests compared pre- and postoperative gradients.

RESULTS:
N=30 patients were identified, with median age of 22 years (range 3 – 48) at index LVOT procedure (Figure). Most prevalent prior LVOT operations included arterial switch (ASO; N=7), structural prosthetic aortic valve deterioration or somatic outgrowth (N=7), subaortic resection (N=5), Ross operation (N=3), and other (N=8). Median number of sternotomies was 3 (range 2 – 7), and 17 patients had severe multi-valve disease. There have been 2 mortalities up to median follow up of 10.7 months. LVOT gradient improved significantly following surgery (36.5±29.4 vs. 21.7±8.5; P=0.016) (Figure). Technical pearls include: 1) liberal use of anterior aortoventriculoplasty for complex LVOTO; 2) primary anterior aorticoventriculoplasty should follow the subpulmonary conus as opposed to being directed to the LV apex, whereas this incision is more vertical for post-ASO patients; 3) oblique division of the RPA can improve aortic exposure following a Lecompte maneuver; 4) preoperative imaging of mediastinum and peripheral vasculature is essential to create preferred and contingency cannulation strategies.

CONCLUSIONS:
Re-operation to address the LVOTO following prior LVOT repair can be accomplished with excellent mid-term outcome despite the high complexity. Anterior aorticoventriculoplasty in specific patients, such as post-ASO, require technical modifications. Many patients will require multiple concomitant valve repairs or replacements.

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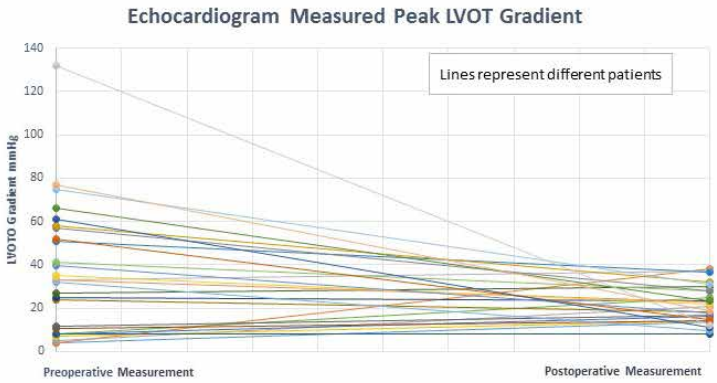
FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

60. SURGICAL STRATEGIES TO ADDRESS RE-OPERATIVE COMPLEX LEFT VENTRICULAR OUTFLOW TRACT OBSTRUCTION IN PATIENTS POST-REPAIR OF CONGENITAL HEART DISEASE

CONTINUED

Figure 1



	Age at index LVOT surgery (years)	Number of Sternotomies	Follow-up Time (days)	Duration of Hospital Stay (days)	Cardiopulmonary Bypass Time(min)	Cross-Clamp Time (min)	Pre-Index LVOTO Gradient (peak) mmHg	Discharge LVOTO Gradient (peak) mmHg
Post-Arterial Switch Operation (7)	19.5 [3-29]	2 [2-7]	184.5 [12-999]	8 [5-15]	136 [90-224]	82 [57-90]	7 [3.8-132.1]	14 [12.3-38]
Post-Aortic Valve Replacement (7)	25 [16-48]	3 [2-6]	366 [14-1298]	8 [5-42]	195 [159-397]	155 [129-196]	35 [24-77]	18.75 [9.7-23.6]
Post-Subaortic Resection (5)	30 [8-36]	2 [2-3]	490 [7-1258]	6 [4-24]	109 [56-143]	83 [35-120]	33 [27-75]	30 [11-37]
Post-Ross (3)	22 [22-45]	2 [2-4]	223 [223-373]	4 [4-10]	104 [104-156]	83 [83-142]	5.1 [5.1-57.2]	14 [14-28]
Other* (8)	20 [11-45]	3 [2-4]	306 [8-1043]	8 [4-18]	143.5 [54-205]	120 [16-142]	26.35 [5.1-66]	16.9 [3.9-36.8]
Total (30)	22 [3-48]	3 [2-7]	320 [7-1298]	7.5 [4-42]	143 [54-397]	117 [16-196]	33 [3.8-132.1]	19 [3.9-38]

*Post: Konno, Norwood, Ascending Aorta/Root, Left ventricle- to-aortic tunnel repair, coarctation and aortic valve repair, interrupted arch repair

Demographics and echocardiographic measurements of left ventricular outflow tract gradients pre-intervention and post-intervention

FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

61. THE CENTRAL PATCH TECHNIQUE FOR REPAIR OF ATRIOVENTRICULAR SEPTAL DEFECTS: INTERMEDIATE FOLLOW-UP

AUTHORS
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OBJECTIVES:
The central patch technique (CPT) is an alternative repair for atrioventricular septal defects (AVSD). The CPT involves incising the bridging leaflets in the midline and augmenting the valve tissue with a central patch. The CPT provides improved exposure of the ventricular crest while preserving the physiological height of the valve tissue above the crest post-repair. This study presents an intermediate follow-up of patients undergoing CPT for AVSD.

METHODS:
A retrospective review of a single surgeon's series of patients undergoing CPT of AVSD repairs from 03/2011 – 03/2020 was performed. Medical records were reviewed for demographic data. Echocardiograms from the index operation hospital admission and the most recent follow-up visit were reviewed for atrioventricular valve (AV) function, residual septal defects and left ventricular outflow tract (LVOT) gradients. Medical records were also reviewed for evidence of re-operation or mortality.

RESULTS:
24 patients underwent repair of AVSD with the CPT. Follow-up was available in 21/24 patients. Average age was 6 months, and average weight was 5.4 kg. All patients had Down's syndrome. Average cardiopulmonary bypass and cross clamp times were 150 minutes and 110 minutes, respectively. 19 patients had Rastelli A defects. Follow-up averaged 37 months (interquartile range 17-69 months). One patient had moderate left AV valve regurgitation at hospital discharge (4.7%), which was unchanged after 6 years follow-up. All other patients had less than moderate regurgitation, both at hospital discharge and at latest follow-up. No patient had a significant septal defect or AV valve stenosis. No patient had LVOT obstruction (flow velocity range .5-1.6 m/s). No patient required reoperation. There was no early or late mortality.

CONCLUSIONS:
Intermediate follow-up from a case series of 24 patients demonstrate results which are comparable to standard techniques. Longer follow-up and a larger patient cohort from multiple surgeons and institutions are needed to adequately compare results of the CPT versus other known techniques.

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FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

62. RIGHT VENTRICULAR OUTFLOW TRACT RECONSTRUCTION WITH 18+ PTFE CONDUITS: COMPARISON BETWEEN ORTHOTOPIC VS HETEROTOPIC POSITION

AUTHORS
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OBJECTIVES:
Conduit longevity in RVOT reconstruction is affected mainly by somatic growth in the pediatric population. However, when a bigger conduit size is attainable, other factors may play a role such as a conduit material and risk of endocarditis. Previous studies have identified a heterotopic position as an independent risk factor for conduit failure in small patients. We aim to evaluate 18+ PTFE conduit durability in relation to the anatomic position.

METHODS:
RVOT reconstructions using a PTFE conduit > 18 mm were identified from June 2004 to December 2020 at a single institution. Catheter-based interventions or need for conduit replacement were recorded and comparatively assessed between orthotopic vs heterotopic conduit position. Kaplan-Meier function was used to evaluate time to reintervention and time to replacement as primary outcomes, censored by death between the groups.

RESULTS:
A total of 91 patients were included with a median age of 13.2 (IQR 8.9-17.8), median weight, and BSA of 47 kg (IQR 29-67) and 1.4 m2 (1-1.7), respectively. Regarding the anatomic position, 49.5% (n= 45) were conduits placed in an orthotopic position. The most common diagnosis in the heterotopic position was TOF in 39% (n=18) followed by Truncus arteriosus with 33% (n=15). In contrast, congenital aortic valve abnormalities were the most common in the orthotopic group with 80% (n=36). No differences were observed in terms of tricuspid configuration (67% vs 69%; p=0.32) between the groups and most of the conduits in the heterotopic group were reoperations (98% vs. 18%) (Table 1). The proportion of reintervention (15% vs 9%; p=0.38) and replacement procedures (4% vs 4%; p=0.9) were similar between the groups. Kaplan Meier estimates showed no differences in conduit survival free from reintervention nor replacement between the groups (log-rank > 0.05) (Figure 1)

CONCLUSIONS:
RVOT reconstruction with PTFE conduits >18 mm provides favorable long-term results independently of the anatomic position, showing more than 90% conduit survival free from replacement at 10 years in our cohort.

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FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

62. RIGHT VENTRICULAR OUTFLOW TRACT RECONSTRUCTION WITH 18+ PTFE CONDUITS: COMPARISON BETWEEN ORTHOTOPIC VS HETEROTOPIC POSITION

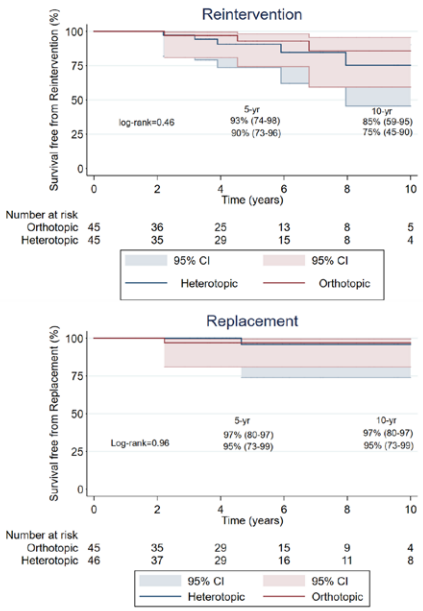
CONTINUED

Clinical characteristics

Variables	Total N=91	Heterotopic N=46	Orthotopic N=45
Age	13.2 (8.9-17.8)	12.0 (8.3-14.0)	15.2 (9.7-18.4)
Weight	47 (29-67)	33.5 (28-54)	56 (31-73)
BSA	1.4 (1-1.7)	1.15 (.975-1.5)	1.6 (1.1-1.9)
Diagnosis			
Congenital abnormal aortic valve	36 (40%)	0 (0%)	36 (80%)
TOF	18 (20%)	18 (39%)	0 (0%)
Truncus arteriosus	15 (16%)	15 (33%)	0 (0%)
Acquired aortic valve disease	5 (5%)	0 (0%)	5 (11%)
DORV-TOF	4 (4%)	3 (7%)	1 (2%)
TGA	9 (3%)	7 (2%)	2 (4%)
IAA	2 (2%)	1 (2%)	1 (2%)
PA/Pulmonary Stenosis	2 (1%)	2 (2%)	0 (0%)
Surgical procedure			
Rastelli/Rastelli type	46 (51%)	46 (100%)	0 (0%)
Ross/Ross-Konno	43 (47%)	0 (0%)	43 (100%
Post-ASO	2 (2%)	0 (0%)	2 (4%)
Re-Operation	53 (58%)	45 (98%)	8 (18%)
Graft Size (mm)			
18	15 (16%)	9 (20%)	6 (13%)
19	2 (2%)	2 (4%)	0 (0%)
20	19 (21%)	14 (30%)	5 (11%)
22	17 (19%)	9 (20%)	8 (18%)
24	38 (42%)	12 (26%)	26 (58%)
Graft Description			
Monocusp	3 (3%)	3 (7%)	0 (0%)
Bicuspid	26 (29%)	12 (26%)	14 (31%)
Tricuspid	62 (68%)	31 (67%)	31 (69%)

Distribution of clinical characteristics by the anatomic position of the RVOT conduit.

Conduit survival



Kaplan-Meier estimates of RVOT conduits stratified by anatomic position showing freedom of intervention (A) and freedom of replacement (B).

FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

63. ALTERNATIVE CARDIOPULMONARY BYPASS STRATEGY IS ASSOCIATED WITH IMPROVED NEUROLOGICAL OUTCOMES IN NEONATES AND INFANTS UNDERGOING CARDIAC SURGERY

AUTHORS
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OBJECTIVES:
The incidence of neurological injury in neonates and infants during cardiac surgery utilizing cardiopulmonary bypass is reportedly 2.4%-15%. In 2013 we started using a novel "high flow/high hematocrit" bypass strategy which has been associated with a significantly lower incidence of acute kidney injury; in this study, we sought to compare our incidence of neurological complications with contemporary published historical controls which used conventional bypass strategies.

METHODS:
The charts of all neonates and infants undergoing cardiopulmonary bypass between January 2013 and December 2019 (n=704) were reviewed. Adverse neurological events were defined as any abnormality of pupils, delayed awakening, seizures, or focal deficits promting a neurological consultation. As compared to conventional bypass strategy, our bypass strategy included "high flow rate" (150-200 ml/kg/min) without reducing the flow rates during cooling even to a rectal temperature of 15 degrees Celsius, and maintaining a target hematocrit on bypass >32%, with a terminal hematocrit of >42%.

RESULTS:
The incidence of adverse neurological events was 0.8% (6/704). Complete brain imaging identified ischemic injury in 4 patients (3 of which occurred after cardiac arrest and initation of ECMO in the ICU), and interventricular hemmorhage in 2 patients.This was significantly better than the 2.4% reported by Boston Children's Hospital ($p<0.03$).

CONCLUSIONS:
Conventional bypass strategies may under-estimate cardiac output requirements and oxygen delivery necessary to fully protect neonates and infants after open heart surgery. The "high flow/high hematocrit" strategy had no discernable negative neurological effects, and was indeed associated with improved neurological outcome in this vulnerable population.

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FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

64. SUBAORTIC STENOSIS IN ADULT PATIENTS WITH ATRIOVENTRICULAR SEPTAL DEFECTS

AUTHORS
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OBJECTIVES:
While patients with atrioventricular septal defects (AVSD) are known to be at risk for development of subaortic stenosis throughout their lifetime, the early and mid-term outcomes of adults with AVSD undergoing primary operation or reoperation for subaortic stenosis remain unknown.

METHODS:
All adult patients (age ≥18) with AVSD who underwent first time operation or reoperation for subaortic stenosis at a single institution from 1992 to 2016 were queried. Standard demographics, preoperative data, and surgical intervention details were collected. Data are presented as median (interquartile range) for non-normally distributed data and mean ± standard deviation for normally distributed data.

RESULTS:
Nineteen patients were identified of whom 89% were female. The diagnoses included partial ASVD in 15 patients (79%), complete AVSD in 3 (16%), and transitional AVSD in 1 patient (5%). Three patients (16%) had Down syndrome. Fifteen patients (79%) had previously corrected AVSD (median 8 years; IQR 3.6-23.1), while 4 patients (21%) with partial AVSD were unrepaired at the time of the subaortic resection. Twelve patients (63%) presented for their first surgical correction of subaortic stenosis while 7 patients (37%) had prior surgery for subaortic stenosis (Table). Indications for operation other than left ventricular outflow tract obstruction included left atrioventricular (AV) valve regurgitation in 10 patients (53%), left AV valve stenosis in 5 (26%), aortic regurgitation in 3 (16%), left AV valve periprosthetic leak in 2 (11%), and right AV valve regurgitation in 1 patient (5%). The mechanism for obstruction included subaortic membrane (n=19, 100%), septal hypertrophy (n=11, 58%), anomalous papillary muscle, chordae, or left AV valve tissue (n=9, 47%), and tunnel obstruction (n=5, 26%). Relief of the obstruction was accomplished via transaortic resection of the fibromuscular membrane in all patients. A septal myectomy was performed in 17 patients (89%). There were no early mortalities. The average length of stay was 7 days (range, 4 to 15 days). One patient with second degree AV block that progressed to complete heart block after subaortic resection required a pacemaker. During late follow-up (median 6.6 years, maximum 27.7 years), overall survival was 100% and 95%, at 5 and 10 years, respectively. One patient required re-intervention for subaortic stenosis 15 years after the operation at our institution.

CONCLUSIONS:
Surgical correction of subaortic obstruction in adult patients with AVSD can be accomplished with a low morbidity and mortality. Subaortic stenosis can appear late after the initial repair of AVSD, but once resected, the risk of recurrence is low.

Primary Operation and Re-operations for Subaortic Stenosis

Primary operation for subaortic stenosis at our institution (n=12):	
Prior AVSD repair: 8 patients (67%)	Time from AVSD repair to primary operation here: Median 26 years (IQR 11.9-36.2, range 5-37 years)
Unrepaired AVSD: 4 patients (33%)	Time to primary operation for subaortic obstruction: Median 38 years (IQR 37.2-39.5, range 37-45 years)
Re-operations for subaortic stenosis prior to surgery at our institution (n=7):	
Subaortic stenosis addressed at time of AVSD repair: 3 patients (43%)	Time from initial subaortic resection to surgery here: Median 12 years (IQR 11.3-13.9, range 11-16 years)
Subaortic stenosis resection after AVSD repair: 4 patients (57%)	Time from AVSD repair to first resection: Median 18 years (IQR 9.3-24.8, range 4-27 years) Time for first resection to second operation here: Median 8 years (IQR 5.7-11.5, range 4-14 years)

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FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

65. A TECHNIQUE TO CONTROL AND STABILIZE PRESERVATION OF THE DONOR HEART DURING TRANSPORTATION: INITIAL EXPERIENCE WITH 47 CONSECUTIVE HEART TRANSPLANTS, INCLUDING 24 PEDIATRIC HEART TRANSPLANTS

AUTHORS
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OBJECTIVES:
Myocardial function of the donor heart is a critical factor influencing outcomes after cardiac transplantation. Multiple factors contribute to donor heart myocardial function, including myocardial preservation during transportation. We reviewed our experience with a novel transportation system that stabilizes myocardial temperature with uniform cooling and no direct contact with ice.

METHODS:
We reviewed 47 consecutive patients, including 24 pediatric patients, undergoing cardiac transplantation utilizing an organ preservation device (Paragonix SherpaPak™ Cardiac Transport System [CTS]) that provides a sterile, temperature- and pressure-controlled environment for donor heart transportation. Unlike the conventional "ice and cooler" method of cardiac transportation of the past 50 years, CTS maintains constant temperature and pressure throughout the transport and provides continuous real-time data about this temperature.

For each patient and for the entire cohort, we examined the relationship of average run temperature to transportation time and the relationship of temperature spread (defined as maximum temperature excursion from start of run) to transportation time.

RESULTS:
Mean weight of all donors was 57.4 kilograms (median=66.2, range 3.1–107.3).
Mean weight of all pediatric donors was 30.1 kilograms (median=18.5, range=3.1–95.3).

For the entire cohort, average temperature during transportation was 5.88 degrees Celsius (average minimum temperature = 5.15 degrees Celsius and average maximum temperature = 6.35 degrees Celsius). Average temperature spread was degrees 1.25 degrees Celsius.

For the pediatric cohort, average temperature during transportation was 5.85 degrees Celsius (average minimum temperature = 5.15 degrees Celsius and average maximum temperature = 6.31 degrees Celsius). Average temperature spread for pediatric transplants was degrees 1.18 degrees Celsius.

Overall Operative Mortality is 2.1% (1/47). Zero patients experienced primary graft dysfunction. Operative Mortality in pediatric transplant recipients is zero (0/23). One adult recipient of a heart and kidney transplant developed extensive intestinal ischemia and infarction after renal transplantation and died on post-transplant day 35 from fungal sepsis and ARDS.

Table 1 documents the following variables for each donor: Average Temperature, Minimal Temperature, Maximal Temperature, Range of Temperature, Transport Time, and Age Category.

Figure 1 documents the relationship between transportation time and temperature of the donor heart.

CONCLUSIONS:
Transportation of the donor heart utilizing an organ preservation device can assure appropriate uniform myocardial cooling with minimal fluctuation in temperature during cardiac transportation. This strategy also prevents suboptimal focal myocardial freezing that may occur using ice.

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FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

65. A TECHNIQUE TO CONTROL AND STABILIZE PRESERVATION OF THE DONOR HEART DURING TRANSPORTATION: INITIAL EXPERIENCE WITH 47 CONSECUTIVE HEART TRANSPLANTS, INCLUDING 24 PEDIATRIC HEART TRANSPLANTS

CONTINUED

Table 1. Overview of 47 Patients

Number	Date of Procurement	Average Temperature	Minimal Temperature	Maximal Temperature	Range of Temperature	Transport Time	Peds/Adult
1	7/26/2019	6.00	5.54	6.46	0.92	88	Adult
2	8/6/2019	6.09	5.41	6.46	1.05	117.5	Peds
3	8/19/2019	6.27	5.44	6.53	1.09	125	Peds
4	9/13/2019	7.31	6.64	7.79	1.15	126.5	Peds
5	9/26/2019	4.50	3.93	4.74	0.81	115	Peds
6	9/28/2019	7.46	6.38	8.05	1.67	146	Adult
7	10/8/2019	5.50	4.74	5.82	1.08	110.5	Adult
8	10/29/2019	4.36	3.96	4.71	0.75	78	Peds
9	10/31/2019	4.34	3.96	4.69	0.73	89.5	Adult
10	11/3/2019	4.47	3.96	4.84	0.88	76	Adult
11	11/24/2019	4.49	4.04	4.84	0.80	80.5	Peds
12	11/25/2019	5.80	5.02	6.03	1.01	111	Adult
13	12/3/2019	6.05	5.44	6.33	0.89	109.5	Peds
14	12/6/2019	5.82	5.08	6.26	1.18	87	Peds
15	12/14/2019	4.87	4.35	5.28	0.93	107.5	Adult
16	1/13/2020	5.87	5.21	6.53	1.32	132	Peds
17	2/12/2020	5.92	5.18	6.41	1.23	133	Adult
18	2/21/2020	7.14	6.05	7.59	1.54	147	Adult
19	2/24/2020	7.26	6.33	8.14	1.81	134	Adult
20	2/28/2020	6.30	5.51	6.74	1.22	110.5	Adult
21	3/7/2020	6.23	5.36	6.61	1.25	87	Peds
22	3/16/2020	5.35	4.22	6.43	2.21	195	Peds
23	3/24/2020	3.90	2.42	5.13	2.71	111	Peds
24	4/10/2020	6.55	5.77	6.96	1.19	113	Adult
25	5/4/2020	5.01	4.53	5.57	1.04	105	Adult
26	5/13/2020	5.62	5.10	6.10	1.00	87	Adult
27	5/14/2020	6.34	5.77	6.81	1.04	91	Adult
28	5/20/2020	4.13	3.06	5.02	1.96	95	Adult
29	6/11/2020	6.61	5.95	7.02	1.07	99.5	Peds
30	7/9/2020	4.83	4.61	5.10	0.49	87.5	Adult
31	7/12/2020	6.86	6.15	7.22	1.07	99	Peds
32	7/16/2020	5.64	5.02	5.85	0.83	80.5	Peds
33	9/8/2020	5.52	5.15	5.77	0.62	92	Adult
34	9/23/2020	5.72	5.08	6.20	1.13	104	Adult
35	10/8/2020	7.31	6.81	7.54	0.73	78	Peds
36	10/9/2020	6.34	5.67	6.69	1.02	78	Peds
37	11/7/2020	6.90	6.13	7.09	0.96	103.5	Adult
38	12/4/2020	4.22	3.54	4.58	1.04	140	Peds
39	1/12/2021	7.18	6.20	7.69	1.49	114	Adult
40	1/31/2021	6.34	5.57	6.59	1.02	105	Adult
41	2/3/2021	4.31	3.80	4.58	0.78	80.5	Peds
42	2/5/2021	5.27	4.58	5.64	1.06	133	Peds
43	2/11/2021	4.72	4.22	5.00	0.78	99	Adult
44	2/13/2021	4.52	3.85	4.92	1.07	136.5	Peds
45	3/1/2021	7.97	7.09	9.24	2.15	98.5	Peds
46	3/2/2021	6.73	5.97	7.02	1.05	86.5	Peds
47	3/18/2021	9.19	8.09	9.85	1.76	149.5	Peds

Table 1 documents the following variables for each donor: Average Temperature, Minimal Temperature, Maximal Temperature, Range of Temperature, Transport Time, and Age Category.

FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

66. SINGLE VENTRICLE CONGENITAL HEART DISEASE AND CHROMOSOME 22Q11 COPY NUMBER VARIANTS

AUTHORS
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OBJECTIVES:
Congenital heart disease (CHD) is an important feature of chromosome (Chr) 22q11.2 copy number variants (CNV). The types of CHD associated with Chr 22 CNVs include tetralogy of Fallot (TOF), truncus arteriosus, and interruption of the aortic arch (IAA). Biventricular repair is usually possible, however there are rare reports of patients with Chr 22 CNVs and functional single ventricle (SV).

METHODS:
This is a single center retrospective review of patients with CNVs of Chr 22 and functional SV who underwent staged SV reconstructive surgery between 7/1/1984 and 12/31/2020. Data was abstracted from the medical record.

RESULTS:
Nineteen patients met inclusion criteria. The most common types of CHD were hypoplastic left heart syndrome (HLHS) (n=9) and small left-sided structures (n=7). Additional cardiac lesions included pulmonary atresia with intact ventricular septum (n=1), and a SV variant of TOF (n=1). The right ventricle was dominant in 15 patients. Vascular anomalies included interrupted aortic arch (IAA) (n=8), right-sided aortic arch (n=2), and anomalous right subclavian artery (n=5).

A Chr 22q11.2 deletion was present in 15 patients, typically the standard LCR22A-LCR22D microdeletion (n=7). There were 4 patients with a duplication in the LCR22-A-D region. Craniofacial and auricular abnormalities were documented in 9 patients, but cleft palate or velopharyngeal incompetence was identified in only 2 patients. Most patients had developmental delay and 53% had history of hypocalcemia.

Neonatal intervention was performed in 17 patients including Blalock Taussig shunt (n=1), pulmonary artery banding (n=1), and Stage I Norwood operation (n=17). Superior cavopulmonary anastomosis was performed in 11 patients, 8 patients had a Fontan completion, and 2 patients are alive awaiting Fontan. One patient underwent cardiac transplantation after full staged reconstruction. Survival at one year is 67% and 61% at 5 and 10 years. Most deaths occurred following neonatal intervention (n=6).

CONCLUSIONS:
Congenital heart disease necessitating SV reconstruction associated with Chr 22 CNVs is not common, but does occur, typically as a variant of HLHS with the usual cytogenetic microdeletion. The most common neonatal surgical intervention performed is the Norwood, where most of the mortality burden occurs. Survival at 10 years is similar to all infants with SV disease. Associated anomalies and medical issues, such as hypocalcemia, may cause additional morbidity and increase complexity of cardiac surgery. Thus, it is important to consider a diagnosis of 22q CNVs in patients with SV CHD so prompt multidisciplinary care can be initiated.

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FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

66. SINGLE VENTRICLE CONGENITAL HEART DISEASE AND CHROMOSOME 22Q11 COPY NUMBER VARIANTS

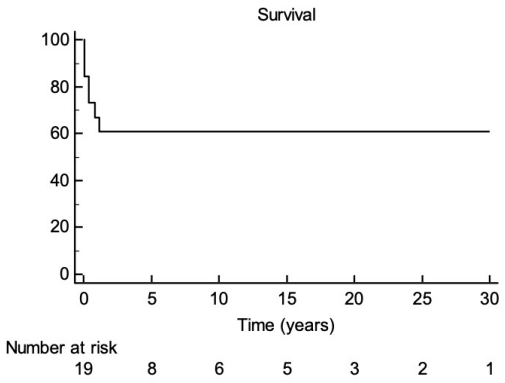
CONTINUED

Patient Characteristics

Variable	Overall Frequency	*Deletion*	*Duplication*
		15	4
Sex			
Female	10	8	2
Male	9	7	2
Ethnicity			
Not-Hispanic or Latino	17	13	4
Hispanic or Latino	2	2	0
Race			
White	14	11	3
Black	3	3	0
Other	2	1	1
Asian	0	0	0
Native American/Alaskan	0	0	0
Pacific islander	0	0	0
SV Primary Diagnosis			
HLHS	9	6	3
Small left-sided structures*	7	7	0
AV Canal	1	1	0
PA/IVS	1	0	1
TOF	1	1	0
HLHS Type			
AA/MA	3	2	1
AS/MA	2	2	0
AA/MS	1	0	1
AS/MS	3	2	1
Interrupted Aortic Arch	8	8	0
Type B	6	6	0
Unknown	2	2	0
Anomalous Right Subclavian	5	5	0
Heterotaxy	0	0	0
Ductal Dependent	17	15	2
Arch sidedness			
Left	16	13	3
Right	2	2	0
Unknown	1	0	1
Ventricular Dominance			
Right	15	12	3
Left	4	3	1
Pulmonary Artery Hypoplasia			
None	12	9	3
Branch	3	3	0
Main only	0	0	0
Both MPA & Branch	1	1	0

*Includes various combinations of sub aortic stenosis, hypoplastic aortic valve, hypoplastic left ventricle.

Survival Curve



FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

67. RELATIONSHIP BETWEEN THE NUMBER OF POST-OPERATIVE PROCEDURES AND SURVIVAL IN CONGENITAL HEART SURGERY

AUTHORS
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OBJECTIVES:
Outcomes for congenital heart disease have dramatically improved over the years based on advances in both cardiac surgical technique and the care provided post-operatively in dedicated intensive care units. In spite of these advancements, there are still cases in which the outcome is unsuccessful. We hypothesized that the number of post-operative procedures performed after the index operation would correlate with the subsequent survival to hospital discharge. The purpose of this study was to evaluate this relationship between the number of post-operative procedures and survival for patients undergoing congenital heart surgery.

METHODS:
This was a retrospective review of 938 consecutive patients undergoing congenital heart surgery at a single institution. All patients were included who had an index operation that was categorizable in the STS Congenital DataBase codes. This included 197 STAT 1, 206 STAT 2, 89 STAT 3, 408 STAT 4, and 38 STAT 5 cases.

The number of procedures performed following the index operation was determined thru chart review. The total number of post-operative procedures included all surgical procedures and those diagnostic studies that were ordered as part of the recovery process from the index procedure. Routine diagnostic studies (such as EKGs) were excluded from the count.

RESULTS:
The aggregate mortality for all index procedures was 4.1%. Mortality by STAT score was 0.5% for STAT 1, 1.5% for STAT 2, 6.6% for STAT 3, 6.6% for STAT 4, and 10.5% for STAT 5.

581 patients (62% of the entire cohort) had zero post-operative procedures with a single post-operative death (0.2%). There were 180 patients who had one or two post-operative procedures (1.1% mortality), 56 patients who had three or four procedures (3.6% mortality, $p < 0.001$ compared to zero procedures), 34 patients who had five or six procedures (20.6% mortality, $p < 0.0001$ compared to zero procedures), 47 patients who had seven, eight, or nine procedures (14.9% mortality, $p < 0.0001$ compared to zero procedures), and 40 patients with a double digit number of procedures (50.0% mortality, $p < 0.0001$ compared to zero procedures).

Patients with double digit number of procedures accounted for 51% of the overall deaths and there were no survivors when the procedure count exceeded 15.

The data for the number of post-operative procedures and mortality are summarized visually in the graph.

CONCLUSIONS:
The data demonstrate that the number of post-operative procedures following the index operation was predictive of the likelihood of survival or death. Patients with a double digit number of post-operative procedures had a high mortality and patients who exceeded 15 procedures appeared to reach a point of no return. These results suggest that the post-operative procedure count may be used as a tool to assess the likelihood of survival in the post-operative setting.

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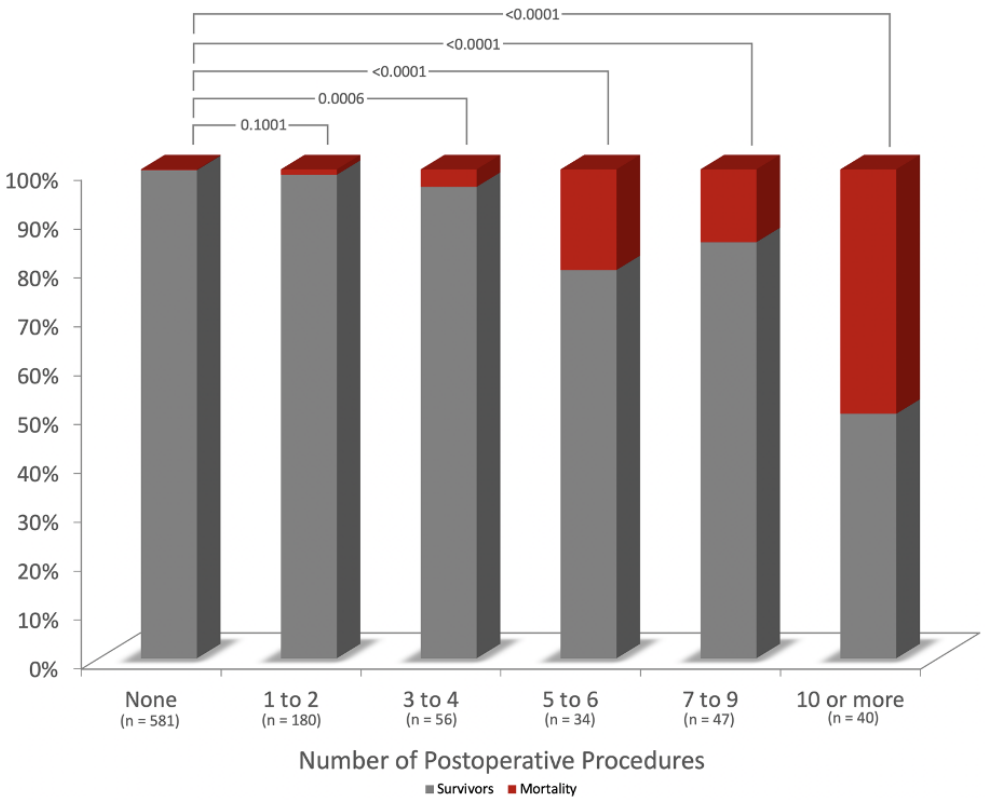
FOURTH SCIENTIFIC SESSION B – CONGENITAL RAPID FIRE BREAKOUT

67. RELATIONSHIP BETWEEN THE NUMBER OF POST-OPERATIVE PROCEDURES AND SURVIVAL IN CONGENITAL HEART SURGERY

CONTINUED

Figure 1



Bar graph demonstrating the number of post-operative procedures (x-axis) and survival/mortality on the y-axis.

FOURTH SCIENTIFIC SESSION C – CORONARY ARTERY DISEASE BREAKOUT

68. EMERGENCY CORONARY ARTERY BYPASS GRAFTING IN THE UNITED STATES: REGIONAL VARIATION AND TRENDS

AUTHORS
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COMMERCIAL RELATIONSHIPS
W.B. Keeling: Consultant/ Advisory Board: AngioDynamics

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OBJECTIVES:
Emergency CABG is often omitted from current research, and volumes as well as outcomes are unknown. There have been multiple events since the turn of the century that have potentially altered emergency CABG volumes. The purpose of this research is to examine trends in emergent CABG and how volumes, outcomes, and patient risk profiles align.

METHODS:
The STS national adult cardiac surgical database was queried from 2005-2017 for all patients who underwent emergent and emergent salvage isolated CABG procedures. 92607 patients were included for analysis. Continuous variables that had a symmetric distribution were summarized using mean ± standard deviation and groups were compared using one-way analysis of variance (ANOVA). Variables that had a skewed distribution were log-transformed prior to performing one-way ANOVA. In the risk-adjusted analyses, analysis of covariance (ANCOVA) was performed with PROM score as the covariate. In the risk-adjusted analyses, logistic regression models were built to adjust for PROM score.

RESULTS:
Over the study period, volumes of emergent and emergent salvage CABG declined from 7991 cases/ year to 6916 cases/year. Interestingly, predicted risk of mortality (PROM) also declined in the patient cohort over time from 10% to 8% ($p<0.001$). Rates of important postoperative morbidities also declined over the study period including prolonged intubation, re-exploration for hemorrhage, and postoperative pneumonia ($p<0.001$). Observed to expected (O/E) mortality rates rose over the study period from 1.06 to 1.20. Emergent salvage CABG rates also declined over the course of the study from 358 cases/year to 323 cases/year. Notably, the O/E ratios for mortality also increased for emergent salvage CABG during the study from 1.20 to 1.56. Emergent salvage mortality rates averaged 46.5%. There was also significant regional variation in emergent CABG cases with the highest rates in the South Atlantic region (22.9%) and the lowest rates in New England (2.9%).

CONCLUSIONS:
The volume of patients undergoing emergent and emergent salvage CABG in the US has declined. Increases in mortality are largely driven by emergent salvage cases, and the predicted risk of mortality algorithm may not accurately reflect the risk involved for these patients. Significant regional variation exists in which patients are referred for emergent or emergent salvage CABG.

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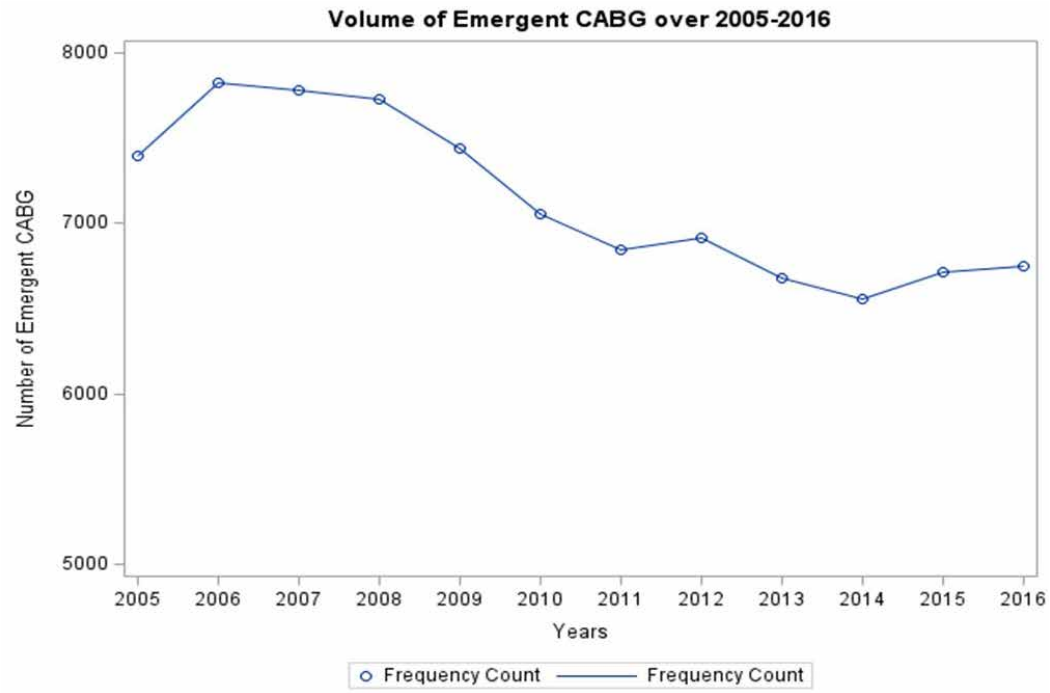
FOURTH SCIENTIFIC SESSION C – CORONARY ARTERY DISEASE BREAKOUT

68. EMERGENCY CORONARY ARTERY BYPASS GRAFTING IN THE UNITED STATES: REGIONAL VARIATION AND TRENDS

CONTINUED

Emergency CABG Volumes



FOURTH SCIENTIFIC SESSION C – CORONARY ARTERY DISEASE BREAKOUT

69. ANALYSIS OF CONCOMITANT CORONARY ARTERY BYPASS AND SURGICAL ABLATION FOR ATRIAL FIBRILLATION IN UNITED STATES VETERANS

AUTHORS
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OBJECTIVES:
Concomitant surgical ablation (CSA) for atrial fibrillation (AF) at the time of coronary artery bypass grafting (CABG) is a class I recommendation from the Society of Thoracic Surgeons but is often underutilized. We aimed to assess the outcomes of CSA using the Veterans Affairs Surgical Quality Improvement Program (VASQIP) database.

METHODS:
The VASQIP database was queried for patients that underwent CABG with a history of AF from the years 1998-2018. Patients were stratified based on the utilization of CSA, which due to database limitations restricted the analysis to the years 2010 through 2014. The primary outcome was major adverse cardiovascular event (MACE), defined as a composite of 30-day mortality, myocardial infarction, cardiac arrest, and stroke. Secondary outcomes included individual complications, operative time, cardiopulmonary bypass time, and aortic cross clamp time. Univariate comparisons were performed using Chi square and Wilcoxon rank sum tests for categorical and continuous variables, respectively. Separate multivariable logistic regression models were constructed to assess the primary outcome and the probability of receiving CSA.

RESULTS:
We included 939 patients with AF that underwent CABG. Of these, 199 (21.2%) received CSA. CSA patients were more often functionally independent (93.5% vs 82.6%, p=.001), had less peripheral vascular disease (18.1% vs 29.5%, p=.001), less cerebrovascular disease (23.1% vs 30.7%, p=.04), fewer prior myocardial infarctions (33.2% vs 56.2% p<.001), and were less likely to have an ASA class of IV or greater (77.4% vs 83.4%, p=0.002). Operative times were similar, but CSA had longer cardiopulmonary bypass times (138 vs 98 min, p<.001) and aortic cross clamp times (87 vs 65 min, p<.001). Number of arterial conduits and total bypasses did not differ between the cohorts. There were no differences in 30-day mortality (2.5% vs 3.2%, p=0.9) or MACE (3.5% vs 6.5%, p=0.1), between CSA and no CSA, respectively. On multivariable analysis, African American race and depressed ejection fraction were significantly associated with MACE, while full and partial CSA were not associated with MACE. After adjustment, African American race and partially dependent functional status were less likely to receive CSA.

CONCLUSIONS:
CSA is not associated with MACE in veterans with AF undergoing CABG. Although CSA is underutilized in the entire cohort, African American veterans were less likely to receive CSA after adjustment. Efforts to improve utilization of CSA in the veteran population are needed.

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FOURTH SCIENTIFIC SESSION C – CORONARY ARTERY DISEASE BREAKOUT

69. ANALYSIS OF CONCOMITANT CORONARY ARTERY BYPASS AND SURGICAL ABLATION FOR ATRIAL FIBRILLATION IN UNITED STATES VETERANS

CONTINUED

Table 1: Multivariable logistic regression for composite outcome of 30-day mortality, cardiac arrest, stroke, and perioperative myocardial infarction in patients undergoing coronary artery bypass grafting

Variable	OR	95% CI
CSA (yes)	0.89	0.46-1.74
Age	1.01	0.97-1.04
ASA		
4	2.53	0.99-6.51
5	18.87	0.82-431.55
Functional Status		
Partially dependent	0.86	0.41-1.78
Totally dependent	2.78	0.55-14.12
Race		
Black	2.26	1.05-4.89
Hispanic	1.27	0.36-4.50
Other	1.60	0.17-15.34
Unknown	1.20	0.44-3.22
COPD	1.05	0.62-1.77
Diabetes		
Oral medication	0.87	0.42-1.80
control	1.14	0.65-2.02
Insulin dependent		
LVEF		
45-54	2.72	1.34-5.55
40-44	2.29	0.93-5.60
35-39	3.18	1.34-7.51
25-34	3.76	1.67-8.47
<25	8.71	3.58-21.22

CSA=Concomitant surgical ablation, ASA=American Society of Anesthesiologist physical status classification, COPD=Chronic obstructive pulmonary disease, LVEF=Left ventricular ejection fraction

Table 2: Multivariable logistic regression for the use of concomitant surgical ablation for atrial fibrillation at the time of coronary artery bypass surgery

Variable	OR	95% CI
Age	0.98	0.96-1.01
ASA		
4	0.76	0.50-1.15
5	1	---
Functional Status		
Partially dependent	0.34	0.18-0.65
Totally dependent	0.32	0.04-2.51
Race		
Black	0.43	0.19-0.98
Hispanic	1.42	0.63-3.17
Other	1	---
Unknown	0.95	0.47-1.90
COPD	0.96	0.67-1.37
Diabetes		
Oral medication	1.28	0.83-1.98
control	0.99	0.67-1.47
Insulin dependent		
Employment Status		
Part time	0.62	0.23-1.68
Unemployed	1.09	0.66-1.81
Self-employed	0.94	0.34-2.58
Retired	1.03	0.34-2.58

ASA=American Society of Anesthesiologist physical status classification, COPD=Chronic obstructive pulmonary disease

FOURTH SCIENTIFIC SESSION C – CORONARY ARTERY DISEASE BREAKOUT

70. DOES SIDE OF ARTERIOVENOUS FISTULA AND INTERNAL THORACIC ARTERY INFLUENCE OUTCOMES AFTER CORONARY ARTERY BYPASS GRAFTING IN DIALYSIS PATIENTS?

AUTHORS
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OBJECTIVES:
There are limited data evaluating the influence of arteriovenous fistula (AVF) side and the use of ipsilateral or contralateral internal thoracic artery (ITA) on early and late outcomes after coronary artery bypass grafting (CABG).

METHODS:
Patients were identified who underwent CABG with ITA-to-left anterior descending artery (LAD) grafting between January 2000 and December 2016 at our institution and on chronic hemodialysis through an AVF in the arm. These were further categorized into ipsilateral (LAD revascularized with ITA ipsilateral to the AVF side) and contralateral (LAD revascularized with ITA contralateral to the AVF side) groups. A concomitant cardiac procedure was performed in 30 (31%) patients. We compared early and late outcomes between these two groups. Kaplan-Meier estimator and log-rank test were used to compare long-term survival. Cumulative incidence of major adverse cardiovascular events (MACE) defined as a composite of repeat revascularization, myocardial infarction, heart failure hospitalization, and ischemic stroke was evaluated accounting for the competing risk of death.

RESULTS:
We identified 99 patients; mean age was 65.1 ± 10.5 years and 76% were male. There were 62 (63%) patients in the ipsilateral group and 37 (37%) in the contralateral group. All patients in the ipsilateral group had LITA-LAD grafting and 34 patients in the contralateral group had LITA-LAD grafting. There were no differences in baseline characteristics between the groups. There were 3 (3%) in-hospital deaths with one patient in the ipsilateral group and two in the contralateral group. After a median follow-up period of 8.8 (IQR 3.9-12.8) years, overall survival at 1, 5, and 10 years was 80.8%, 35.1%, and 10.4% respectively. Survival at 5 and 10 years in the ipsilateral group was 32.8% and 10.1% whereas it was 38.7% and 12.4% in the contralateral group. There was no difference in long-term survival between patients receiving ipsilateral graft or contralateral ITA graft (log-rank P=0.34). Accounting for the competing risk of death, overall cumulative incidence of MACE at 1 and 3 years was 32% and 53% with no difference between the groups. A total of 13 patients underwent repeat revascularization with 5 of these to address LAD territory (3 in the ipsilateral LITA-LAD group and 2 in the contralateral LITA-LAD group).

CONCLUSIONS:
The choice of ITA graft for CABG relative to the side of arteriovenous fistula has no influence on early or late survival and occurrence of MACE in dialysis patients. These patients, however, have a substantial risk of MACE over follow-up.

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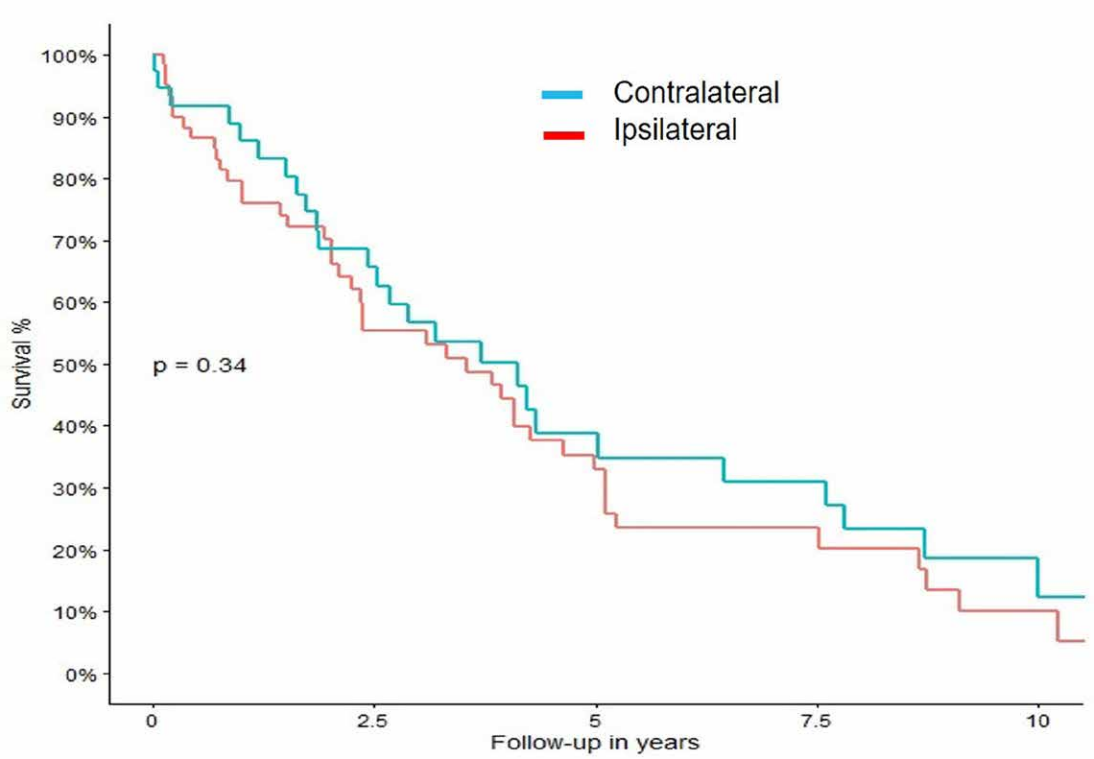
FOURTH SCIENTIFIC SESSION C – CORONARY ARTERY DISEASE BREAKOUT

70. DOES SIDE OF ARTERIOVENOUS FISTULA AND INTERNAL THORACIC ARTERY INFLUENCE OUTCOMES AFTER CORONARY ARTERY BYPASS GRAFTING IN DIALYSIS PATIENTS?

CONTINUED

Kaplan-Meier estimated survival comparing Ipsilateral and contralateral groups after CABG



FOURTH SCIENTIFIC SESSION C – ESOPHAGUS OUTCOMES BREAKOUT

71. CLINICAL AND PATIENT REPORTED OUTCOMES FOLLOWING LONG-SEGMENT SUPERCHARGED JEJUNAL INTERPOSITION FOR ESOPHAGEAL RECONSTRUCTION: TARGETED MODIFICATIONS TO IMPROVE OUTCOMES

AUTHORS
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AUTHOR INSTITUTION(S)
[1]Mayo Clinic, Rochester, MN; [2]Montefiore Medical Center, Bronx, NY

OBJECTIVES:
Re-establishing gastrointestinal continuity after esophagectomy without a viable gastric conduit can be challenging. This study evaluated the patient-reported outcomes (PROs) of long-segment supercharged pedicled jejunal (SPJ) interposition in a consecutive cohort of complex esophageal reconstruction patients following optimization, technical refinements and standardization of a perioperative protocol.

METHODS:
A six-year retrospective study of all patients who underwent complex esophageal reconstruction with SPJ interposition at a single tertiary academic medical center with a specific protocol and team was conducted. Data collection included demographic, perioperative, and PRO validated questionnaires using the Upper Digestive Disease mobile application (UDD App) tool.

RESULTS:
SPJ was performed in 19 patients (71% men; median age 62 years (IQR= 57- 68) who had ischemic loss of prior gastric conduit (n=10), prior gastrectomy (n=5), airway-esophageal fistulae (n=4), and tumor extension into gastric conduit (n=6). Eighteen patients (94%) had a delayed reconstruction after esophageal diversion. Fifteen patients had a history of malignant disease and all had a prior history of chemoradiation. The median hospital stay was 12 days (IQR 9-20). There were no flap losses with no 90-day mortalities. Resumption of an enteral diet was achieved in 18/19 patients. Early complications (≤90 days) included pneumonia (n=5) with respiratory failure (n=2), bleeding requiring re-exploration (n=3), grade III anastomotic leaks (n=2) and thoracic duct leak requiring embolization (n=1). Four patients developed strictures requiring subsequent dilation. The median follow-up time was 19 months (IQR 14-31). PRO data were collected in 14 out of 15 living patients, providing a total of 30 questionnaires and median follow-up of 23 months (IQR 3-36). Seven patients completed two or more questionnaires. Median scores within 12 months of surgery included physical health 43.6(IQR, 38.6-49.3), mental health 45.8 (IQR, 42.9-54), pain 35.3 (IQR 19.1-48.6), dysphagia 8.6 (IQR, 0-42.9), reflux 0 (IQR, 0-23.8), dumping-hypoglycemia 14.2 (IQR 0-30), and dumping-gastrointestinal 33.2 (IQR, 0-52.3). PRO data comparing scores from the first 12 months to after 12 months were comparable. Patients maintained "good" scores for reflux, moderate to good functional scores for pain, dysphagia and dumping-hypoglycemia beyond 12 months after SPJ, but experienced a decline in dumping-GI (p=0.02), Figure 1. Refinements for optimization, as seen in Figure 2, significantly reduced subsequent postoperative events.

CONCLUSIONS:
Targeted modifications can optimize postoperative and PRO outcomes in esophageal reconstruction with SPJ interposition to re-establish and maintain gastrointestinal continuity in high-risk patients without a suitable gastric conduit.

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FOURTH SCIENTIFIC SESSION C – ESOPHAGUS OUTCOMES BREAKOUT

71. CLINICAL AND PATIENT REPORTED OUTCOMES FOLLOWING LONG-SEGMENT SUPERCHARGED JEJUNAL INTERPOSITION FOR ESOPHAGEAL RECONSTRUCTION: TARGETED MODIFICATIONS TO IMPROVE OUTCOMES

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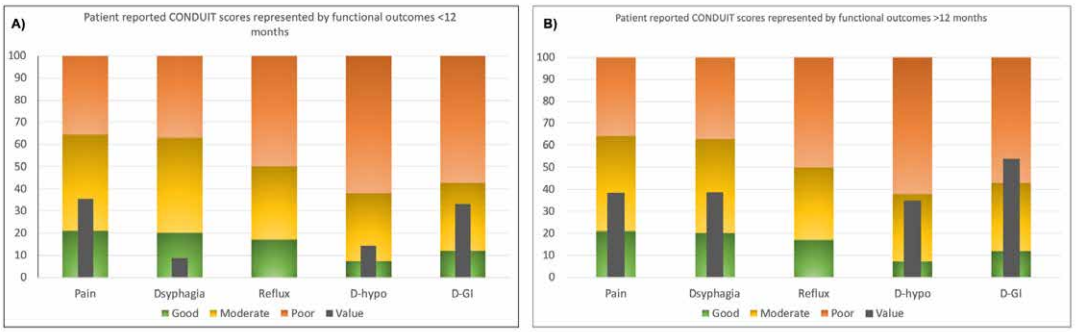
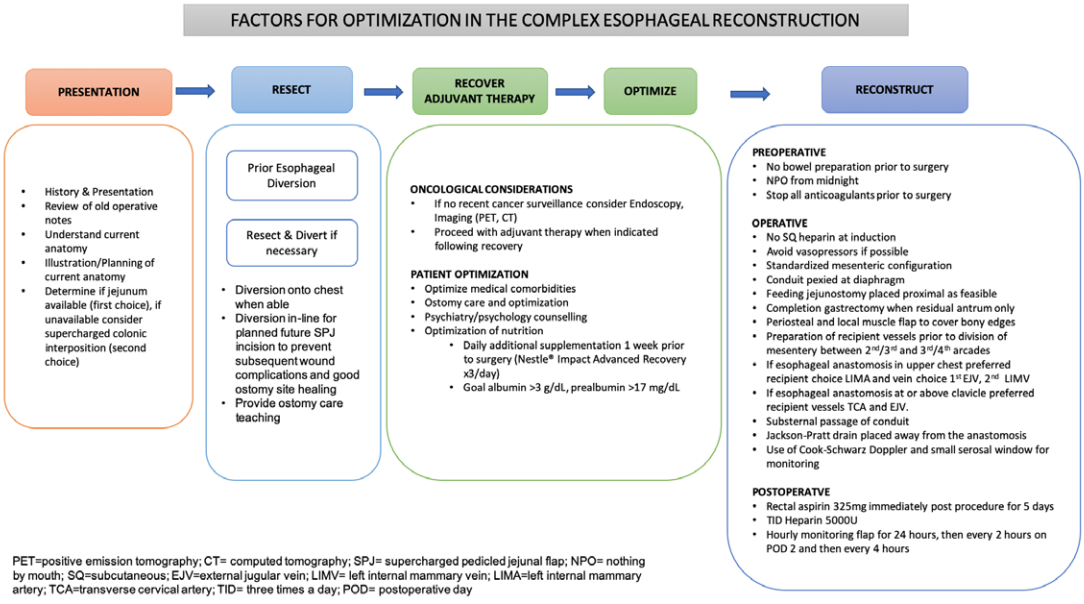
Figure 1: Median patient reported CONDUIT outcome scores relative to category of functional outcomes A) reported up to 12 months post-surgery, and B) reported >12 months post-surgery.



Median patient reported CONDUIT outcome scores relative to category of functional outcomes A) reported up to 12 months post-surgery, and B) reported >12 months post-surgery. (Intervals for ranges of scores categorized under "good", "moderate" and "poor" are represented by the colored bar charts for each domain, based on validated PRO tool. Reflux median value was 0)

Figure 2: Overview of complex esophageal pathway and factors for surgical optimization



Overview of complex esophageal pathway and factors for surgical optimization

FOURTH SCIENTIFIC SESSION C – ESOPHAGUS OUTCOMES BREAKOUT

72. RECUPERATION OF PATIENT-REPORTED QUALITY OF LIFE AFTER ESOPHAGECTOMY

AUTHORS
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[1]Emory University Hospital, Atlanta, GA; [2]Emory University School of Medicine, Atlanta, GA; [3]Rollins School of Public Health, Atlanta, GA; [4]Emory University, Atlanta, GA

OBJECTIVES:
Esophagectomy is often necessary for optimal management of both benign and malignant diseases. However, it carries significant risk of morbidity and can have a significant impact on quality of life (QOL). Patient reported outcomes (PRO) are the ideal method for obtaining health-related QOL metrics after surgery. The aim of this study was to describe patterns of change and recovery in QOL PRO in the first year after esophagectomy.

METHODS:
Longitudinal patient-reported QOL scores measuring physical function, pain intensity, and dyspnea severity were obtained from esophagectomy patients during all thoracic surgery clinic visits as part of routine clinical care. PRO were obtained using NIH-sponsored PROMIS (Patient-Reported Outcomes Measurement Information System) from April 2018 to December 2019. Mean PRO scores over the first 200 days after surgery were plotted over time and compared with baseline PRO scores using mixed effects modeling with a compound symmetry correlational structure.

RESULTS:
A total of 69 esophagectomy patients with PRO results were identified. Preoperative demographics and comorbidities are shown in the attached table. Reasons for esophagectomy were malignancy (89.9%), end-stage achalasia (5.8%), and benign stricture (4.3%). PRO scores showed considerable declines initially after surgery. When comparing mean PRO scores at visits ≤ 30 days post-surgery to mean preoperative PRO scores, physical function scores had declined by 26.8% ($p<0.001$), while dyspnea severity and pain intensity scores had increased by 26.7% ($p<0.001$) and 23.6% ($p<0.001$), respectively. Recovery was seen over the course of the year; however, at 150-200 days post-surgery, mean physical function scores and dyspnea severity were still 10.6% ($p=0.065$) and 24.6% ($p=0.003$) worse than mean preoperative levels, respectively.

CONCLUSIONS:
There are considerable declines in quality of life scores immediately after esophagectomy, with recovery lasting nearly a year. These results are of considerable importance when counseling patients regarding esophagectomy. Further long-term follow-up is needed to determine recovery beyond 1 year.

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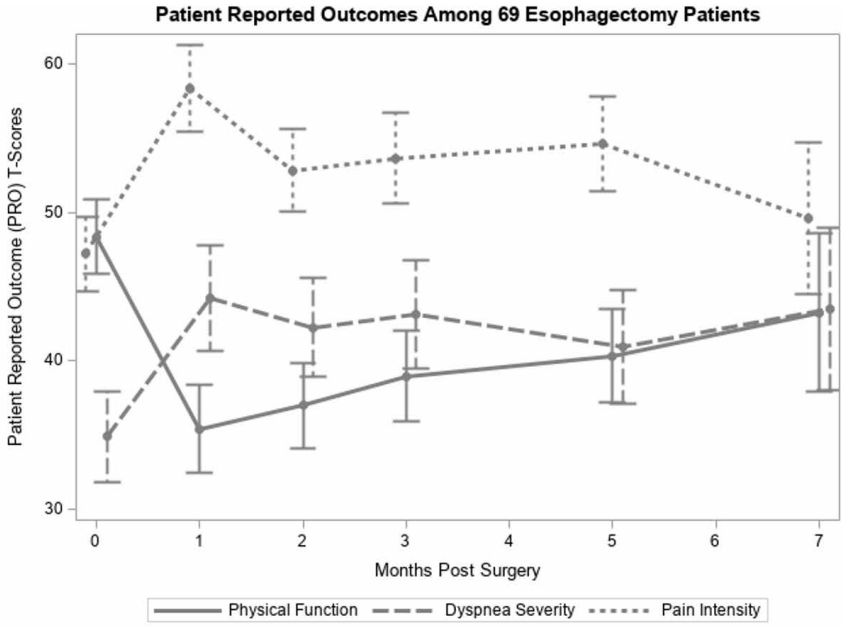
FOURTH SCIENTIFIC SESSION C – ESOPHAGUS OUTCOMES BREAKOUT

72. RECUPERATION OF PATIENT-REPORTED QUALITY OF LIFE AFTER ESOPHAGECTOMY

CONTINUED

Figure 1



Patient reported outcomes after esophagectomy

Table 1

Demographics, n (%)	n = 69
Average age in years (SD)	63.2 (9.5)
Gender (Female)	14 (20.6%)
Race (Caucasian)	58 (85.3%)
Preoperative risk factors, n (%)	
Average BMI, kg/m2 (SD)	28.2 (6.2)
Current smoker	10 (14.5%)
Average pack years (SD)	40.9 (29.4)
Hypertension	55 (79.7%)
Coronary Artery Disease	12 (17.4%)
Diabetes	19 (27.5%)
Cerebrovascular disease or TIA	5 (7.3%)
Neoadjuvant chemotherapy	55 (79.7%)
Neoadjuvant radiation	51 (73.9%)
American Society of Anesthesiologists Physical Status Class	
1	0
2	6 (8.7%)
3	54 (78.3%)
4	9 (13.0%)
Zubrod/ECOG Score	
0	48 (69.6%)
1	17 (24.6%)
2	4 (5.8%)
Indication for Esophagectomy	
Esophageal Malignancy	62 (89.9%)
Achalasia	4 (5.8%)
Benign Esophageal Stricture	3 (4.3%)
Surgical Approach	
Open Transthoracic (Ivor Lewis and Mckeown)	25 (36.2%)
Open Transhiatal	13 (18.8%)
Minimally Invasive Esophagectomy (Video-assisted and Robotic)	31 (44.9%)

Demographics and clinical characteristics in patients undergoing esophagectomy

FOURTH SCIENTIFIC SESSION C – ESOPHAGUS OUTCOMES BREAKOUT

73. THE UPPER DIGESTIVE DISEASE MOBILE APPLICATION: A COMPARISON OF PATIENT-REPORTED OUTCOME SCORES VERSUS PROVIDER SCORES AMONG POST-ESOPHAGECTOMY PATIENTS

AUTHORS
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OBJECTIVES:
While advancements in neoadjuvant therapies, operative approaches and complication management have improved outcomes post-esophagectomy, patients remain at high risk for complications and deterioration in quality of life. Importantly, questions remain about the ability of clinicians to readily detect patient problems. This study utilized a novel mobile application (app), the Upper Digestive Disease (UDD) App, to compare post-esophagectomy patient-reported outcomes (PROs) versus evaluation by a provider.

METHODS:
From 12/15/2017-12/15/2020, prescreened patients presenting to a tertiary referral center after esophagectomy were approached for consent to enroll in a prospective clinical trial (NCT02530983), offering the PRO digital assessment with the UDD app at the same time as being seen by a provider. The app consists of a previously validated tool with 67 individual questions within five novel domains (dysphagia, reflux, dumping-hypoglycemia, dumping-gastrointestinal, and pain). Providers were given score sheets to concurrently rate patients in the same five domains based on their clinical evaluation after a 30 minute scheduled appointment with the patient. Evaluations were performed by 13 providers with a limit of 10 individual patient assessments per provider. The weighted kappa statistic was used to determine the magnitude of agreement between PROs using the UDD app and provider responses.

RESULTS:
Sixty-one patients (76% male), median age 63 [IQR 56, 71] reported outcomes utilizing the UDD app. Providers reviewed between 1 and 10 patients at a median time of 296.5 days [IQR 50, 975] post-esophagectomy. The magnitude of agreement between patients and providers was moderate for dysphagia (κ= 0.52, p<0.001) and reflux (κ= 0.42, p<0.001), Figure. Dumping-related hypoglycemia (κ= 0.03, p=0.148), gastrointestinal complaints (κ= 0.02, p=0.256) and pain (κ= 0.05, p<0.184), showed minimal agreement, with providers underestimating the symptoms and problems reported by patients in these domains.

CONCLUSIONS:
While there was satisfactory agreement between PROs and provider evaluation of dysphagia and reflux following esophagectomy, there was discordance between patient responses and provider's assessments for dumping-related symptoms and pain. Clinicians in this sample underestimated the severity of problems in this domain. The UDD app may provide for more nuanced and remote assessment of PROs when added to the traditional evaluation of this complex patient population.

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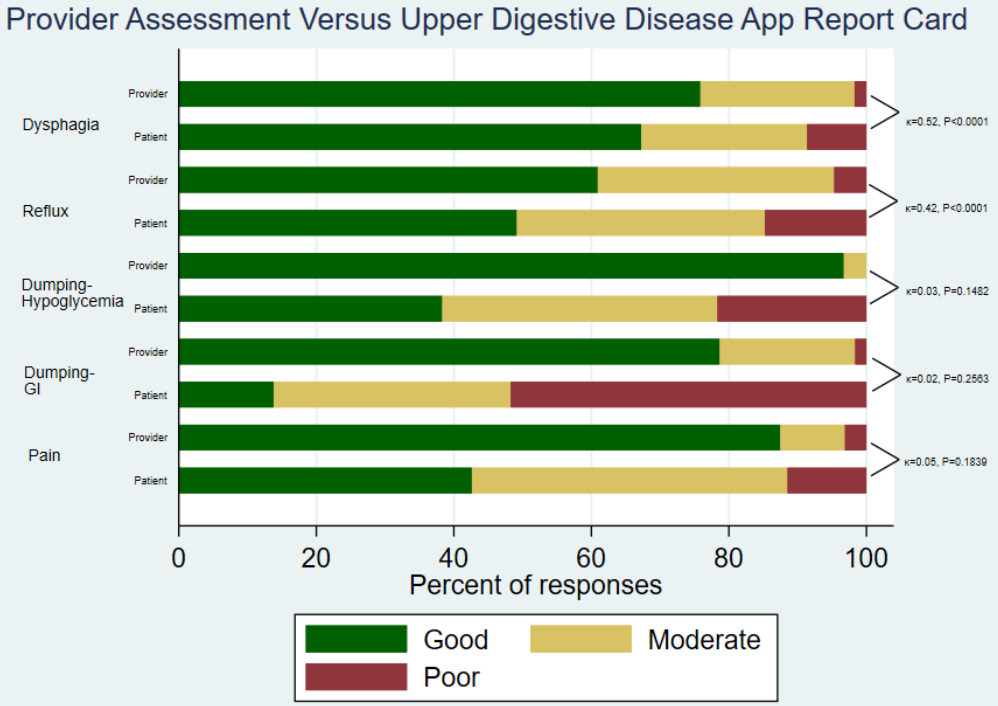
FOURTH SCIENTIFIC SESSION C – ESOPHAGUS OUTCOMES BREAKOUT

73. THE UPPER DIGESTIVE DISEASE MOBILE APPLICATION: A COMPARISON OF PATIENT-REPORTED OUTCOME SCORES VERSUS PROVIDER SCORES AMONG POST-ESOPHAGECTOMY PATIENTS

CONTINUED

Provider Assessment Versus Upper Digestive Disease App Report Card



FOURTH SCIENTIFIC SESSION C – ESOPHAGUS OUTCOMES BREAKOUT

74. PILOT STUDY USING THE PATIENT REPORTED OUTCOMES MEASUREMENT INFORMATION SYSTEM (PROMIS) FOLLOWING ESOPHAGEAL CANCER RESECTION

AUTHORS
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OBJECTIVES:
Patient-reported outcomes (PROs) are important tools for assessing patients before and after esophagectomy. The National Institutes of Health (NIH)-developed Patient Reported Outcome Measurement Information System (PROMIS) is a well-established platform for collecting PROs which has been poorly explored following esophagectomy. In this study, we examined PROMIS scores in patients undergoing esophagectomy and hypothesized that scores return to pre-operative baseline values by 6 months following surgery.

METHODS:
We prospectively collected PROMIS at our institution from May 2017 until March 2020. We collected 3 PROMIS instruments (dyspnea severity, physical function, and pain interference) before and after surgery. All data were merged with our institutional Society of Thoracic Surgery (STS) database. We used a linear mixed-effect multivariable model controlling for repeated measures to compare baseline and post-operative scores across several time points.

RESULTS:
The study included 112 patients with esophageal cancer undergoing esophagectomy. 86.6% were male, 79.5% received induction therapy, and 36.6% underwent transhiatal esophagectomy (THE). Completed PROMIS assessments were classified as pre-operative, 1-month post-operative, and 6-month post-operative. Pain interference, physical function, and dyspnea severity scores were significantly worse 1 month following surgery (Table 1). While physical function and dyspnea severity scores returned to baseline by 6 months after surgery, pain interference scores were persistently worse up to 6 months following esophagectomy (difference 2.7 ± 2.5, p=0.036, Figure 1). PROMIS scores were further assessed among patients undergoing THE versus other forms of esophagectomy. Physical function and dyspnea scores were equivalent between the groups at each time point after surgery. However, pain interference scores were persistently better among patients undergoing THE at both 1 month (difference 6.5 ± 5.1, p=0.013) and 6 months after surgery (difference 5.2 ± 3.9, p=0.008).

CONCLUSIONS:
High-quality PROs, like PROMIS, are important but underutilized metrics for assessing patients before and after esophageal cancer resection. In general, patients report persistent pain interference for at least 6 months after esophagectomy. Long-term pain interference scores are better in patients undergoing THE as opposed to other forms of esophagectomy. PROs are important surgical outcomes that should be widely collected in order to guide operative candidacy and to assess quality of care.

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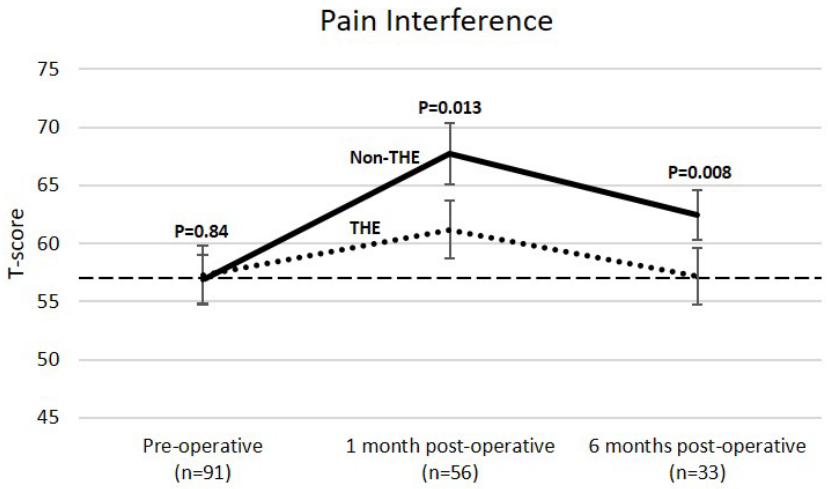
FOURTH SCIENTIFIC SESSION C – ESOPHAGUS OUTCOMES BREAKOUT

74. PILOT STUDY USING THE PATIENT REPORTED OUTCOMES MEASUREMENT INFORMATION SYSTEM (PROMIS) FOLLOWING ESOPHAGEAL CANCER RESECTION

CONTINUED

PROMIS Scores Following Esophagectomy

PROMIS domain	Pre-op baseline	Difference			
		1 month follow up	p-value	6 month follow up	p-value
Dyspnea severity	35.4 ± 3.4	8.9 ± 4.1	<0.001	3.1 ± 5.0	=0.22
Pain interference	57.1 ± 4.1	7.3 ± 3.1	<0.001	2.7 ± 2.5	=0.036
Physical function	42.4 ± 2.1	9.2 ± 2.4	<0.001	0.5 ± 2.8	=0.71



Pain interference, dyspnea severity, and physical function PROMIS scores before and after esophagectomy.

FOURTH SCIENTIFIC SESSION C – ESOPHAGUS OUTCOMES BREAKOUT

75. UPPER DIGESTIVE DISEASE APPLICATION AS A DIGITAL HEALTH INTERVENTION TO COLLECT ELECTRONIC PATIENT REPORTED OUTCOMES IN ESOPHAGECTOMY PATIENTS: A SINGLE ARM PILOT TRIAL

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COMMERCIAL RELATIONSHIPS
S. Blackmon: Research Grant: Medtronic, Steris; Ownership Interest: Mayo Clinic

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OBJECTIVES:
Patient reported outcomes (PROs) enable patients to communicate symptoms, functional status and quality of life. Mobile devices through digital health platforms facilitate remote electronic PRO assessment through novel clinical decision support tools to facilitate productive healthcare interactions while facilitating personalized treatment. This study explored the acceptability and feasibility of collecting PROs using a post esophagectomy upper digestive disease (UDD) mobile phone application, named the UDD App, after initial development of domains, standardized setting, assimilated normative data analysis, automatic scoring, tailored education, and creation of a triaged care platform.

METHODS:
From 1-10-2020 to 12-15-2020, patients underwent evaluation utilizing the UDD App to assess outcomes after esophagectomy with mobile phone evaluations followed by customized scoring and interventions guided by the score. From 1-10-2020 to 12-15-2020, a single arm pilot study including a mixed methods approach was conducted which included structured telephone interviews of the patient cohort after completion of the UDD App. Both quantitative and qualitative data were collected through the telephone interviews.

RESULTS:
Sixty-four patients were approached for consent to use the mobile UDD App, and 14 (21.9%) declined. Fifty patients (50/64) initiated 109 evaluations utilizing the UDD App, Table 1. All but one patient (49/50, 98%) reached satisfactory questionnaire completion. The lower bound of the exact binomial one-sided 95% CI is 90.9%, exceeding the feasibility threshold of 90%. Of the 50 patients completing the mobile UDD App who were then contacted to participate in the structured telephone interview, 32 patients were able to be reached and consented for interview. Domain scores from these 32 patients can also be seen in Table 1. A summary of selected items from the 32 telephone assessment results is presented in Table 2. Most participants (23/32, 74%) self-identified with having a high computer literacy. All patients reported that using the smart phone UDD App was easier than or equivalent to the traditional paper approach, providing evidence of acceptability for the use of remote ePRO monitoring. All patients appreciated the immediate feedback of the color domain score, but one patient reported being color-blind. Thematically analyzed interviews revealed the following: (1) value of identifying problems through use of the UDD App to raise awareness, (2) enhanced communication with providers and caregivers with a more clear identification of problems, (3) a sense that they are not forgotten (4) liked being monitored without having to return for costly visits or take time off work to return for evaluation, (5) enhanced convenience, (6) patient concerns over privacy, and (7) a desire for more personalized digital engagement tools.

CONCLUSIONS:
The UDD App demonstrated feasible and acceptable methods of data collection for ePROs. A high compliance rate confirmed the UDD App as a reliable tool for patients to monitor symptoms and function after esophagectomy. This study expands on current research findings documenting the value of digital health apps to improve symptoms, function and well-being remotely.

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FOURTH SCIENTIFIC SESSION C – ESOPHAGUS OUTCOMES BREAKOUT

75. UPPER DIGESTIVE DISEASE APPLICATION AS A DIGITAL HEALTH INTERVENTION TO COLLECT ELECTRONIC PATIENT REPORTED OUTCOMES IN ESOPHAGECTOMY PATIENTS: A SINGLE ARM PILOT TRIAL

CONTINUED

Domain Scores from Patients Who Completed the UDD App and Those Who Completed the Telephone Survey

	PATIENT DOMAIN SCORES FROM UDD APP: ALL PATIENTS IN STUDY (N=50)	PATIENT DOMAIN SCORES FROM UDD APP: PATIENTS WHO COMPLETED THE TELEPHONE INTERVIEWS (N=32)
PROMIS Phys		
Median (IQR)	42.3 (39.8, 47.7)	42.3 (39.8, 46.3)
PROMIS Ment		
Median (IQR)	48.3 (43.5, 53.3)	48.3 (43.5, 52.1)
Pain		
Median (IQR)	41.2 (0.0, 52.9)	41.2 (5.9, 52.9)
Dysphasia		
Median (IQR)	14.3 (0.0, 31.4)	11.4 (0.0, 18.6)
Reflux		
Median (IQR)	9.8 (0.0, 43.9)	8.5 (0.0, 43.9)
Dumping		
Median (IQR)	31.8 (18.2, 54.6)	27.3 (11.7, 61.8)
Hypoglycemia		
Median (IQR)	16.7 (0.0, 33.3)	13.9 (0.0, 33.3)

Domain Scores are presented by Median Score with IQR for the 50 patients who completed the UDD App mobile questionnaire and the 32 patients who were interviewed by telephone. Scores are presented by median and IQR (interquartile range).

Selected Quantitative Telephone Survey Results

TABLE 1. SURVEY RESULTS

	VERY POOR	POOR	ACCEPTABLE	GOOD	VERY GOOD	MISSING
Typing Skills, n (%)	1 (3.7%)	4 (14.8%)	8 (29.6%)	11 (40.7%)	3 (11.1%)	5
Web Search Skills, n (%)	0	2 (6.7%)	6 (20.0%)	17 (56.7%)	5 (16.7%)	2
Computer Literacy, n (%)	1 (3.2%)	2 (6.5%)	5 (16.1%)	16 (51.6%)	7 (22.6%)	1
Internet Literacy, n (%)	1 (3.2%)	1 (3.2%)	4 (12.9%)	18 (58.1%)	7 (22.6%)	1
Digital Literacy, n (%)	2 (6.5%)	2 (6.5%)	5 (16.1%)	15 (48.4%)	7 (22.6%)	1

Telephone survey results from a section of the quantitative assessment are included from the 32 patients surveyed after esophagectomy and after use of the UDD App.

FOURTH SCIENTIFIC SESSION C – CONGENITAL BREAKOUT

76. THE FAILED BI-DIRECTIONAL GLENN SHUNT: RISK FACTORS FOR POOR OUTCOMES AND THE ROLE OF EARLY REOPERATION

AUTHORS
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OBJECTIVES:
Bidirectional Glenn shunt (BDG) failure carries high morbidity and mortality. The current study was undertaken to identify predictors for early BDG failure and determine the optimal management strategy.

METHODS:
Two hundred seventeen patients undergoing BDG at our institution between 1989-2000 were retrospectively reviewed and categorized as success or failure. BDG failure included:

Need for reoperation including transplantation at any time postoperatively; need for transcatheter intervention after BDG and before Fontan; and death due to BDG malfunction during index hospitalization or within 30 days of discharge. Statistical analyses included univariate analysis and binary logistic regression.

RESULTS:
BDG failure occurred in 14 (6.5%) patients. Univariate predictors were: HLHS (p=0.037), RV dominance (p=0.010), greater pre-BDG PVR (p=0.012), concomitant AV valve repair (p=0.020), prolonged pleural drainage (p=0.001), ICU (p<0.001) and hospital (p=0.002) stays, and ECMO requirement (p<0.001). Multivariate predictors were: RV dominance (p=0.002), greater PVR (p=0.041), ICU (p<0.001) and hospital (p=0.020) stays, and need for ECMO (p<0.001). 10/14 (71%) patients with BDG failure died. Reoperation was performed 10 patients with BDG failure. Five patients who underwent reoperation survived until discharge, with one dying 4 months after reoperation from an unrelated etiology and the others alive at last follow-up (mean 7.9 years). Survivors underwent reoperation earlier than non-survivors (36 vs. 94 days).

CONCLUSIONS:
Early BDG failure is a catastrophic event with high mortality, but predictors for failure exist. In the setting of BDG failure, survival may be attained by the performance of early rescue reoperations with BDG takedown and aorta-pulmonary shunt creation.

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FOURTH SCIENTIFIC SESSION C – CONGENITAL BREAKOUT

76. THE FAILED BI-DIRECTIONAL GLENN SHUNT: RISK FACTORS FOR POOR OUTCOMES AND THE ROLE OF EARLY REOPERATION

CONTINUED

Demographics and Clinical Factors

	Successful BDG n=203	Failed BDG n=14	p value
RV dominance	**109 (54%)**	**13 (93%)**	**0.010**
Hypoplastic left heart syndrome	**67 (33%)**	**9 (64%)**	**0.037**
Age at BDG (months)	11.5 ± 16	7.8 ± 7.8	0.398
Weight at BDG (kg)	7.2 ± 2.8	6.2 ± 2.5	0.182
Pre-BDG PVR (mmHg)	**2.1 ± 1.2**	**3.2 ± 2.2**	**0.012**
CPB time (min)	129 ± 55	129 ± 55	0.076
Aortic XC time (min)	37 ± 28	55 ± 28	0.052
Concomitant AV valve repair	**14 (7%)**	**4 (29%)**	**0.020**
Pleural chest tube (days)	**5 ± 11**	**16 ± 17**	**0.001**
PICU LOS (days)	**7 ± 10**	**28 ± 24**	**<0.001**
Hospital LOS (days)	**18 ± 37**	**51 ± 45**	**0.002**
ECMO requirement	**4 (2%)**	**4 (29%)**	**<0.001**

Pre-, intra-, and post-operative variables of patients with successful and failed BDG

Demographics and Clinical Factors

Predictor of Failure	Odds Ratio	Confidence Limit	*p*
ECMO	**37**	**7.6-180**	**<0.001**
RV Dominance	**11**	**1.4-84.6**	**0.002**
AV Valve Repair	2.3	0.5-11.2	0.352
HLHS	2.5	0.8-7.5	0.100
PVR	**1.5**	**1.0-2.2**	**0.041**
TPG	1.1	1.0-1.3	0.067
ICU days	**1.1**	**1.0-1.1**	**<0.001**
Hospital Days	**1.0**	**1.0-1.0**	**0.020**
Chest Tube Days	1.0	1.0-1.1	0.060

AV = atrioventricular; ECMO = extracorporeal membrane oxygenation; HLHS = hypoplastic left heart syndrome; ICU = intensive care unit; PVR = pulmonary vascular resistance; RV = right ventricular; TPG = trans-pulmonary gradient

FOURTH SCIENTIFIC SESSION C – CONGENITAL BREAKOUT

77. NATIONAL OUTCOMES OF THE FONTAN OPERATION WITH ENDOCARDIAL CUSHION DEFECT

AUTHORS
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OBJECTIVES:
Traditionally outcomes of the Fontan operation (FO) in patients with Endocardial Cushion Defect (ECD) have been suboptimal. However, some contemporary studies have suggested improved outcomes. We analyzed a large administrative database to study short-term outcomes after a FO in patients with ECD

METHODS:
A retrospective analysis of the Healthcare Cost and Utilization Project (HCUP) Kids' Inpatient Database (KID) (2009-16) for the FO was done. The KID is the largest publicly available all-payer health pediatric inpatient care database in the United States, including over 3 million pediatric discharges each year. The groups were divided into those who underwent FO with ECD diagnosis as compared to Non-ECD diagnosis. The data was abstracted for demographics, clinical characteristics, and operative outcomes. Standard statistical tests were used.

RESULTS:
3379 patients underwent the FO during this period of which 360 (11%) were FO-ECD. FO-ECD patients were more likely to have Downs' syndrome (4.4% vs. 1%, p=0.009), heterotaxy (30% vs. 4%, p< 0.001), transposition/DORV (42% vs. 28%, p=0.001), and TAPVR (12% vs. 1%, p<0.001) as compared to FO-Non-ECD patients. There were no age, ethnicity, median household income and regional difference between the groups. FO-ECD had a higher discharge-mortality (2.84% vs. 0.45%, p=0.04)(Figure 1A). The length of stay (16 vs. 13 days, p=0.05) and total charges incurred ($ 283, 280 vs. 234, 106, p=0.03) for the admission were higher in the FO-ECD as compared to Non-ECD patients (Figure 1B). In multivariate analysis: ECD diagnosis, non-white ethnicity, cardiac arrest, acute kidney injury, mechanical ventilation >96 hours were predictors of a mortality (Figure 3).

CONCLUSIONS:
Contemporary short-term outcomes for FO-ECD are still inferior as compared to FO- Non- ECD. Occurrence of postoperative complications, non-white ethnicity and ECD diagnosis were predictive of a negative outcome. There are unclear regional differences in the outcomes of the FO.

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FOURTH SCIENTIFIC SESSION C – CONGENITAL BREAKOUT

77. NATIONAL OUTCOMES OF THE FONTAN OPERATION WITH ENDOCARDIAL CUSHION DEFECT

CONTINUED

Table 1A: Patient demographics, diagnoses, and other characteristics, stratified by Fontan type (FO-ECD vs. FO-Non-ECD).

	ECD (n=360) 11%	Non-ECD (n=3020) 89%	p
Age in years (Mean/SE)	3.46/0.20	3.17/0.08	0.14
Gender Male	210(58.33%)	1800(59.61%)	0.70
Female	150(41.66%)	1200(40.38%)	
Race			0.74
White	174(48.33%)	1464(48.47%)	
Black	44(12.22%)	355(11.75%)	
Hispanic	72(20%)	598(19.80%)	
Other	34(9.44%)	271(8.97%)	
Down's syndrome	11(4.4%)	21(1.01%)	0.009
Comorbidities			
Chronic pulmonary disease	8(3.25%)	15(0.71%)	0.041
Pulmonary hypertension	16(6.22%)	100(4.75%)	0.322
Cardiac dysrhythmias	35(14.60%)	225(10.85%)	0.11
Chronic liver disease	0	2(0.060)	
Chronic kidney disease	0	1(0.04%)	
Malnutrition	4(1.56%)	25(1.19%)	0.67
Single ventricle group			
HLHS	62(17.25%)	1769(58.57%)	<0.0001
Tricuspid atresia	8(3.28%)	311(15.19%)	<0.0001
Pulmonary atresia	28(11.24%)	366(17.27%)	0.0098
Ebstein's anomaly	0	37(1.77%)	
Transposition/DORV	103(41.67%)	580(27.92%)	0.0014
Heterotaxy	73(29.75%)	96(4.17%)	<0.001
TAPVR	30(12.21%)	24(1.14%)	<0.001
AV valve replacement/repair	11(4.23%)	51(2.38%)	0.14
Elective admission	321(89.66%)	2793(92.79%)	0.12
Zone			0.93
Northeast	61(16.97%)	368(17.28%)	
Midwest	88(24.53%)	561(26.43%)	
South	136(37.86%)	725(35.84%0	
West	74(20.62%)	422(20.42%)	
Median household income			0.62
$1-24,999	100(28.31%)	799(27.05%)	
$25,000-34,999	91(25.75%)	751(25.44%)	
$35,000-44,999	79(22.44%)	779(26.39%)	
$45,000 and above	83(23.49%)	623(21.10%)	
Year			0.054
2009	110(30.47%)	1146(37.94%)	
2012	103(29.97%)	905(29.97%)	
2016	147(32.085%)	969(32.085%)	

Table 1A: Patient demographics, diagnoses, and other characteristics, stratified by Fontan type (FO-**ECD** vs. FO-**Non-ECD**).

Table 1B: Post-operative outcomes stratified by Fontan type (FO-ECD vs. FO-Non-ECD).

	ECD (n=360) 11%	Non-ECD (n=3020) 89%	p
Discharge mortality	10(2.84%)	14(0.45%)	0.04
Complications			
Acute kidney injury	7(2.72%)	63(2.93%)	0.83
Acute stroke	4(1.51%)	16(0.76%)	0.34
Mechanical ventilation > 96 hrs.	0	25(1.19%)	
Acute hepatic injury	3(1.11%)	10(0.48%)	0.34
Acute congestive heart failure	46(18.77%)	345(16.55%)	0.51
Cardiac arrest	7(1.98%)	9(0.305%)	0.06
Diaphragm paralysis	1(0.44%)	15(0.74%)	0.55
Chylothorax	13(5.41%)	133(6.44%)	0.54
Post-op hemorrhage	12(3.20%)	111(5.42%)	0.07
Secondary procedures			
Tracheostomy	0	10(0.45%)	-
Diaphragm plication	0	1(0.048%)	-
Disposition of patient			0.60
Routine	320(88%)	2767(91.64%)	
Short-term hospital	1(0.3%)	14(0.47%)	
Skilled nursing facility/ intermediate care	5(1.5%)	17(0.58%)	
Home healthcare	24(6.66%)	205(6.79%)	
Length of stay in days (Mean/SE)	16.12/1.27	13.61/0.40	0.05
Total charges (Mean/SE)	283,280/21.69	234,106/10.12	0.03

Table 1B: Post-operative outcomes stratified by Fontan type (FO-**ECD** vs. FO-**Non-ECD**).

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FOURTH SCIENTIFIC SESSION C – CONGENITAL BREAKOUT

77. NATIONAL OUTCOMES OF THE FONTAN OPERATION WITH ENDOCARDIAL CUSHION DEFECT

CONTINUED

Figure 2: Multivariate logistic regression for discharge mortality after a Fontan operation.

	Odds Ratio Estimates	95-CI	p
ECD vs Non-ECD	7.976	1.60-39.63	**0.01**
Age (every 1-year increase)	0.91	0.64-1.27	0.58
Female vs male	1.65	0.53-5.22	0.39
Race			
Black vs White	6.44	1.75-24.35	**<0.0001**
Hispanic vs White	1.05	0.19-5.88	**0.08**
Other vs White	8.36	1.49-46.68	**<0.0001**
Elective vs non-elective admission	0.36	0.05-5.22	0.28
Downs syndrome	2.17	0.14-33.43	0.57
Single ventricle group			
HLHS	0.49	0.10-2.26	0.35
Tricuspid atresia	0.34	0.04-2.82	0.31
Transposition/DORV	0.62	0.12-3.10	0.56
Heterotaxy	0.72	0.19-2.70	0.62
Median household income			
0-25th percentile vs 76th to 100th percentile	0.79	0.14-4.52	0.86
26th to 50th percentile (median) vs 76th to 100th percentile	0.38	0.08-1.71	0.08
51st to 75th percentile vs 76th to 100th percentile	1.95	0.25-14.9	0.24
Region			
Northeast vs South	0.67	0.17-2.63	0.31
Midwest vs South	1.07	0.19-5.88	0.20
West vs South	0.03	0.002-0.44	**0.03**
Year			
2012 vs 2009	3.71	0.71-19.39	0.09
2016 vs 2009	1.57	0.16-14.71	0.82
Post-op morbidity			
Acute kidney injury	26.89	4.41-163.77	**0.0004**
Mechanical ventilation >96 hrs.	12.82	1.72-95.47	**0.01**
Acute congestive heart failure	0.43	0.04-4.24	0.47
Cardiac arrest	80.6	5.9-999.99	**0.001**
Acute stroke	0.93	0.10-8.42	0.95
Post-op hemorrhage	1.55	0.20-11.93	0.67
Chylothorax	4.09	0.36-46.63	0.25
Length of stay (every 1-day increase)	0.95	0.91-0.98	**0.01**
Total charges (every 1000 $ increase)	1.003	1.002-1004	**<0.0001**

FOURTH SCIENTIFIC SESSION C – CONGENITAL BREAKOUT

78. ASSESSMENT OF CURRENT STS DATA ELEMENTS FOR ADULTS WITH CONGENITAL HEART DISEASE

AUTHORS
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OBJECTIVES:
Current STS Databases lack the necessary granularity for capture of several variables relevant to the growing adult congenital heart disease (ACHD) population. To identify opportunities for enhanced ACHD data collection, a structured review of existing variables in the Congenital Heart Surgery Database (CHSD) and the Adult Cardiac Surgery Database (ACSD) was conducted. The review aimed to synchronize with the planned upgrade of the CHSD in the winter and spring of 2021, and strategically followed the update of the ACSD that occurred in the summer of 2020.

METHODS:
A working group was assembled representing the Workforce on the Surgical Treatment of ACHD, the Workforce on National Databases, the Informatics Taskforce, and STS Quality Department staff. The ACSD was reviewed systematically over eight 90 minute calls. ACSD version 4.20.2 and CHSD version 3.41 were used, and the ACSD was approached in sections. ACSD variables were classified as either: 1) represented in identical form in the CHSD (no further discussion), 2) represented in similar form in the CHSD (discussed for potential harmonization of definitions), or 3) not represented in the CHSD (discussed for potential inclusion). Variables felt to be relevant to ACHD were noted, and consideration was given to STS required fields and variables utilized in existing STS adult risk models. Other factors that were examined were the frequency, utilization, and capture of existing ACSD variables.

RESULTS:
Over 22 weeks (8 calls), the existing 1069 variables in version 4.20.2 of the ACSD were discussed. Ultimately, 418 total variables were found to be both 1) relevant to ACHD and 2) not currently collected in the CHSD (Table). These variables were recommended for inclusion in the next CHSD upgrade for patients older than 18 years.

CONCLUSIONS:
For adult patients having case records entered into the CHSD, the inclusion of a limited set of additional data fields from the ACSD should enhance capture of co-morbidities and other clinical data relevant to the ACHD population. Over time, continuing to track utilization of data fields (already being done for STS National Databases) will guide future upgrades and efforts to refine this system.

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FOURTH SCIENTIFIC SESSION C – CONGENITAL BREAKOUT

78. ASSESSMENT OF CURRENT STS DATA ELEMENTS FOR ADULTS WITH CONGENITAL HEART DISEASE

CONTINUED

Summary of Variables Relevant to Adults With Congenital Heart Disease Recommended for Patients > 18 Years

Section	Number of Variables Recommended for Inclusion[a]	Summary of information collected by variables recommended for inclusion
Administrative	0	
Demographics	2	Street address and city
Hospitalization	1	Hospital CMS Certification Number
Risk Factors	54	Acquired co-morbid conditions including diabetes, hypertension, substance use/abuse, liver disease and severity, malignancy, peripheral and cerebral vascular disease, select laboratory values
Previous Cardiac Interventions	4	Previous PCI details
Preoperative Cardiac Status	14	Coronary symptoms, cardiogenic shock, arrhythmia details
Preoperative Medications	25	Includes: anti-arrhythmics, antianginals, antiplatelet agents, anticoagulants, inotropes, lipid lowering drugs, and steroids
Hemodynamics/Cath/Echo	53	Catheterization data relating to coronary disease and anatomy, valve disease (functional diagnosis and etiology)
Operative	14	Details relating to coronary artery bypass, aortic, valve, and atrial fibrillation procedures
Coronary Bypass	0	
Valve Surgery/Explant	43	Explant position, type, and etiology. Transcatheter valve replacement details. Valve repair/reconstruction techniques and annular enlargement technique
Mechanical Cardiac Assist Devices	0	
Other Cardiac Procedures	182	Includes: Cardiac trauma, acquired VSD repair, M.1. Atrial fibrillation Procedures (n=3) and M.2. Aorta and Aortic Root Procedures (n=177)
Other Non-Cardiac Procedures	1	Carotid endarterectomy
Post-operative	9	Select post-operative laboratory values and blood product usage
Postoperative Events	15	Limb ischemia, vascular complications, anticoagulation and bleeding events
Discharge / Mortality	1	Substance abuse screening and counseling
Readmission	0	

FOURTH SCIENTIFIC SESSION C – CONGESTIVE HEART FAILURE BREAKOUT

79. HEART TRANSPLANTATION FOR PERIPARTUM CARDIOMYOPATHY: IMPROVING OUTCOMES AND DIMINISHING RACIAL DISPARITIES OVER TIME

AUTHORS
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OBJECTIVES:
Orthotopic heart transplantation (OHT) for peripartum cardiomyopathy (PPCM) is infrequent and data are therefore limited. The aim of this study was to evaluate trends and outcomes of OHT for PPCM in the United States.

METHODS:
The United Network for Organ Sharing (UNOS) registry was used to identify patients undergoing isolated OHT between 1987 and 2020. Patients were stratified by the decade in which they underwent transplantation (1987-1998, 1999-2009, or 2010-2020). Overall survival was compared using Kaplan-Meier survival analysis. Cox proportional hazards modeling was used for risk-adjustment.

RESULTS:
Of 76,009 OHTs during the study period, 20,352 were performed in females and 809 in females with PPCM. The frequency of OHT for PPCM increased over the study period (p=0.015). PPCM was associated with increased 1-year mortality in risk-adjusted analysis as compared to other females (HR 1.62, [95% CI 1.25–2.09], p<0.001, non-ischemic cardiomyopathy as reference). Black and Hispanic recipients had higher mortality risk compared to white recipients of OHT for PPCM (HR 2.12, [95% CI 1.24–3.61], p=0.006 for black recipients; HR 2.69, [95% CI 1.24–5.80], p=0.012 for Hispanic recipients). Long-term survival for females with PPCM versus non-PPCM is shown in Figure 1. Ten-year survival was worse in PPCM compared to other females (51.7% vs 59.4%). However, 20- (33.7% vs 31.9%) and 30-year survival (25.1% vs 15.6%) were better for females with PPCM (p<0.001). Survival improved in the last decade for OHTs for PPCM (p=0.012), and this improvement was most pronounced in black and Hispanic recipients (Figure 2).

CONCLUSIONS:
Although PPCM is associated with higher early mortality compared to non-PPCM etiologies in females undergoing OHT, outcomes have improved over the past few decades and very long-term survival can be achieved. In addition, despite racial disparities existing in outcomes of OHT for PPCM, the greatest improvements in outcomes have occurred in black and Hispanic recipients.

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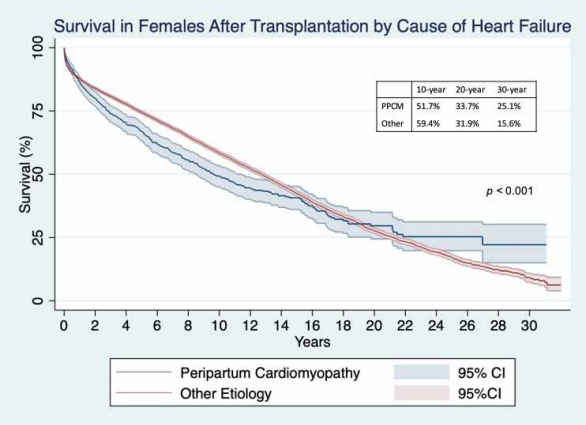
FOURTH SCIENTIFIC SESSION C – CONGESTIVE HEART FAILURE BREAKOUT

79. HEART TRANSPLANTATION FOR PERIPARTUM CARDIOMYOPATHY: IMPROVING OUTCOMES AND DIMINISHING RACIAL DISPARITIES OVER TIME

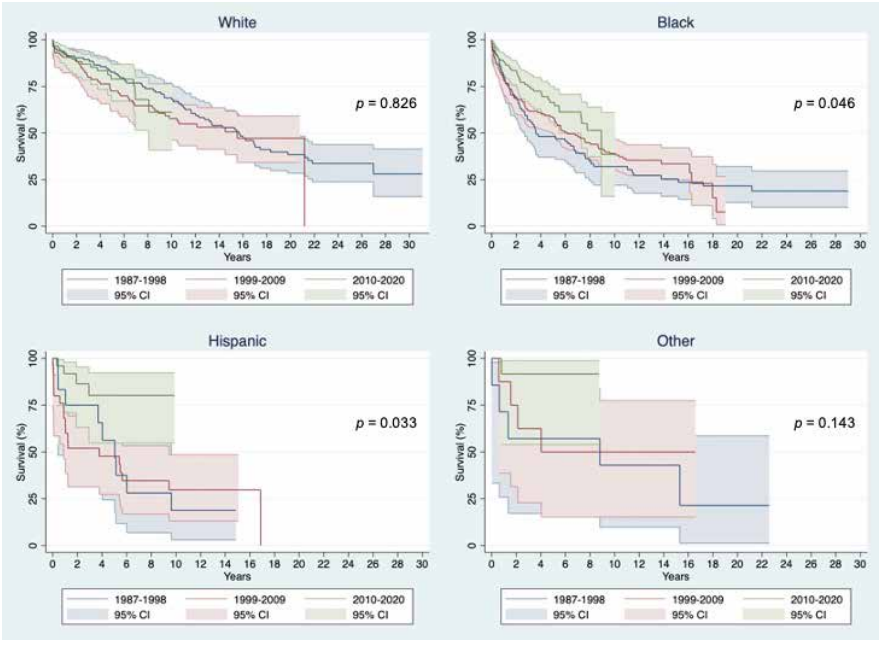
CONTINUED

Figure 1.



Kaplan-Meier survival analysis of females undergoing orthotopic heart transplantation by cause of heart failure (peripartum cardiomyopathy versus other etiology).

Figure 2.



Kaplan-Meier survival analysis by race or ethnicity following orthotopic heart transplantation for peripartum cardiomyopathy, stratified by era.

FOURTH SCIENTIFIC SESSION C – CONGESTIVE HEART FAILURE BREAKOUT

80. REJECTION IN HEART AND LUNG TRANSPLANT WITH HEPATITIS C DONORS

AUTHORS
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OBJECTIVES:
The use of donors who have a positive hepatitis C (HCV) nucleic amplification test (NAT) has helped to expand the donor pool and provide heart and lungs to an increased number of recipients. However, single institution data demonstrated an increased incidence of acute rejection in recipient of HCV/ NAT positive (HCV+) donors in heart transplantation (HT). Thus, we aimed to examine the association between HCV+ donors and HT and lung transplantation (LT) at a national level.

METHODS:
Using the Scientific Registry of Transplant Recipients (SRTR) we identified all adult heart and lung transplants from 4/1/2015-3/31/2019. Patients without data on HCV status or treatment for rejection and multivisceral transplants were excluded. Based on HCV status, the recipients were stratified: 1) HCV negative (HCV-) recipient and donor (D-/R-), 2) HCV+ donor, HCV- recipient (D+/R-), and 3) HCV positive recipient (R+). All HCV classifications were based on NAT positivity. Comparisons were made between groups and a multivariable logistic regression model was created to identify the independent effect of HCV status on treatment for rejection in the first year following transplant.

RESULTS:
8,896 HT and 8,209 LT identified with 215 D+/R- HT and 86 D+/R- LT. Recipients were relatively similar, although patients with obstructive lung disease were more likely to be D+/R-. While the waitlist time was not significantly different for HT, D+/R- LT recipients had a significantly increased waitlist time ($p<0.001$). In both HT and LT donors HCV+ donors, were more commonly white, had more comorbidities and were more likely to be classified as increased risk ($p<0.001$). Use of HCV+ donors increased over the years and the D+/R- recipients had increased distance traveled and ischemic time ($p<0.001$). On unadjusted analysis there was no difference in the incidence of treated rejection in the first year for both HT ($p=0.298$) and LT ($p=0.810$) (Table). With adjustment for covariates, there was a significant association between the D+/R- group in HT (Odds Ratio [OR]-1.535, 95% confidence interval [CI] 1.103-2.137, $p=0.011$) as well as recipient diabetes (OR-1.278, 95% CI 1.132-1.443, $p<0.001$) (Figure). However, in LT HCV+ donors were not associated with rejection (OR-1.260, 95% CI 0.738-2.150, $p=0.397$). Notably in both HT and LT, more recent transplant year (2019) was associated with decreased rejection.

CONCLUSIONS:
While HCV+ donors are not associated with rejection in LT, there is a significant association of the use of HCV+ donors and rejection in HT. Further study into the mechanisms of this association and immunosuppressive regimens is warranted.

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FOURTH SCIENTIFIC SESSION C – CONGESTIVE HEART FAILURE BREAKOUT

80. REJECTION IN HEART AND LUNG TRANSPLANT WITH HEPATITIS C DONORS

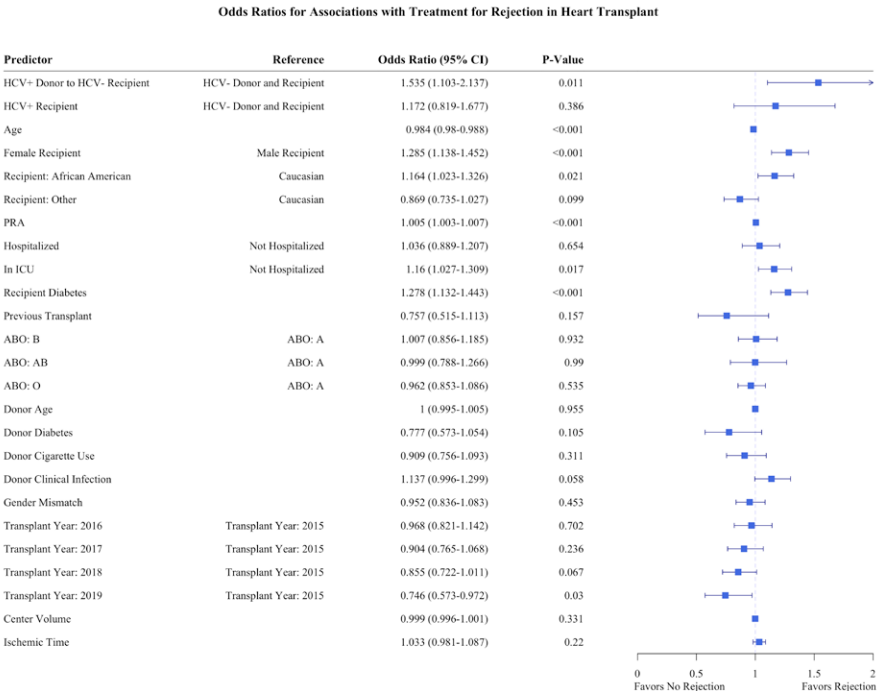
CONTINUED

Table of Recipient, Donor and Transplant Characteristics

Variable	Heart Transplantation				Lung Transplantation			
	HCV- Donor/Recipient (D-/R-) (n=8,488)	HCV+ Donor/HCV- Recipient (D+/R-) (n=215)	HCV+ Recipient (R+) (n=193)	P-Value	HCV- Donor/Recipient (D-/R-) (n=7,936)	HCV+ Donor/HCV- Recipient (D+/R-) (n=86)	HCV+ Recipient (R+) (n=187)	P-Value
Age (Years)	56 (46, 63)	57 (49, 64)	57 (48, 63)	0.053	61 (52, 66)	60 (54.2, 67)	60 (55, 64)	0.583
Male Sex	6,190 (72.9%)	168 (78.1%)	140 (72.5%)	0.232	4,686 (59%)	46 (53.5%)	122 (65.2%)	0.132
Previous Transplant	166 (2%)	7 (3.3%)	6 (3.1%)	0.223	220 (2.8%)	1 (1.2%)	3 (1.6%)	0.419
Blood Group				0.012				0.641
A	3,419 (40.3%)	74 (34.4%)	76 (39.4%)		3,181 (40.1%)	28 (32.6%)	75 (40.1%)	
B	1,272 (15%)	25 (11.6%)	23 (11.9%)		868 (10.9%)	14 (16.3%)	24 (12.8%)	
AB	491 (5.8%)	6 (2.8%)	12 (6.2%)		307 (3.9%)	3 (3.5%)	7 (3.7%)	
O	3,306 (38.9%)	110 (51.2%)	82 (42.5%)		3,580 (45.1%)	41 (47.7%)	81 (43.3%)	
PRA	0 (0, 2)	0 (0, 0)	0 (0, 3)	0.187	0 (0, 0)	0 (0, 0)	0 (0, 0)	0.191
Days On Wait List	100 (29, 305)	89 (18, 234)	131 (31, 289)	0.059	49 (15, 148)	90.5 (33.5, 360.8)	47 (16, 158.5)	< 0.001
CDC High Risk	2,469 (29.1%)	197 (91.6%)	60 (31.1%)	< 0.001	1,926 (24.3%)	75 (87.2%)	57 (30.5%)	< 0.001
Smoking History	907 (10.8%)	44 (20.9%)	23 (12.2%)	< 0.001	560 (7.2%)	13 (15.7%)	18 (9.8%)	0.005
Recent Cocaine Use	1,972 (23.5%)	122 (57.8%)	41 (21.8%)	< 0.001	1,438 (18.4%)	46 (54.8%)	40 (21.5%)	< 0.001
Donor Clinical Infection	6,676 (78.8%)	175 (81.4%)	146 (76.4%)	0.472	6,127 (77.4%)	69 (80.2%)	147 (78.6%)	0.755
Year of Transplant				< 0.001				< 0.001
2015	1,418 (16.7%)	1 (0.5%)	23 (11.9%)		1,302 (16.4%)	0 (0%)	23 (12.3%)	
2016	2,231 (26.3%)	8 (3.7%)	48 (24.9%)		1,988 (25.1%)	2 (2.3%)	37 (19.8%)	
2017	2,193 (25.8%)	44 (20.5%)	47 (24.4%)		2,077 (26.2%)	21 (24.4%)	44 (23.5%)	
2018	2,161 (25.5%)	120 (55.8%)	64 (33.2%)		2,076 (26.2%)	42 (48.8%)	68 (36.4%)	
2019	485 (5.7%)	42 (19.5%)	11 (5.7%)		493 (6.2%)	21 (24.4%)	15 (8%)	
Average Yearly Center Volume	26.3 (16.3, 41)	32 (20.8, 60)	23.3 (16.5, 41)	< 0.001	45.8 (26.5, 76.1)	45.8 (17.5, 45.8)	48 (28.3, 76.1)	< 0.001
Distance Traveled (Nautical Miles)	82 (12, 260)	296 (96.5, 451.5)	74 (11, 274)	< 0.001	137 (26, 299)	409 (151.2, 689.2)	109 (24, 226)	< 0.001
Ischemia Time (Hours)	3.1 (2.3, 3.7)	3.6 (3, 4)	3.1 (2.3, 3.7)	< 0.001	5.2 (4.2, 6.2)	5.6 (4.7, 6.6)	5.2 (4.2, 6.3)	0.038
Treated for Rejection in 1st Year	1,661 (19.6%)	51 (23.7%)	40 (20.7%)	0.298	1,818 (22.9%)	18 (20.9%)	40 (21.4%)	0.81

Data displayed as median (interquartile range) or number (%); CDC, Centers for Disease Control; HCV, Hepatitis C Virus; PRA, Panel Reactive Agent

Forest Plot of Multivariable Model of Rejection in Heart Transplantation



HCV, Hepatitis C Virus; ICU, Intensive Care Unit; PRA, Panel Reactive Agent

FOURTH SCIENTIFIC SESSION C – CONGESTIVE HEART FAILURE BREAKOUT

81. IMPACT OF INCREASED DONOR DISTANCE FOLLOWING ADULT HEART ALLOCATION SYSTEM CHANGES: A SINGLE CENTER REVIEW OF ONE-YEAR OUTCOMES

AUTHORS
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OBJECTIVES:
On October 18,2018, several changes to donor heart allocation system were enacted. We hypothesize that patients undergoing orthotopic heart transplantation (OHT) under the new allocation system will see an increase in ischemic times, rates of primary graft dysfunction, and one-year mortality due to these changes.

METHODS:
In this single-center retrospective study, we reviewed the charts of all OHT patients from October 2017 through October 2019. Pre- and post- allocation recipient demographics were compared. Survival analysis was performed using the Kaplan-Meier method. Descriptive summary statistics were calculated for the variables of interest.

RESULTS:
184 patients underwent OHT. Recipients were largely similar between cohorts. The average distance from donor increased by more than 150 km (p=0.006). Patients in the post-allocation change cohort had a significant increase in the rate of severe left ventricle PGD from 5.4% to 18.7% (p=0.005). There were no statistically significant differences in thirty-day mortality or in one-year survival. Time on the waitlist was reduced from 203.8 days to 103.7 days (p=0.006).

CONCLUSIONS:
Changes in heart allocation resulted in shorter waitlist times at the expense of longer donor distances and ischemic times, with an associated negative impact on early post-transplantation allograft outcomes. No significant differences in 30-day or one-year mortality were observed. Given the increased rate of post-allocation change severe left ventricular primary graft dysfunction, considerable attention should be given to long-term allograft outcomes.

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FOURTH SCIENTIFIC SESSION C – CONGESTIVE HEART FAILURE BREAKOUT

81. IMPACT OF INCREASED DONOR DISTANCE FOLLOWING ADULT HEART ALLOCATION SYSTEM CHANGES: A SINGLE CENTER REVIEW OF ONE-YEAR OUTCOMES

CONTINUED

Figure 1: Geographic distribution of donor hearts pre- and post-allocation change

Table 1: Intraoperative Times and Postoperative Outcomes. Continuous variables are listed as mean (SD). Categorical variables are listed as counts (percentages).

	Pre (N=93)	Post (N=91)	Total (N=184)	p value
CPB Time (min)	148.677 (55.994)	173.176 (60.165)	160.793 (59.223)	**0.002**
Warm Ischemic Time (min)	47.796 (20.978)	52.154 (20.981)	49.951 (21.036)	0.061
Total Ischemic Time (min)	172.860 (69.079)	210.363 (62.489)	191.408 (68.359)	**< 0.001**
Length of Stay (days)	19.968 (13.279)	21.700 (16.695)	20.820 (15.039)	0.379
ICU Length of Stay (days)	9.978 (11.122)	10.900 (9.393)	10.432 (10.290)	0.205
Acute Kidney Injury				0.974
None	27 (29.0%)	28 (30.8%)	55 (29.9%)	
Stage 1	24 (25.8%)	25 (27.5%)	49 (26.6%)	
Stage 2	23 (29.9%)	21 (29.2%)	44 (29.5%)	
Stage 3	19 (20.4%)	17 (18.7%)	36 (19.6%)	
Need for renal replacement therapy	20 (21.5%)	24 (26.4%)	44 (23.9%)	0.439
Severe LV-PGD	5 (5.4%)	17 (18.7%)	22 (12.0%)	**0.005**
30-day mortality	5 (5.4%)	9 (9.9%)	14 (7.7%)	0.257
1 year mortality	9 (9.7%)	14 (15.4%)	23 (12.5%)	0.328

FOURTH SCIENTIFIC SESSION C – AORTA BREAKOUT

82. SELECTIVE SINUS REPLACEMENT FOR AORTIC ROOT ANEURYSM: DURABLE APPROACH IN SELECTED PATIENTS

AUTHORS
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OBJECTIVES:
Selective sinus replacement (SSR, "hemi-Yacoub" operation) allows for a tailored repair approach in patients with sinus of Valsalva aneurysm or asymmetric aortic root aneurysm; however, the potential for late growth of the remaining sinuses remains a concern. The objective of the current study is to describe patient characteristics and assess operative outcomes and long-term aortic root dimensions after SSR for root aneurysm.

METHODS:
From 2006 to 2020, 59 patients underwent hemi-Yacoub selective sinus replacement for aneurysmal disease at a single referral institution. Patients with aortic dissection or with active or prior endocarditis were excluded. All pre-operative and follow-up imaging was reviewed utilizing 3D reconstruction with standardized measurements of the aortic sinuses of Valsalva from cusp to commissure.

RESULTS:
Mean patient age was 54±13 years and 93% (N=55) were male. 23 patients (39%) had Bicuspid Aortic Valve syndrome. The majority of patients (N=54, 92%) underwent single sinus replacement (N=45 non-coronary, N=9 right coronary), while five patients (8%) underwent repair of both the right and non-coronary sinuses. 14 patients (24%) underwent concomitant aortic valve replacement, while 26 (44%) underwent aortic valve repair with rigid internal geometric annuloplasty ring and/or cusp plication and 19 (32%) had no valve intervention. There was no operative death, stroke, renal failure or respiratory failure. Median ICU and hospital length of stay were 1 [Q1-Q3 1-1] and 5 [Q1-Q3 4-5] days, respectively. Mean pre-operative aortic root diameter was 54±6mm versus 44±5mm at a median follow up of 23 [Q1-Q3 10-36] months (Figure 1). There was 100% Kaplan-Meier freedom from death, aortic valve or proximal aortic reintervention at 8 years.

CONCLUSIONS:
SSR is associated with excellent operative outcomes and long-term follow up suggests that the repair is durable in selected patients with sinus of Valsalva aneurysm or asymmetrical dilation of one or two sinuses. Longer term follow up is needed to confirm continued stability of aortic root.

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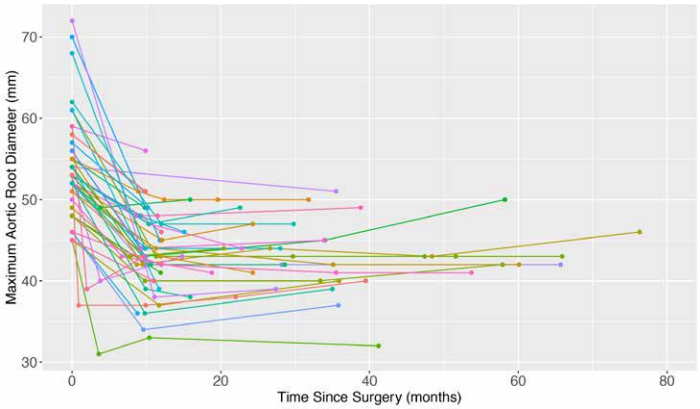
FOURTH SCIENTIFIC SESSION C – AORTA BREAKOUT

82. SELECTIVE SINUS REPLACEMENT FOR AORTIC ROOT ANEURYSM: DURABLE APPROACH IN SELECTED PATIENTS

CONTINUED

Natural History of Aortic Root After Hemi-Yacoub



Longitudinal analysis of pre-operative and follow-up computed tomography or magnetic resonance angiography. All sinus of Valsalva measurements were performed from cusp to commissure in a standardized fashion. Note that time zero is the pre-operative measurement.

Operative Details

	Overall (N=59)
Root Operation	
Hemi-Yacoub Valve Sparing SSR (Single Sinus)	54 (91.5%)
Hemi-Yacoub Valve Sparing SSR (Double Sinus)	5 (8.5%)
Sinus Repaired	
Non-Coronary	45 (76.3%)
Right-Coronary	9 (15.2%)
Non/Right-Coronary	5 (8.5%)
Bicuspid Aortic Valve	23 (39.0%)
If Bicuspid, Sievers Type	
0	2 (3.4%)
1	18 (30.5%)
2	3 (5.1%)
If Bicuspid, Commissural Fusion	
True Bicuspid	2 (3.4%)
LR/RN	3 (5.1%)
RL	15 (25.4%)
RN	3 (5.1%)
Concomitant Operations	
Ascending Aortic Repair	47 (79.7%)
Hemi-Arch Repair	39 (66.1%)
Hybrid Arch Repair	1 (1.7%)
Aortic Valve Replacement	14 (23.7%)
Aortic Valve Repair: Annuloplasty Ring	24 (40.7%)
Aortic Valve Repair: Cusp Plication	13 (22.0%)
Coronary Artery Bypass Grafting	5 (8.5%)
Aortic Valve Replacement: Prosthesis Type	
Bioprosthetic	11 (18.6%)
Mechanical	3 (5.1%)
Cardiopulmonary Bypass Time (mean (SD), median [Q1-Q3])	159 (36.3), 153 [136 - 182]
Aortic Crossclamp Time (mean (SD), median [Q1-Q3])	121 (27.9), 126 [97.0 - 140]

Descriptive presentation of operative approach and intra-operative valve findings.

FOURTH SCIENTIFIC SESSION C – AORTA BREAKOUT

83. LONG TERM RESULTS OF THE MODIFIED BENTALL PROCEDURE: A 21-YEAR EXPERIENCE IN COMPOSITE GRAFT REPLACEMENT FOR AORTIC ROOT DISEASE

AUTHORS
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AUTHOR INSTITUTION(S)
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OBJECTIVES:
Aortic root replacement with a composite graft (CG) is considered the gold standard for various root pathologies. Due to the evident shift towards biological valve prostheses in younger patients, the optimal choice of conduit remains controversial. We investigated long-term results and the impact of prosthetic valve choice on mortality and morbidity in patients who underwent root replacement with a CG.

METHODS:
Between January 2000 and December 2020, a total of 507 patients underwent aortic root replacement with either a mechanical (59%, n=299) or a biological (41%, n=208) CG. Mean age was 56±14 years and 78.1% were male. Indications for surgery were aortic valve pathology with root dilatation (73.8%, n=372), aortic dissection (20.5%, n=104), endocarditis (3.2%, n=16) and others (2.6%, n=13). Concomitant procedures were performed in 37.3% (n=189) and 12.6% (n=64) underwent previous cardiac surgery. Perioperative data and postoperative events were obtained to investigate late mortality and morbidity. The mean follow-up was 72±65 months.

RESULTS:
The overall 30-day mortality in all patients was 5.9% (n=30, mechanical 6% versus biological 5.8%, p=0.9). Patients operated for acute type-A dissection presented with a higher 30-day mortality (23.7%, p=0.0001). Overall, freedom from mortality at 5, 10 and 15 years was 83.9±1.8%, 77.9±2.3% and 72.3±3.3%, respectively. Twenty-four patients (n=4.7%) suffered from a perioperative stroke; 32 bleeding events (0.0147/ patient year) and 33 embolic events (0.015/ patient year) were observed. Two patients (0.9% of bio-conduits) were subject to structural valve deterioration. Re-Replacement of the aortic root was performed in 13 patients (2.6%) with a median time of 24 months and a freedom of re-replacement of 94.1±1.8% at 10 years after surgery. A subgroup analysis of all patients aged 50 to 70 years showed comparable collectives with 151 patients with mechanical (57.9%) and 110 (42.1%) with biological conduits (mechanical vs. biological: mean age 57.5 vs 64.1 years, p=0.058; male 83.4% vs 80.9%, p=0.59). In this subgroup, no significant difference of KM estimated mortality was observed between patients receiving mechanical or biological conduits (p=0.38).

CONCLUSIONS:
The modified Bentall procedure showed favorable results at very long-term follow-up with good survival up to 15 years. In a specific subset of patients aged 50-70 years, no differences in long-term mortality were observed between mechanical and biological valve conduits. Very long-term data will provide further insight on the optimal conduit choice in this specific subset of patients.

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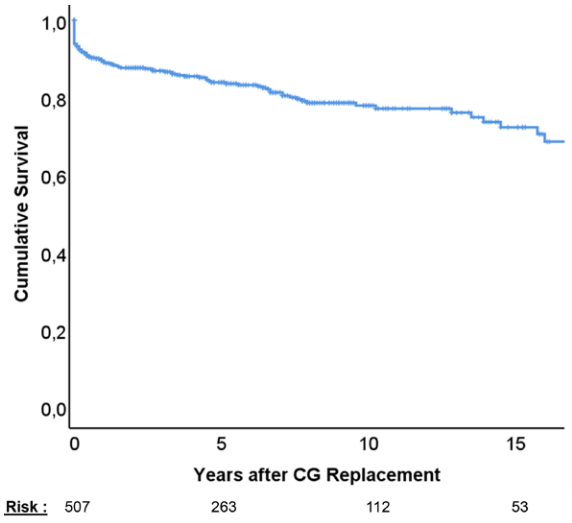
FOURTH SCIENTIFIC SESSION C – AORTA BREAKOUT

83. LONG TERM RESULTS OF THE MODIFIED BENTALL PROCEDURE: A 21-YEAR EXPERIENCE IN COMPOSITE GRAFT REPLACEMENT FOR AORTIC ROOT DISEASE

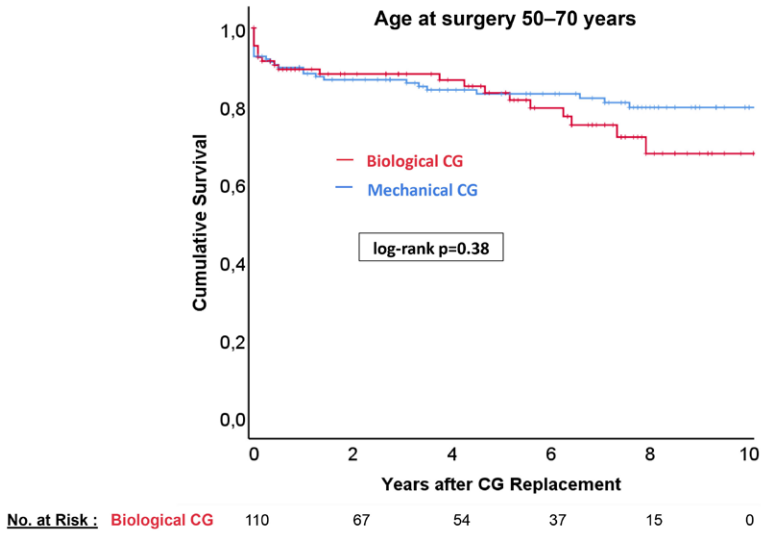
CONTINUED

Figure 1



Cumulative survival curve of all patients who underwent aortic root replacement with a CG between 2000 and 2020.

Figure 2



Cumulative survival curves of patients aged 50 – 70 years at the time of surgery with either biological or mechanical CG replacement.

FOURTH SCIENTIFIC SESSION C – AORTA BREAKOUT

84. AORTIC VALVE REPAIR DECREASES RISKS OF VALVE- RELATED EVENTS IN AORTIC INSUFFICIENCY AT 10 YEARS: A PROPENSITY SCORE-MATCHED ANALYSIS

AUTHORS
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OBJECTIVES:
With new advancements in our understanding of the anatomy and function of both the aorta and aortic valve (AV), AV repair (AVr) has become a highly feasible and reproducible alternative to AV replacement (AVR). However, little data exists on the long-term outcomes of AVr compared to AVR. Therefore, the purpose of this study was to compare early and long-term postoperative outcomes in matched groups of AVR versus AVr patients in the treatment of AI, focusing on valve-related events (VRE), mortality, echocardiographic changes, and cardiovascular symptoms.

METHODS:
Single centre, retrospective study of all patients (n=417) undergoing AVr (n=264) or AVR (n=153) for primary AI. Propensity-matching using a 1:1 greedy matching algorithm identified 140 patients using six covariates (age, gender, left ventricular (LV) function, LV size, presence of aortopathy, and urgency of operation) for comparison. The primary outcome was a composite of all valve-related events (VRE), including: endocarditis, myocardial infarction (MI), stroke, transient ischemic attack (TIA), thromboembolisms, bleeding, and aortic valve (AV) reoperation. VRE were defined as per published guidelines. Survival and freedom from VRE were reported using the Kaplan-Meier method.

RESULTS:
Propensity-matching identified 70 well matched pairs with no major differences in baseline demographics, comorbidities, or AI severity (p=0.57). Perioperative outcomes showed no significant differences in VRE (AVR 8 vs AVr 7, p=0.78) or mortality (AVR 3 vs AVr 1, p=0.62). Event-free survival from the primary outcome at 10-years was significantly better after AVr than after AVR (82% vs 68%, p=0.024), with no significant differences in 10-year overall survival between groups (82% vs 72%, p=0.29). No significant differences in AI severity (p=0.07) or reoperation rate (p=0.44) were detected between groups.

CONCLUSIONS:
This study demonstrated a lower long-term risk of VRE with repair compared to replacement, with low mortality and comparable durability. Further prospective randomized control trials are necessary to formally compare outcomes and determine superiority.

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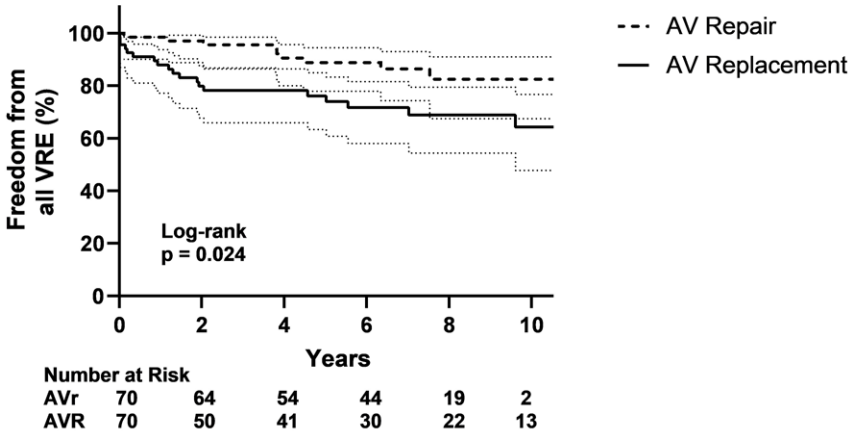
FOURTH SCIENTIFIC SESSION C – AORTA BREAKOUT

84. AORTIC VALVE REPAIR DECREASES RISKS OF VALVE- RELATED EVENTS IN AORTIC INSUFFICIENCY AT 10 YEARS: A PROPENSITY SCORE-MATCHED ANALYSIS

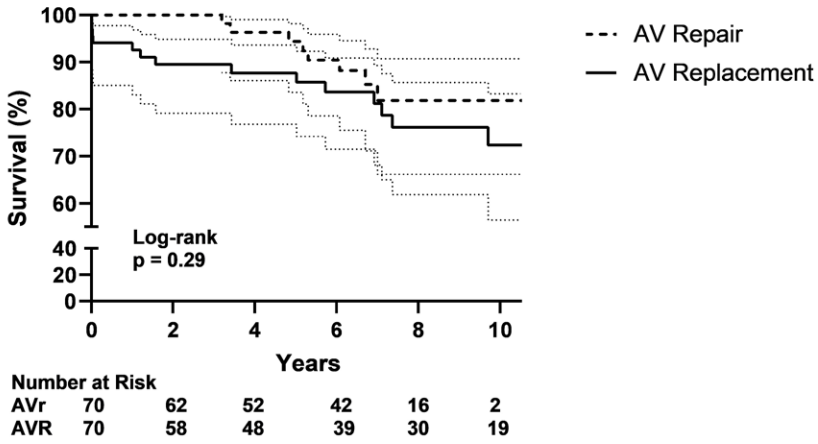
CONTINUED

Figure 1. Kaplan-Meier curve displaying 10-year freedom from primary outcome (dotted line – 95% confidence interval)



Abbreviations: AV – aortic valve, AVR – aortic valve replacement, AVr – aortic valve repair, VRE – valve related events (endocarditis, myocardial infarction, stroke, transient ischemic attack, thromboembolisms, bleeding, and aortic valve reoperation.

Figure 2. Kaplan-Meier curve displaying 10-year freedom from mortality (dotted line – 95% confidence interval)



Abbreviations: AV – aortic valve, AVR – aortic valve replacement, AVr – aortic valve repair.

85. PREDICTORS OF 30-DAY POSTOPERATIVE PULMONARY COMPLICATIONS IN VETERANS UNDERGOING VIDEO-ASSISTED THORACOSCOPIC LOBECTOMY

AUTHORS
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OBJECTIVES:
Postoperative pulmonary complications are the most common source of major morbidity or mortality after lobectomy via thoracotomy. Video-assisted thoracoscopic surgery(VATS) has emerged as a favorable option for lobectomy yet there are few large-scale studies that have examined risk factors for development of pulmonary complication after VATS. United States veterans, older and less healthy compared to non-veterans, represent a unique cohort that require further investigation. Our objective is to determine predictors of pulmonary complication after VATS lobectomy in the veteran population.

METHODS:
A retrospective review was conducted on patients that underwent VATS lobectomy from 2008-2018 using the Veterans Affairs Surgical Quality Improvement Program database. Patients were divided into two cohorts based on documentation of a pulmonary complication within 30 days. Demographics and clinical characteristics were compared via multivariable analysis to determine risk factors and clinical predictors associated with pulmonary complication. Risk factors were reported as adjusted odds ratios(aOR) with 95% confidence intervals(CI). Mortality, non-pulmonary morbidity, and length of stay were also compared. Patients with pre-operative pneumonia, ventilator dependence, and emergent cases were excluded.

RESULTS:
4,127 VATS lobectomy cases met inclusion criteria, with 453 (10.98%) cases having a documented pulmonary complication. Pre-operative factors independently associated with development of pulmonary complication after adjusting for confounders included underlying chronic obstructive pulmonary disease(COPD)(aOR=1.36[1.14-1.63];p=0.0006), consumption of >2 alcoholic drinks/day within 2 weeks of surgery (aOR= 1.30[1.02-1.66];p=0.037), pre-operative hyponatremia (aOR=1.42[1.06-1.91];p=0.02), subjective dyspnea (aOR=1.27[1.05-1.53];p=0.014) and American Society of Anesthesiologists(ASA) Class >3 (aOR=1.46[1.17-1.82;p=0.007). Smoking was not significantly associated with development of pulmonary complication (aOR=0.90[0.76-1.08];p=0.27). Cases with a pulmonary complication had significantly longer operative times (4.0 ± 1.7 vs. 3.6 ± 1.5 hours;p<0.0001). The presence of a pulmonary complication was significantly associated with increased mortality [39(8.61%) vs. 26(0.71%) cases;p<0.0001], cardiac complications [26(5.74%) vs. 22(0.60%) cases;p<0.0001], infectious complications [22(4.86%) vs. 104(2.83%) cases;p=0.018], and longer length of post-operative hospital stay (10.6 vs 6.0 days;p<0.0001).

CONCLUSIONS:
This analysis revealed several modifiable pre-operative factors associated with the development of a pulmonary complication, which was shown to be significantly associated with mortality and other major morbidity in this population. It is imperative to optimize pulmonary-specific comorbidities such as COPD or subjective dyspnea prior to VATS lobectomy. However, pre-operative alcohol consumption and hyponatremia are two additional findings linked with development of pulmonary complication in our cohort that should be addressed prior to surgery in the setting of elective VATS lobectomy. Future studies should focus on long-term consequences of pulmonary complications in the veteran population.

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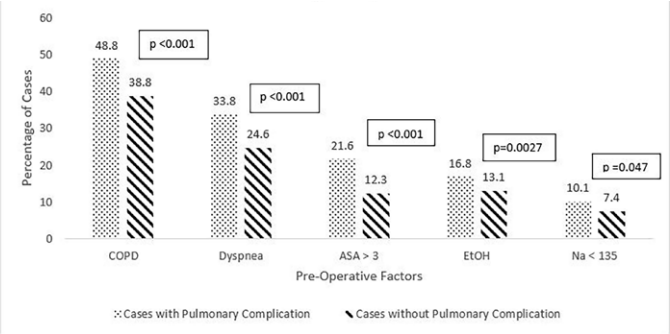
85. PREDICTORS OF 30-DAY POSTOPERATIVE PULMONARY COMPLICATIONS IN VETERANS UNDERGOING VIDEO-ASSISTED THORACOSCOPIC LOBECTOMY

CONTINUED

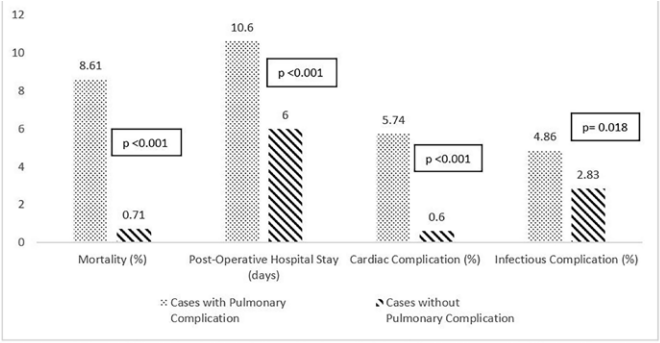
Figure 1: Proportion of Cases with Clinical Predictors of Pulmonary Complication



Presented as percentages of respective cohorts. ASA=American Society of Anesthesiologists. EtOH= Greater than 2 alcoholic beverages per day within 2 weeks of surgery. Na < 135= Preoperative serum sodium level less than 135 mEq. Absolute numbers for respective percentages: COPD [221 (48.8%) vs. 1,426 (38.8%) cases], Dyspnea [153(33.8%) vs. 902(24.6%) cases], ASA >3 [98(21.6%) vs. 452(12.3%) cases], EtOH [76(16.8%) vs. 478(13.0%) cases], Na<135 [44(10.1%) vs. 266(7.4%) cases].

Presented as percentages of respective cohorts. ASA=American Society of Anesthesiologists. EtOH= Greater than 2 alcoholic beverages per day within 2 weeks of surgery. Na < 135= Preoperative serum sodium level less than 135 mEq. Absolute numbers for respective percentages: COPD [221 (48.8%) vs. 1,426 (38.8%) cases], Dyspnea [153(33.8%) vs. 902(24.6%) cases], ASA >3 [98(21.6%) vs. 452(12.3%) cases], EtOH [76(16.8%) vs. 478(13.0%) cases], Na<135 [44(10.1%) vs. 266(7.4%) cases].

Figure 2: Effect of Pulmonary Complication on Other Clinical Outcomes



Presented as percentages of respective cohorts.

Presented as percentages of respective cohorts.

86. PROGRESSION OF THE AORTIC ROOT BASED ON LONG-TERM IMAGING STUDIES AFTER ACUTE TYPE-A DISSECTION SURGERY

AUTHORS
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AUTHOR INSTITUTION(S)
[1]University of Michigan, Ann Arbor, MI; [2]St. Joseph Mercy Hospital, Ann Arbor, MI

OBJECTIVES:
Patients with acute type-A aortic dissection (ATAAD) have a risk of developing coronary button aneurysms after aortic root replacement, especially those with connective tissue disease. Likewise, after aortic root repair, patients have persistent risk of root aneurysm and may not be candidates for reoperation. Reoperation rate may not truly reflect progression of the aortic root after ATAAD repair. Hence, we aim to determine the progression of the aortic root in patients with root repair or replacement based on long-term follow-up imaging studies.

METHODS:
From 1996-2019, 732 patients had ATAAD repair at our institution. 598 of these patients had either aortic root repair, (n= 378) or aortic root replacement (n= 220). 46 patients from the root repair group and 26 patients from the root replacement group were excluded due to lack of post-operative imaging studies. A total of 332 patients were included in repair group, and 194 patients in the replacement group.

RESULTS:
Compared to the replacement group, the repair group was significantly older (61 years vs 56 years) and had more hypertension [262/332 (79%) vs 120/194 (62%)] but less male patients [211/332 (64%) vs 154/194 (79%)], patients with aortic insufficiency [215/332 (65%) vs 153/194 (79%)] and prior cardiac surgery [13/332 (4%) vs 18/194 (9%)]. Intra-operatively, compared to the replacement group, the repair group had more zone 2 arch replacement [76/332 (23%) vs 26/194 (13%)], hypothermic circulatory arrest (HCA) [316/332 (95%) vs 173/194 (89%)] and longer HCA time (38 minutes vs 33 minutes) but shorter cardiopulmonary bypass time (206 minutes vs 260 minutes), aortic cross clamp time (134 minutes vs 215 minutes) and less patients with concomitant coronary bypass graft [8/332 (2%) vs 15/194 (8%)]. Postoperatively, the repair group had more prolonged mechanical ventilation (>24 hours) compared to the replacement group [191/332 (58%) vs 80/194 (41%)]. Other peri-operative outcomes were similar between groups, including sepsis, myocardial infarction, stroke, renal failure requiring dialysis/permanent dialysis, and operative mortality (4.2% vs. 4.1%) (Table 1). The aortic root growth rate over 12 years was similar between the repair and replacement group (0.20mm/year vs. 0.18mm/year, p=0.75), (Figure). Both the repair and replacement groups had similar 10-year cumulative incidence of reoperation (11.8% vs 9.4%; p= 0.97) and survival over 10 years (79% vs 77%; p=0.21).

CONCLUSIONS:
There was minimal growth of the aortic root or coronary buttons after root repair or replacement for ATAAD patients. Both aortic root repair and replacement were acceptable techniques for ATAAD surgery in appropriate patients.

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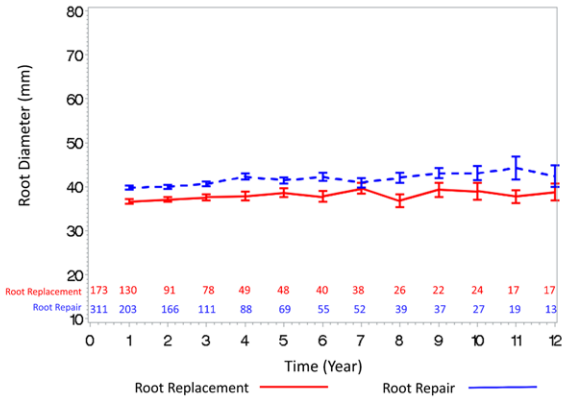
86. PROGRESSION OF THE AORTIC ROOT BASED ON LONG-TERM IMAGING STUDIES AFTER ACUTE TYPE-A DISSECTION SURGERY

CONTINUED

Table 1: Demographics and Peri-operative Outcomes

	Root replacement (n=194)	Root repair (n=332)	p-value
Pre-Operative Data			
Patient age (years)	56 (44, 67)	61 (52, 69)	**0.0002**
Sex, male	154 (79)	211 (64)	**0.0001**
BMI (kg/m^2)	26 (21, 31)	27 (23, 31)	0.07
Hypertension	120 (62)	262 (79)	**<.0001**
Coronary Artery Disease	35 (19)	53 (17)	0.61
Chronic Renal Failure	10 (5.2)	14 (4.2)	0.62
Connective tissue disease	17 (10)	5 (1.8)	**<.0001**
COPD	20 (10)	34 (10)	0.90
Prior Cardiac Surgery	18 (9.3)	13 (4.0)	**0.01**
Aortic Insufficiency	153 (79)	215 (65)	**<.0001**
Intra-Operative Data			
Arch replacement	187 (96)	323 (97)	0.56
CPB time	260 (218, 297)	206 (170, 257)	**<.0001**
Aortic cross clamp time	215 (181, 250)	134 (109, 173)	**<.0001**
HCA time	33 (25, 45)	38 (28, 48)	0.18
Concomitant CABG	15 (7.7)	8 (2.4)	**0.004**
Concomitant MVR	3 (1.6)	1 (0.3)	0.12
Concomitant TVR	3 (1.6)	2 (0.6)	0.29
Lowest temperature (°C)	19 (18, 24)	18 (17, 22)	**0.04**
Blood Transfusion (PRBCs, units)	5.0 (1.0, 8.0)	3.0 (1.0, 6.0)	0.57
Frozen elephant trunk	18 (9.3)	35 (11)	0.65
Postoperative Data			
Reoperation for bleeding	12 (6.2)	23 (6.9)	0.74
Cerebrovascular accident	13 (7.9)	15 (5.3)	0.28
New-onset dialysis	19 (9.9)	27 (8.4)	0.55
Permanent dialysis	5 (2.6)	7 (2.2)	0.76
Prolonged ventilation	80 (41)	191 (58)	**0.007**
Hours intubated	30 (19, 91)	43 (24, 96)	**0.04**
Reintubation	8 (4.2)	26 (8.0)	0.09
Pneumonia	28 (14)	54 (16)	0.85
Postoperative LOS (days)	11 (7.0, 18)	12 (8.0, 19)	0.43
Operative mortality	8 (4.1)	14 (4.2)	0.97

Image 1: Progression of The Aortic Root After Acute Type-A Dissection Surgery



The aortic root growth rate over 12 years was similar between the repair and replacement group (0.20mm/year versus 0.18mm/year, p=0.75)

FIFTH SCIENTIFIC SESSION

87. LONG-TERM SURVIVAL FOLLOWING INTERVENTION FOR FUNCTIONAL SINGLE VENTRICLE HEART DISEASE: A 15-YEAR ANALYSIS FROM A SINGLE INSTITUTION

AUTHORS
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OBJECTIVES:
Children with single ventricle (SV) heart disease possess a spectrum of heart malformations, yet share similar physiologic states, suggesting differences in outcomes are related to fundamental morphologic differences or procedural pathways. We sought to provide a holistic overview of survival following intervention for SV heart disease at our institution, in order to better understand survival differences between subgroups of SV patients.

METHODS:
SV heart disease was defined as patients with a hypoplastic or dysfunctional ventricle with uncertain or unacceptable candidacy for a two-ventricle circulation. Patients with complex intracardiac anatomy initially managed with a SV strategy were also included. Patients were stratified into 8 diagnostic groups and 11 procedural categories based on the initial interventional pathway. Survival was compared using the Kaplan-Meier method. Risk factors for death were determined using multiphase parametric risk hazard analysis.

RESULTS:
Between 2005-2020, 381 patients with SV heart disease were born at our institution and underwent intervention. Median length of follow-up was 2.3 (0.6-6.9) years. Overall survival at 10 years was 65±3%. Survival was compared based on underlying diagnosis (Figure 1). Patients with double inlet left ventricle experienced the best survival (10-year: 89±7%) and patients with hypoplastic left heart syndrome experienced the worst survival (10-year: 55±5%). From a procedural stand-point, patients initially palliated with less-invasive procedures such as ductal stent (4-year: 100%) or pulmonary artery banding (10-year: 95±5%) demonstrated superior survival compared to patient's managed with more invasive procedures such as the Norwood procedure (10-year: 59±4%). SV patients with left ventricular dominance had higher survival compared to patients with right ventricular dominance (10-year: 78±5% vs 58±4 %, P = 0.002). Survival of patients who were able to achieve a biventricular circulation was superior to patients who remained on the single ventricle pathway (10-year: 87±5% vs 63±3%, P = 0.04). Birth in the second half of the study period was associated with improved survival (8-year survival; 2005-2012: 60±4% vs 2013-2020: 74±3%, P = 0.04). In a multivariable analysis, chromosomal abnormality, lower birthweight, hybrid Norwood procedure, right ventricular dominance, and earlier year of operation were risk factors for death.

CONCLUSIONS:
Long-term survival differences in patients with SV heart disease are related primarily to underlying cardiac anatomy and procedural complexity. Left ventricular dominance, intervention in the most recent era, and attainment of a 2-ventricle circulation were associated with improved survival in SV patients.

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87. LONG-TERM SURVIVAL FOLLOWING INTERVENTION FOR FUNCTIONAL SINGLE VENTRICLE HEART DISEASE: A 15-YEAR ANALYSIS FROM A SINGLE INSTITUTION

CONTINUED

Unadjusted Survival in Patients with Single Ventricle Heart Disease Stratified by Diagnosis

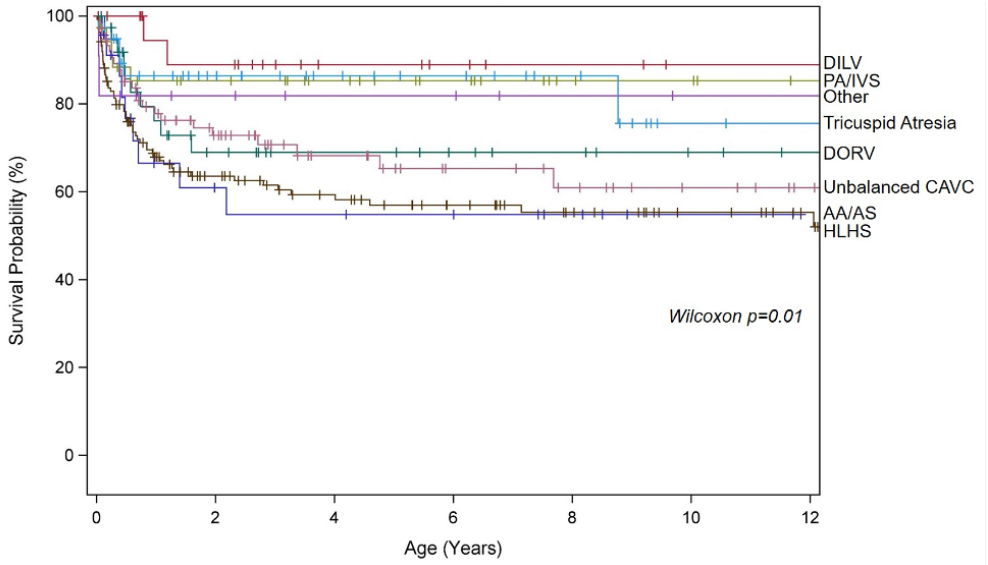

Figure 1: Unadjusted Survival in Patients with Single Ventricle Heart Disease Stratified by Diagnosis. DILV - Double Inlet Left Ventricle; PA/IVS - Pulmonary Atresia/Intact Ventricular Septum; DORV - Double Outlet Right Ventricle; Unbalanced CAVC - Unbalanced Complete Atrioventricular Canal; AA/AS - Aortic Atresia/Aortic Stenosis; HLHS - Hypoplastic Left Heart Syndrome

FIFTH SCIENTIFIC SESSION

88. DEMOGRAPHICS OF INTEGRATED THORACIC SURGERY APPLICANTS AND RESIDENTS: IS THERE A LEAKY PIPELINE OR WEAK STREAM?

AUTHORS
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OBJECTIVES:
In recent years, increasingly more women and racial/ethnic minorities have matched into cardiothoracic (CT) surgery. However, the representation of minorities in the budding workforce is still disproportionately low compared to that among all medical students or the general US population. The integrated thoracic surgery (I-6) residency model was developed, in part, to promote interest in CT surgery early in diverse trainees. To determine gaps in and opportunities for recruitment of women and minority groups in the pipeline for I-6 residency, we quantified rates of progression at each training level, as well as trends over time.

METHODS:
We obtained 2015-2020 medical student, I-6 residency applicant, and I-6 resident gender and race/ethnicity demographic data from the American Association of Medical Colleges and Electronic Residency Application Service public databases and Accreditation Council for Graduate Medical Education Data Resource Books. We performed Chi-square, Fisher exact, and Cochran-Armitage tests for trend to compare 2015 and 2020.

RESULTS:
In 2020, there were a total of 94,243 medical students, 175 I-6 applicants, and 193 I-6 residents. There were increases in women and trainees of all racial/ethnic backgrounds except American Indian from 2015 to 2020 ($p<0.001$ for all). Among non-White medical students in 2020, Asians/Pacific Islanders were the largest minority (23%), followed by Black/African Americans (8%) and Hispanics (7%). The greatest, though not significant, increases were seen in the proportions of female (28% vs 22%, $p=0.46$) and Asian/Pacific Islander (25% vs 15%, $p=0.08$) applicants in 2020 versus 2015. Although the proportions of Hispanic and Black/African American I-6 applicants have remained flat over time, the proportion of Hispanic I-6 applicants mirrors Hispanic representation in medical school, whereas the proportion of Black/African American I-6 applicants is less than that of Black/African American medical students. Finally, the proportions of female (28% vs 24%, 2020 vs 2015, $p=0.024$) and White (61% vs 58%, $p=0.007$) I-6 residents increased between 2015 and 2020, with a trend for Asian/Pacific Islanders (20% vs 17%, $p=0.08$). However, the proportions of Hispanic (5%) and Black/African American (2%) I-6 residents in 2020 remained low, reflecting their underrepresentation in matriculation into I-6 residency programs. Currently, of the 51% of women and 40% of non-White minorities in medical school, 28% and 43% apply to I-6 programs, respectively, and 28% and 36% matriculate successfully.

CONCLUSIONS:
Although the recruitment of women into medical school has been successful, progress has been slower for racial/ethnic minorities, for whom recruitment efforts should begin before medical school. Matriculation to I-6 residency underperforms medical student demographics and spotlights a need to foster early interest in CT surgery among all minority groups, while ensuring that we mitigate bias in the residency recruitment process. Trainee-recruitment efforts emphasizing equity are critical to bolstering the CT surgery workforce and ultimately optimizing the delivery of care to our diverse patient population.

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88. DEMOGRAPHICS OF INTEGRATED THORACIC SURGERY APPLICANTS AND RESIDENTS: IS THERE A LEAKY PIPELINE OR WEAK STREAM?

CONTINUED

Trends in Demographics of Integrated Thoracic Surgery Applicants and Residents from 2015-2020

Number of Trainees	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	p-value
Medical Students	88,185	89,745	91,247	92,674	94,243	**<0.001**
Male	46,149 (0.52)	46,249	46,064	45,808	45,675 (0.48)	0.12
Female	42,036 (0.48)	43,495	45,174	46,851	48,530 (0.51)	**<0.001**
White	47,352 (0.54)	47,058	46,733	46,282	45,738 (0.49)	**<0.001**
Asian/Pacific Islander	19,157 (0.22)	19,686	20,344	20,977	21,586 (0.23)	**<0.001**
Hispanic	5,108 (0.06)	5,477	5,706	6,001	6,295 (0.07)	**<0.001**
Black/African American	5,709 (0.06)	6,079	6,437	6,735	7,126 (0.08)	**<0.001**
American Indian	161 (0.00)	168	183	182	183 (0.00)	0.24
Other	1,689 (0.02)	1,742	1,768	1,775	1,865 (0.02)	**0.003**
ERAS I-6 Applicants	187	538	185	209	175	0.53
Male	145 (0.78)	411	135	155	126 (0.72)	0.25
Female	42 (0.22)	127	50	54	49 (0.28)	0.46
White	79 (0.42)	209	75	87	80 (0.46)	0.94
Asian/Pacific Islander	28 (0.15)	104	35	36	43 (0.25)	0.08
Hispanic	16 (0.09)	50	11	14	14 (0.08)	0.72
Black/African American	9 (0.05)	44	12	11	7 (0.04)	0.62
American Indian	0 (0.00)	1	3	2	1 (0.01)	1.00
Other	4 (0.02)	25	9	7	8 (0.05)	0.68
I-6 Residents	138	161	183	189	193	**0.003**
Male	103 (0.75)	116	131	132	139 (0.72)	**0.021**
Female	33 (0.24)	43	48	55	54 (0.28)	**0.024**
White	80 (0.58)	92	100	108	118 (0.61)	**0.007**
Asian/Pacific Islander	24 (0.17)	27	30	30	38 (0.20)	0.08
Hispanic	8 (0.06)	7	8	10	9 (0.05)	0.81
Black/African American	0 (0.00)	1	4	4	4 (0.02)	0.43
American Indian	0 (0.00)	0	0	0	0 (0.00)	1.00
Other	9 (0.07)	11	13	11	17 (0.09)	0.12

Data are reported as number (proportion). P-value refers to significance of trend from 2015-2016 to 2019-2020. Some gender and race/ethnicity data were unavailable and are not included here, accounting for the proportions that do not add up to 1.

SCIENTIFIC E-POSTERS & VIDEOS

ADULT CARDIAC SURGERY POSTERS

AC-P1. A BRIDGE-TO-BRIDGE STRATEGY FROM INTRA-AORTIC BALLOON PUMP TO LEFT VENTRICULAR ASSIST DEVICE IS ASSOCIATED WITH NON-INFERIOR POST-TRANSPLANT OUTCOMES

AUTHORS
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AUTHOR INSTITUTION(S)
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OBJECTIVES:
Following the United Network of Organ Sharing (UNOS) allocation policy revision in October of 2018, the use of intra-aortic balloon pumps (IABP) in patients with acute decompensated heart failure has significantly increased. Due to this recent shift in practice, it is important to understand outcomes of different bridge-to-transplant strategies in patients supported with IABP. We compared posttransplant outcomes in patients bridged from an IABP to a left ventricular assist device (LVAD) prior to transplantation (bridge-to-bridge) with patients bridged from an IABP directly to transplantation (bridge-to-transplant). We hypothesized that IABP bridge-to-bridge patients have non-inferior post-transplant survival compared to IABP bridge-to-transplant patients.

METHODS:
We identified all adult (≥ 18 years) heart transplant recipients in the UNOS database between January 1, 2000 and March 1, 2020 who were supported with an IABP prior to transplantation. Multi-organ listings and retransplant patients were excluded. IABP bridge-to-bridge patients were propensity matched to IABP bridge-to-transplant patients using a 1:1 nearest neighbor match with replacement. Kaplan-Meier survival curve analysis and Cox proportional hazards regressions were used to assess 1-year, 5-year, and 10-year post-transplant mortality.

RESULTS:
A total of 430 IABP bridge-to-bridge patients and 1,191 IABP bridge-to-transplant patients were identified, of which 430 bridge-to-bridge patients were propensity matched to 430 bridge-to-transplant patients. Bridge-to-bridge patients were 80.7% (n=347) male and had a median age of 56 years (interquartile range [IQR]: 47-62) at transplantation, compared to bridge-to-transplant patients, who were 80.5% (n=346) male and had a median age of 57 years (IQR: 49-62). Bridge-to-bridge patients had a median waitlist time of 174 days (IQR: 95-323), while bridge-to-transplant patients had a median waitlist time of 10 days (IQR: 4-23). Median cardiac output at listing was 3.9 L/min (IQR: 2.96-4.8) and 4.1 L/min (IQR: 3.2-5) for the bridge-to-bridge and bridge-to-transplant groups, respectively. Overall survival at 1-, 5-, and 10-year posttransplant was 95.5%, 83.0%, and 68.2% in bridge-to-bridge patients and 95.9%, 81.3%, and 63.6% in bridge-to-transplant patients, respectively (p=0.27, Figure 1). After adjusting for age, sex, ethnicity, hemodynamic parameters at listing, and transplant year with multivariate Cox proportional hazards modeling, there was no significant difference in 1-year (p=0.64), 5-year (p=0.73), and 10-year (p=0.63) post-transplant survival.

CONCLUSIONS:
Using this propensity-matched analysis of a national database, we found that IABP-to-LVAD prior to transplantation is a non-inferior bridging strategy compared to IABP bridge-to-transplant. In patients supported with IABP, LVAD implantation can be considered as a valid bridging strategy.

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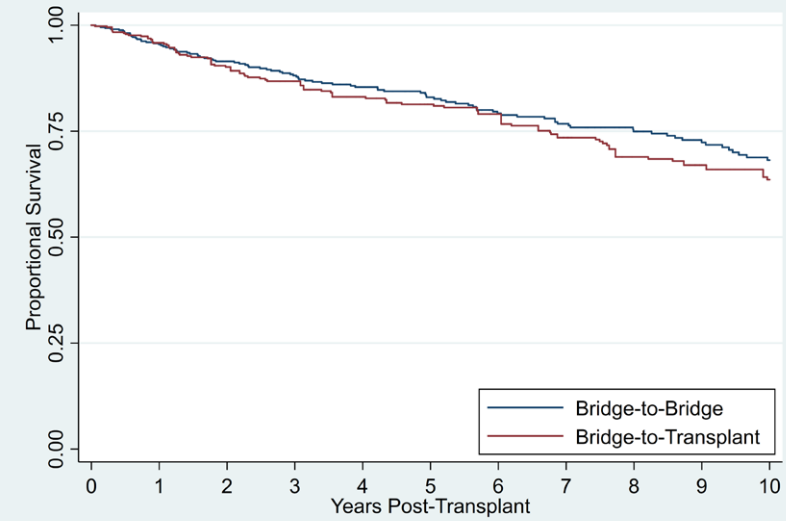
ADULT CARDIAC SURGERY POSTERS

AC-P1. A BRIDGE-TO-BRIDGE STRATEGY FROM INTRA-AORTIC BALLOON PUMP TO LEFT VENTRICULAR ASSIST DEVICE IS ASSOCIATED WITH NON-INFERIOR POST-TRANSPLANT OUTCOMES

CONTINUED

Kaplan-Meier Survival Curves for Post-Transplant Survival in Bridge-to-Bridge vs. Bridge-to-Transplant Patients



Kaplan-Meier survival curve analysis shows no difference in survival between patients bridged from an IABP to LVAD prior to transplantation (Bridge-to-Bridge) and patients bridged directly from an IABP to transplantation (Bridge-to-Transplant). P=0.27.

ADULT CARDIAC SURGERY POSTERS

AC-P2. EXTRACORPOREAL MEMBRANE OXYGENATION USE IN SEVERE COVID PNEUMONIA

AUTHORS
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OBJECTIVES:
Venovenous extracorporeal membrane oxygenation (VV-ECMO) has been shown to improve gas exchange and survival in the setting of acute respiratory distress syndrome. Recently, VV-ECMO has been utilized as a treatment strategy for severe SARS-CoV-2 infection unresponsive to conventional treatment. The purpose of this study was to evaluate the efficacy of VV-ECMO in severe SARS-CoV-2 at an ECMO center of excellence.

METHODS:
All patients with confirmed SARS-CoV-2 infection placed on VV-ECMO were identified from an institutional database. Clinical data were obtained from review of medical records. Patients were stratified by survival status for univariate analysis.

RESULTS:
Twenty-four patients were included in the study with a mean PaO2/FiO2 ratio of 80.75 ± 25.75 and PaCO2 value of 70.8 mmHg ± 19.05 at the time of cannulation. PEEP at cannulation was significantly lower in survivors (p=0.04). Median time from SARS-CoV-2 diagnosis to intubation was 8 days [IQR 3.5-13.5]. Median time from intubation cannulation was 4 days [1-7]. Adjunctive therapies were given to 95.8% of patients, including systemic corticosteroids (95.8%), remdesivir (70.8%), and convalescent plasma (45.8%). Thrombotic and hemorrhagic complication rates from VV-ECMO were 8.3% and 58.3%, respectively. Survivors had significantly lower hemorrhagic complication rates (p=0.04). Fifteen patients (62.5%) were successfully decannulated, and of those 84.6% (11/13) survived to hospital discharge. Overall survival to hospital discharge was 58% (11/19), with five patients still in the hospital.

CONCLUSIONS:
VV-ECMO serves as a rescue therapy for patients with severe SARS-CoV-2 infection failing conventional respiratory measures. Despite a high rate of bleeding complications, overall survival of 58% confirms efficacy of this rescue therapy.

Table: Patient and ECMO Characteristics

Table 1a. Patient Characteristics

Variable	Statistic (n=24)
Female	5 (20.8%)
Race	
White	7 (29.2%)
Hispanic	8 (33.2%)
African American	6 (25%)
Asian	1 (4.2%)
Other	2 (8.3%
Age, years	46.8 ± 11.9
Body Mass Index, kg/m²	30.6 ± 7.9
Diabetes	10 (%)
Hypertension	8 (%)
Chronic Lung Disease	1 (%)
Asthma	4 (%))
SARS-CoV-2 Adjunctive Therapy	
Systemic Corticosteroids	23 (95.8%)
Remdesivir	17 (70.8%)
Convalescent Plasma	11 (45.8%)
Pronation Prior to Cannulation	20 (83.3%)
Paralysis Prior to Cannulation	22 (91.7%)

Table 1b. ECMO Characteristics

Variable	Statistic
Days from SARS-CoV-2 Diagnosis to Intubation	8 (3.5 – 13.5)
Days from Intubation to VV-ECMO	4 (1 – 7)
Days from SARS-CoV-2 Diagnosis to VV-ECMO	14 (9.75 -18.5)
PaO2 at Time of Cannulation, mmHg	78.11 ± 25.05
PaCO2 at Time of Cannulation, mmHg	70.8 ± 19.05
PaO2/FiO2 Ratio at Time of Cannulation	80.75 ± 25.75
pH at Time of Cannulation	7.25 ± 0.09
PEEP at Time of Cannulation (mmHg)	13.55 ± 3.65
Respiratory Rate at Time of Cannulation	29.86 ± 7.53
Days on ECMO	17 (12 – 28)
Dual Site Cannulation	15 (62.5%)
Initial ECMO Flow (L/min)	4.24 ± 0.72
Initial ECMO Sweep (L/min)	4.07 ± 0.95
Thrombotic Complications on VV-ECMO	2 (8.33%)
Bleeding Complications on VV-ECMO	14 (58.3%)
Continuous Renal Replacement Therapy Use	9 (37.5%)
Inhaled Nitric Oxide Use	5 (20.8%)
Days from Decannulation to Discharge	29 (22.5 – 51)
Hospital length of stay, days	70 (41 – 79)
In-hospital Mortality	8 (42.1%)
Discharge to Facility	9 (81.8%)
Discharge with Oxygen	5 (45.5%)

Values are median (interquartile range), mean ± standard deviation, or n (%).

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ADULT CARDIAC SURGERY POSTERS

AC-P2. EXTRACORPOREAL MEMBRANE OXYGENATION USE IN SEVERE COVID PNEUMONIA

CONTINUED

Table: Comparison between survivors and non-survivors

Variable	Non-Survivors	Survivors	P Value
Age	50 ± 9.8	47 ± 12.5	0.60
Gender (Female)	2 (25%)	3 (27.3%)	0.91
Hispanic Ethnicity	3 (37.5%)	4 (36.4%)	0.96
BMI	32.96 ± 5.62	30.68 ± 9.52	0.52
Diabetes Mellitus	4 (50.0%)	4 (36.4%)	0.55
Chronic Lung Disease	0%	1 (9.1%)	0.38
Asthma	2 (25.0%)	2 (18.2%)	0.72
Hypertension	4 (50.0%)	3 (27.3%)	0.31
Prone prior to Cannulation	8 (100.0%)	9 (81.8%)	0.12
Paralyzed Prior to Cannulation	8 (100.0%)	9 (81.8%)	0.20
Dual Site Cannulation	5 (62.5%)	5 (45.5%)	0.46
Initial ECMO Flow (L/min)	4.39 ± 0.80	4.09 ± 0.78	0.44
Initial ECMO Sweep (L/min)	4.06 ± 0.94	4.30 ± 0.34	0.80
FiO2 at Cannulation	0.96 ± 0.09	0.97 ± 0.06	0.94
PaO2 at Cannulation (mmHg)	64.34 ± 29.11	83.72 ± 19.95	0.13
P:F Ratio at Cannulation	67.37 ± 29.84	87.04 ± 21.87	0.14
pH at Cannulation	7.24 ± 0.09	7.28 ± 0.11	0.46
PEEP at Cannulation (mmHg)	15.75 ± 4.59	11.60 ± 2.07	0.04
PCO2 at Cannulation (mmHg)	75.46 ± 24.97	64.12 ± 14.26	0.27
Respiratory Rate at Cannulation	29.1 ± 8.84	28.8 ± 6.73	0.93
Days from SARS-CoV-2 Diagnosis to Intubation	8.5 (7 -13)	9.5 (4 -14)	0.96
Days from Intubation to VV-ECMO	3 (1 -6.5)	2.5 (2 - 5)	0.95
Days from SARS-CoV-2 Diagnosis to ECMO	14 (10 – 16.5)	14 (7 - 20)	0.76
Thrombotic Complications on ECMO	1 (12.5%)	0.0%	0.23
Bleeding Complications on ECMO	6 (75.0%)	3 (27.3%)	0.04
Continuous Renal Replacement Therapy Use	4 (50.0%)	4 (36.4%)	0.55
Inhaled Nitric Oxide Use	2 (25.0%)	3 (27.3%)	0.91
Systemic Glucocorticoids	7 (87.5%)	100.0%	0.23
Remdesivir	6 (75.0%)	8 (72.7%)	0.91
Convalescent Plasma	5 (62.5%)	6 (54.6%)	0.73

Values are median (interquartile range), mean ± standard deviation, or n (%).

ADULT CARDIAC SURGERY POSTERS

AC-P3. REAL TIME ELECTROPHYSIOLOGICAL MAPPING FOR SURGICAL EPICARDIAL ABLATION IN RECURRENT VENTRICULAR ARRHYTHMIAS

AUTHORS
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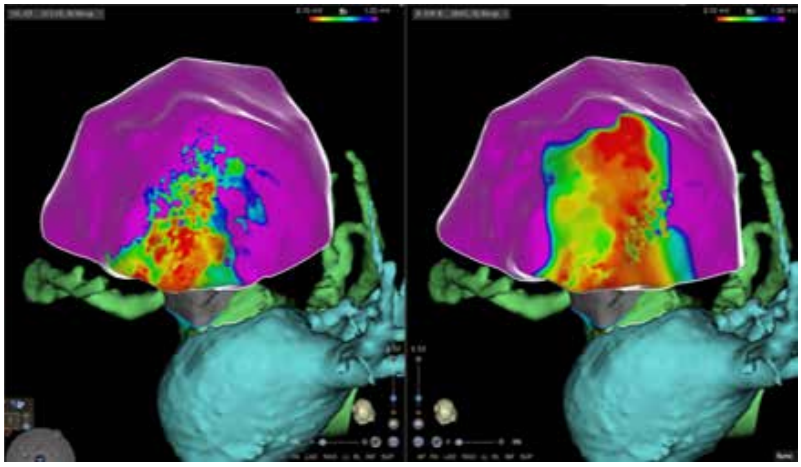
OBJECTIVES:
Recurrent ventricular tachyarrhythmias in ischemic cardiomyopathy represent a challenging clinical problem. We describe an approach to the treatment of ischemic cardiomyopathy related recurrent ventricular tachyarrhythmias using a three-dimensional electroanatomic mapping system (EAMS) to target epicardial foci with subsequent cryoablation through an open epicardial approach.

METHODS:
Between 2016 to 2021, 9 hybrid ablations using EAMS for the treatment of recurrent ventricular tachyarrhythmias were performed at our institution. With the intra-operative use of a 20-pole mapping catheter, a 3-D electro-anatomical voltage map was created of the epicardial surface. Activation and pace-mapping was then used to determine the exit and critical isthmus sites of the VT circuits. Cryothermal energy was then applied to the areas of interest and completion mapping performed.

RESULTS:
Six of the nine patients had undergone prior endocardial ablations with recurrence of ventricular tachyarrhythmias, those patients underwent left thoracotomy with epicardial ablation, three of which also underwent thoracic sympathectomy. The other 3 patients underwent median sternotomy with LV aneurysm resection at the time of epicardial ablation. During the average follow-up period of 13.5 months (2-41), 3 of 9 patients experienced recurrent ventricular tachyarrhythmia's, only one of which required repeat ablation. No patients died during follow up.

CONCLUSIONS:
Surgical epicardial ablation with EAMS for cryoablation of ventricular tachyarrhythmias is an effective treatment strategy as either a stand-alone procedure with open epicardial access or in conjunction with concomitant cardiac surgery. Further studies are needed to determine optimal cryoablation strategy and the usefulness of additional adjunctive procedures.

Epicardial Voltage Mapping Before and After Cryoablation



The image shows the epicardial voltage map of the before (left) and after (right) cryoablation. Abnormal scarring is seen in the image on the left with heterogenous voltage potentials along the border zone. Relative homogeneity of the voltage potentials along the border zone is seen in the image on the right after successful epicardial cryoablation.

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ADULT CARDIAC SURGERY POSTERS

AC-P4. IMPROVING PREDICTION OF AKI AFTER CABG: AN EXPLORATORY ANALYSIS OF THE ACEF TOOL

AUTHORS
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AUTHOR INSTITUTION(S)
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OBJECTIVES:

AKI after CABG occurs in up to 15% of patients. Even mild grades of postoperative AKI are associated with long-term morbidity and mortality. Currently, the STS risk calculator is limited in its usage as it only predicts severe renal failure rather than mild AKI. The ACEF tool was shown to have satisfactory discriminatory ability to predict postoperative AKI (AUC 0.781)1 but performed less well for a population with a high incidence of diabetes and anemia (0.617). The objective of this study was to perform an exploratory analysis of predictive models for the outcome of AKI, incorporating additional known risk factors.

METHODS:

This was a retrospective analysis of patients undergoing isolated CABG at our institution from March 2014 – June 2019. Acute Kidney Injury was defined using AKIN (Acute Kidney Injury Network) criteria. The ACEF tool (Age/LVEF + 1 if SCr>2) was used. Exploratory risk models for AKI were calculated using five versions of the ACEF tool. The modifiers included anemia, insulin-dependent diabetes, and hemoglobin A1c > 7. For each additional criterion met, a 1 was added to the score. Anemia was defined as a hemoglobin < 13.5g/dL or 12g/dL in males and females, respectively.

The discriminatory ability of these versions was compared using an area under the receiver operating characteristic curve (ROC AUC). Statistical analysis was performed using Jamovi statistical software. The five versions were:

Version 1 (Original ACEF) = Age/LVEF + 1 if SCr >2
Version 2 = Age/LVEF + SCr>2 + Anemia
Version 3 = Age/LVEF + SCr>2 + Anemia + Insulin Dependent Diabetes
Version 4 = Age/LVEF + SCr>2 + Anemia + Insulin Dependent Diabetes
Version 5 = Age/LVEF + SCr>2 + Anemia + HbA1c > 7

RESULTS:

A total of 663 patients underwent isolated CABG (mean age = 60.2, 73.9% male), of which 66% (n=438) were elective and 34% (n=225) urgent. The incidence of diabetes was 68% (n=433), with a median HbA1c of 7.0% and insulin dependence was seen in 39% (n=171) of diabetics. Preoperative anemia was present in 45.1% (n=299).

The overall incidence of postoperative AKI (any AKIN stage) was 38.2% (30% Stage 1, 7.2% Stage 2 and 0.9% were Stage 3).

ACEF had an ROC AUC of 0.590. The ROC AUC values were Version 2 – 0.633; Version 3 – 0.615; Version 4 – 0.638, Version 5 – 0.634. Versions 2-5 performed significantly better than Version 1 in predicting AKI ($p<0.05$ for all). Version 4 (Age/LVEF + peak SCr>2 + Anemia + Insulin Dependent Diabetes) had the overall highest discriminative ability out of the five versions, but there was no statistically significant difference between versions 2-5 when compared (p-value >0.05). (Figure)

CONCLUSIONS:

In a cohort of patients with a high prevalence of diabetes and anemia, postoperative AKI after isolated CABG was not uncommon, occurring in over 1/3rd and in equal proportions and severity regardless of urgency status, but was commonly mild by AKIN grade. The limitation of the STS risk calculator is that it predicts severe renal failure (ie, dialysis) only rather than mild AKI. Simplified risk tools may also aid decision-making in the development and eventual use of prophylactic agents for AKI. The ACEF tool is a quick, simple tool that has been proposed to predict a patient's risk of postoperative AKI following isolated CABG, but it performs less well in patients with diabetes and anemia. Addition of any of these risk factors improves the predictive ability as compared to the original version. Continued modification of this tool may delineate its ability to appropriate predict postoperative AKI in more generalized populations than previously studied.

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ADULT CARDIAC SURGERY POSTERS

AC-P4. IMPROVING PREDICTION OF AKI AFTER CABG: AN EXPLORATORY ANALYSIS OF THE ACEF TOOL

CONTINUED

ROC Curve ACEF Versions 1-5

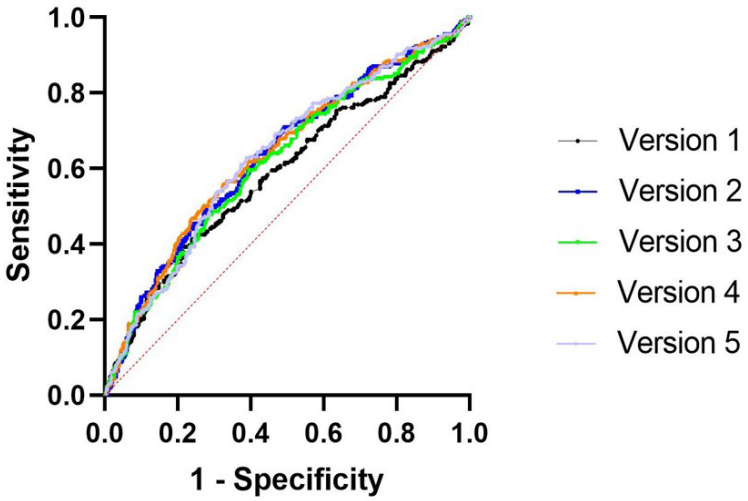

Figure 1 displays the ROC Curve for all versions of the ACEF model in our present study. Each version is listed separately, according to the line color as displayed in the figure's legend. The ROC AUC was calculated from this chart for each version, respectively.

Postoperative Acute Kidney Injury

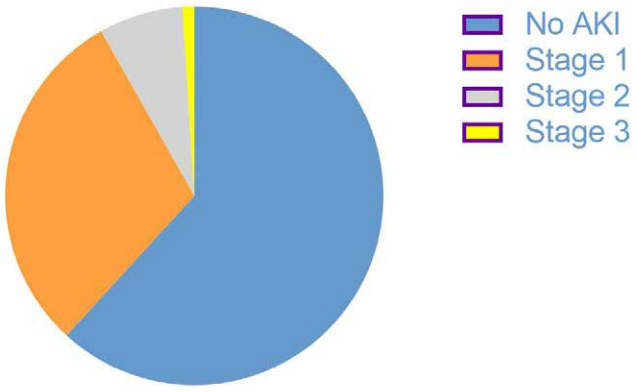

Figure 2 displays the overall incidence of postoperative AKI by AKIN staging in our total patient population of 663 patients. Overall incidence of postoperative AKI was 38.2% with 30% being Stage 1, 7.2% being Stage 2, and 0.9% being Stage 3.

ADULT CARDIAC SURGERY POSTERS

AC-P5. HYBRID ABLATION OF ATRIAL FIBRILLATION IN PATIENTS WITH HEART FAILURE IS SAFE AND EFFECTIVE

AUTHORS
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OBJECTIVES:
The relationship between atrial fibrillation and heart failure continues to be defined. In stand-alone atrial fibrillation patients, Hybrid ablation (combined epicardial surgical and endocardial catheter ablation) is a promising alternative to Cox-Maze IV surgery in this at-risk population. The safety and effect of Hybrid ablation in the heart failure population has yet to be described. We sought to determine if Hybrid ablation can be done safely and if this approach can restore NSR in the tachycardia induced cardiomyopathy heart failure population and to observe the effect on heart failure.

METHODS:
Retrospective review of patients with tachycardia induced cardiomyopathy with heart failure (LVEF% < 40%) that underwent Hybrid ablation. Safety and effectiveness of Hybrid ablation was determined by standard monitoring techniques at 1-year follow-up. Pre-Hybrid ECHO was compared to Post-Hybrid ECHO to determine the effect of Hybrid ablation on LVEF% and LA Diameter. The minimum time between Pre-and Post-ECHO was 1 year. All patients completed both epicardial and endocardial stages of the hybrid ablation. All patients had their left atrial appendage ligated. Statistical significance was determined using Wilcoxon two-tailed test.

RESULTS:
Forty-three patients met the criteria for analysis. Avg age was 65 + 10 years. Forty-two patients had non-paroxysmal AF. Forty patients had NYHA Class II or worse heart failure. Avg time in AF prior to hybrid ablation was 5.3 + 6.6 years. No deaths or strokes occurred in this at-risk patient cohort. Three patients required permanent pacemaker placement. 1 phrenic nerve injury occurred. Success of Hybrid ablation defined by standard HRS guidelines at 1-year was 84.6%. Avg LA Diameter significantly decreased with Hybrid ablation (Pre-5.2 + 0.8cm and Post-4.6 + 1.0 cm; p=0.004). LVEF% significantly improved with Hybrid ablation (Pre-34.5% and Post-47.7%; p<0.0001). Only three patients had a continued decrease in their LVEF% after hybrid ablation.

CONCLUSIONS:
Hybrid ablation of atrial fibrillation appears to be a promising approach to tachycardia induced cardiomyopathy with heart failure. Restoration of NSR in this population is possible, is safe and can result in improved structural heart changes including, improvement in LA diameter and LVEF%. A Heart Team Hybrid approach to the ablation of atrial fibrillation in heart failure patients can fill a critical gap in atrial fibrillation treatment without the use of sternotomy or cardiopulmonary bypass.

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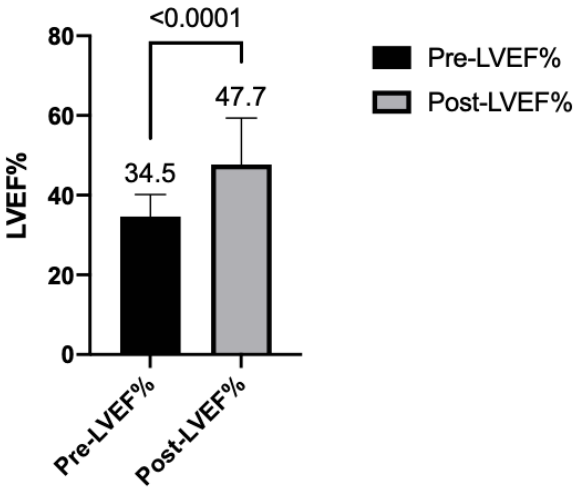
ADULT CARDIAC SURGERY POSTERS

AC-P5. HYBRID ABLATION OF ATRIAL FIBRILLATION IN PATIENTS WITH HEART FAILURE IS SAFE AND EFFECTIVE

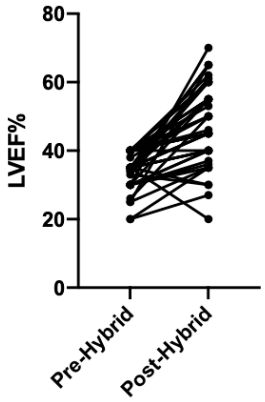
CONTINUED

Improvement in LVEF% with Hybrid Ablation



A heart team Hybrid ablation approach led to significant LVEF% improvement (34.5% to 47.7%) at 1-year follow-up.

The Effect of Hybrid Ablation on AF in Heart Failure Patients



Forty (93%) patients demonstrated an improvement in LVEF% at 1-year after Hybrid ablation.

ADULT CARDIAC SURGERY POSTERS

AC-P6. CLINICAL PREDICTORS OF CEREBROVASCULAR ACCIDENT IN PATIENTS UNDERGOING ISOLATED CORONARY ARTERY BYPASS GRAFTING: A VETERANS AFFAIRS SURGICAL QUALITY IMPROVEMENT PROGRAM ANALYSIS

AUTHORS
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AUTHOR INSTITUTION(S)
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OBJECTIVES:
Cerebrovascular accident (CVA) after coronary artery bypass grafting (CABG) is a devastating complication. Rates of stroke after CABG have ranged from 1-5% in the literature. However, cardiac surgery patients have developed higher risk profiles in recent years, and data on Veterans Affairs (VA) centers is lacking. Up-to-date understanding of pertinent risk factors may help guide surgical planning and post-operative care. The aims of this study are to provide contemporary data in the vulnerable population of United States veterans, and to identify pre- and intra-operative predictors for stroke in CABG.

METHODS:
Patients undergoing isolated CABG at VA centers from 2008-2019 were retrospectively identified using the VA Surgical Quality Improvement Program database. Patients who had concurrent operations were excluded. 30-day postoperative outcomes were observed. Univariate analysis followed by multivariable logistic regression was performed to identify variables that had significant independent associations with postoperative stroke. Receiver operating characteristic (ROC) diagnostics were used to identify optimal inflection points between continuous predictors and odds of stroke.

RESULTS:
24,387 patients met inclusion criteria. The average age was 64.4±7.8 years with 24,135 (99%) male patients. 17,390 patients (71.3%) were white and 2,312 (9.5%) were African American. Incidence of CVA after isolated CABG over the study period was 1.1% (260 cases). 83% of CABG was performed on bypass. There was no difference in percentage of cases done on-pump between the non-stroke cohort and the stroke cohort (82.5% vs 84.2%, respectively, p=0.458). Multivariable analysis revealed numerous preoperative and intraoperative covariates to be statistically significant predictors of postoperative CVA (Table). Preoperative cerebrovascular disease was the strongest predictor of post-operative CVA (adjusted odds ratio (aOR)=2.31; p<0.001). ROC analysis identified that after 104 minutes on bypass, the adjusted odds of stroke increased by 58% (aOR=1.58; p<0.001). Other risk factors included worsening kidney function, cardiomegaly, prior myocardial infarction, and intra-aortic balloon pump use.

CONCLUSIONS:
CVA after CABG is multifactorial. In this study there was no difference in risk of CVA between on- and off-pump groups; however, prolonged time on bypass was associated significantly increased risk of CVA. Reduced ejection fraction, previous cerebrovascular disease and cardiomegaly were also associated with increased risk. Pre-operative optimization of these comorbidities and careful consideration of time on bypass may help improve clinical outcomes and lower the risk of this dreaded complication.

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AC-P6. CLINICAL PREDICTORS OF CEREBROVASCULAR ACCIDENT IN PATIENTS UNDERGOING ISOLATED CORONARY ARTERY BYPASS GRAFTING: A VETERANS AFFAIRS SURGICAL QUALITY IMPROVEMENT PROGRAM ANALYSIS

CONTINUED

Multivariable Analysis of preoperative and intraoperative variables and their respective risk of stroke in the 30-day postoperative period

Covariate	Adjusted Odds Ratio (95% Confidence Interval)	p-value
Cardiomegaly	1.43 (1.03 – 1.99)	0.035
CVD	2.31 (1.80 – 2.97)	<0.001
Prior MI	1.33 (1.03 – 1.73)	0.028
IABP	1.78 (1.13 – 2.81)	0.013
LV contraction grade EF ≥ 0.55 0.45 – 0.54 0.40 – 0.44 0.35 – 0.39	 Reference 1.09 (0.77 – 1.53) 1.80 (1.20 – 2.71) 2.18 (1.43 – 3.34)	 - 0.639 0.004 <0.001
eGFR < 60	1.32 (1.01 – 1.73)	0.043
CPBT > 104 min	1.58 (1.23 – 2.02)	<0.001

Abbreviations: CPBT = cardiopulmonary bypass time; CVD = cerebrovascular disease; EF = ejection fraction; eGFR = estimated glomerular filtration rate; IABP = intra-aortic balloon pump; MI = myocardial infarction

ADULT CARDIAC SURGERY POSTERS

AC-P7. TWENTY-YEAR UNITED STATES NATIONAL DEMOGRAPHIC AND REGIONAL MORTALITY TRENDS FROM TRAUMATIC THORACIC AORTIC INJURY, 1999 TO 2019

AUTHORS
Mariam Shariff[1], Ashish Kumar[2], John Stulak[1]

AUTHOR INSTITUTION(S)
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OBJECTIVES:
Traumatic Thoracic Aortic Injury (TTAI) is associated with high mortality rates and is the second leading cause of death in traumatic patients. There has been a considerable advancement in the management of TTAI with novel and improved surgical procedures and imaging modalities. The aim of this study was to determine the national demographic and regional trends in mortality associated with TTAI in the United States across twenty years, 1999 to 2019.

METHODS:
The multiple cause of death data on Centers for Disease Control and Prevention Wide-Ranging OnLine Data for Epidemiologic Research (CDC-WONDER) database was utilized to query the death certificates data for traumatic thoracic aortic injury from 1999 to 2019. The International Classification of the Diseases, Tenth Revision (ICD-10) code S25.0 was used to identify and abstract data for all TTAI related deaths. The data was further abstracted based on age, race, gender and Census-Bureau defined regions. The age-adjusted mortality rate (AAMR) per 100,000 population and annual percentage change (APC) with 95% Confidence Interval (CI) were computed. The Joinpoint software was utilized to compute the temporal trends in mortality based on a segmented change.

RESULTS:
A total of 20,842 TTAI associated deaths occurred from 1999 to 2019. The overall AAMR reduced from 0.759 to 0.223 from 1999 to 2019 [average APC -6.5 (-7.5; -5.5)] [Table 1] [Figure 1, A], with an accelerated curtail from 2005 to 2019 [average APC -7.1(-8.2; -6.1)]. The following was the reduction in mortality observed among age <45 years versus age >45 years [average APC -6.5 (-7.9; -5.1) vs. -6.2(-7.3; -5.0)]; female versus male [average APC -6.1 (-7.8; -4.3) vs -6.1 (-7.2; -5.0)]; Whites versus Blacks [average APC -6.9 (-7.8; -5.9) vs. -5.0 (-7.4; -2.5)]. The reduction in mortality as per the census regions Mid-West, North-East and South were average APC -6.8(-8.6; -5.0); -6.2(-8.8; -3.6); -5.7(-7.0; -4.4); -5.5(-7.4; -3.6), respectively [Figure 1, B].

CONCLUSIONS:
There was significant decrease in trend in TTAI associated mortality from 1999 to 2019 with a consistent decline in all demographic and regional subsets. The improved mortality outcomes among TTAI patients can be attributed to enhanced car safety features, increasing emergency services and trauma centers, improved management strategies with the utilization of mechanical circulatory support, advanced imaging modalities and novel surgical techniques such as endovascular repair.

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AC-P7. TWENTY-YEAR UNITED STATES NATIONAL DEMOGRAPHIC AND REGIONAL MORTALITY TRENDS FROM TRAUMATIC THORACIC AORTIC INJURY, 1999 TO 2019

CONTINUED

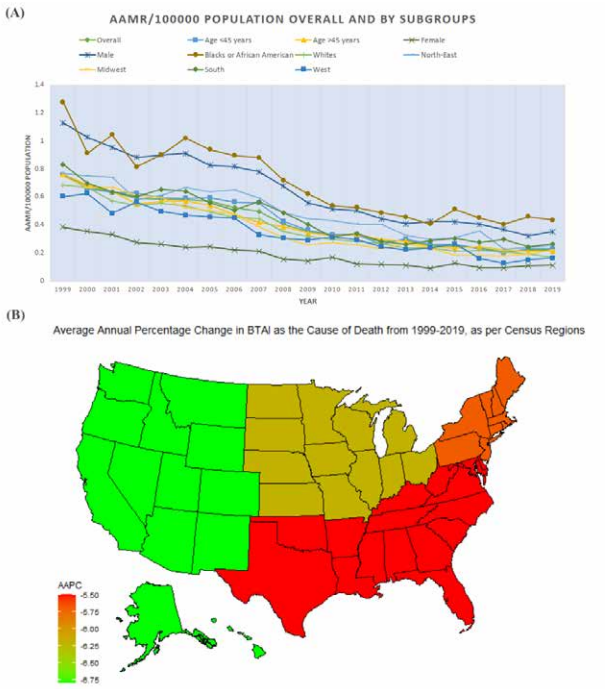
Table 1

Table 1: Average Annual Percentage Change in Mortality Due to Traumatic Thoracic Aortic Injury, Overall and stratified by subgroups

	No. of Deaths, 1999 – 2019	APC [95% CI], Segment 1	APC [95% CI], Segment 2	Joinpoint year	AAPC [95% CI]
Overall	20,842	-5.0[-7.8;-2.1]	-7.1[-8.2;-6.1]	2005	-6.5[-7.5;-5.5]
Age					
<45 years	11,350	-3.8[-7.6;0.1]	-7.6[-9.0;-6.2]	2005	-6.5[-7.9;-5.1]
>45 years	9,492	-6.9[-7.5;-6.3]	-3.1[-9.1;3.2]	2015	-6.2[-7.3;-5.0]
Sex					
Female	5,131	-8.4[-9.4;-7.5]	1.5[-5.8;9.2]	2014	-6.1[-7.8;-4.3]
Male	15,711	-4.5[-7.6;-1.4]	-6.8[-7.9;-5.7]	2005	-6.1[-7.2;-5.0]
Race					
Whites	15,556	-5.5[-8.6;-2.3]	-7.3[-8.1;-6.5]	2004	-6.9[-7.8;-5.9]
Blacks or African American	4,674	-6.1[-7.6;-4.6]	-1.4[-10.7;8.9]	2014	-5.0[-7.4;-2.5]
Asians or Pacific Islanders	415	-	-	-	-
American Indians or Alaska Natives	197	-	-	-	-
Census Region					
North-East	4,435	-3.2[-6.2;-0.3]	-7.1[-8.6;-5.5]	2006	-5.7[-7.0;-4.4]
Midwest	4,184	-8.4[-9.3;-7.4]	6.7[-12.2;29.4]	2016	-6.2[-8.8;-3.6]
South	8,285	-6.9[-8.2;-5.5]	-2.3[-8.5;4.3]	2013	-5.5[-7.4;-3.6]
West	3,938	-5.0[-11.1;1.4]	-9.0[-5.8;-9.6]	2004	-6.8[-8.6;-5.0]

Average annual percentage change in mortality due to traumatic thoracic aortic injury, overall and stratified by subgroups

Figure 1



A: Line graph for age-adjusted mortality rates from 1999 to 2019, overall and stratified by subgroups B: Heat map for average annual percentage change in TTAI associated mortality across census regions from 1999 to 2019

ADULT CARDIAC SURGERY POSTERS

AC-P8. SIGNIFICANT MITRAL REGURGITATION ASSOCIATED WITH LVAD IMPLANTATION MODULATES THE HUMAN MYOCARDIAL TRANSCRIPTOME

AUTHORS
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AUTHOR INSTITUTION(S)
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OBJECTIVES:
We examined for differences in the pre-left ventricular assist device (LVAD) implant myocardial transcriptome between patients who different degrees of MR. This will generate novel insights into the impact of MR on response to LVAD implantation and provide insights on the mechanisms of myocardial recovery during LVAD support.

METHODS:
From 1/2018 to 10/2019, 52 patients underwent durable LVAD implantation with left ventricular (LV) apical cores isolated. We excluded 7 patients who underwent temporary mechanical support prior to durable LVAD implant. We also isolated LV myocardium from clinical unused donor hearts (n=5). Total RNA was isolated from LV cores and used for the construction of cDNA sequence libraries, which were then sequenced in nova seq with 40 million reads per sample. Data were examined by Gene Set Enrichment Analysis (GSEA) or Gene Ontology (GO) analyses. A gene set with FDR < 0.05 was considered to be significant. Patients were stratified by degree of MR: Group I: Mild or less, Group II: Moderate or severe.

RESULTS:
We identified 22 patients in group I and 30 patients in group II. There were no differences in age, gender, comorbidities, or heat failure etiology. Group II patients weighed less (92.94+21.40 vs 77.23+20.17kg, P=0.009), and trended toward more tricuspid valve repairs (18.2% vs 43.3%, P=0.056, Table 1). We then compared the myocardial transcriptome of both mild or less MR and moderate-severe MR to unusable human donor hearts with ejection fraction of 50% or greater (n=5). Compared to donor hearts, there were 3754

differentially expressed genes (DEGs) in group I and 4663 DEGs in group II. Of these, 293 DEGs were specific for mild or less MR and 1202 were specific for moderate-severe MR (Figure 1A). On GSEA, the common regulated genes showed increased adaptive and innate immune gene expression and reduced expression of genes related to contraction and energetics (Figure 1B). Furthermore, of the 1202 specific genes associated with moderate-severe MR, there were additional upregulated genes related to inflammation and reduce expression of genes related to oxygen consumption, organ structure and cellular proliferation (Figure 1C).

CONCLUSIONS:
In patients undergoing durable LVAD implantation, the LV myocardium increased expression of genes relating to inflammatory pathways and reduced genes concerning contractility and energetics. There was additional activation of genes linked to inflammation and reduction of cellular proliferation genes in moderate-severe MR. This has implications for myocardial recovery and outcomes after LVAD.

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ADULT CARDIAC SURGERY POSTERS

AC-P8. SIGNIFICANT MITRAL REGURGITATION ASSOCIATED WITH LVAD IMPLANTATION MODULATES THE HUMAN MYOCARDIAL TRANSCRIPTOME

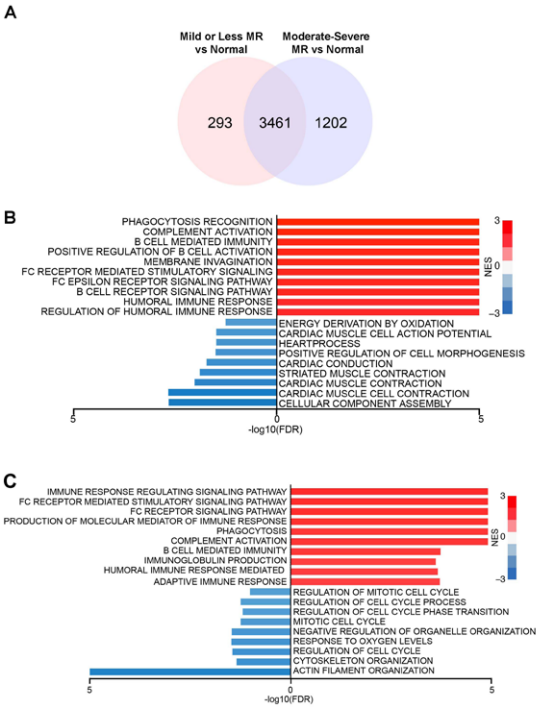
CONTIMUED

Patient Demographics, operative characteristics

	Mild or Less MR (n=22)	Moderate-Severe MR (n=30)	P Value
Demographics: Age	41.46±30.32	49.92±20.68	0.237
Male	19 (86.4%)	21 (70.0%)	0.166
Weight (kg)	92.94±21.40	77.23±20.17	0.009
Height (cm)	174.79±11.18	172.80±9.67	0.497
Comorbidities: Hypertension	10 (45.5%)	17 (56.7%)	0.424
Hyperlipidemia	11 (50.0%)	11 (36.7%)	0.336
Diabetes	7 (31.8%)	8 (26.7%)	0.685
Stroke	2 (9.1%)	4 (13.3%)	0.636
Lung Disease	2 (9.1%)	4 (13.3%)	0.636
Atrial Arrhythmia	6 (27.3%)	10 (33.3%)	0.640
Ventricular arrhythmia	5 (22.7%)	5 (16.7%)	0.584
Implantable Cardioverter Defibrillator	17 (77.3%)	23 (76.7%)	0.959
Creatinine (mg/dL)	1.47±0.44	1.44±0.45	0.859
Smoking history	6 (27.3%)	12 (40.0%)	0.341
Intra-aortic balloon pump	3 (13.6%)	3 (10.0%)	0.685
Heart Failure Etiology: Ischemic cardiomyopathy	9 (40.9%)	9 (30.0%)	0.414
Nonischemic cardiomyopathy	13 (59.1%)	21 (70.0%)	0.414
Concomitant Procedure: Redo-Sternotomy	6 (27.3%)	4 (13.3%)	0.208
Aortic Valve Repair	1 (4.5%)	1 (3.3%)	0.822
Aortic Valve Replacement	1 (4.5%)	1 (3.3%)	0.822
Tricuspid Valve Repair	4 (18.2%)	13 (43.3%)	0.056
Right Ventricular Assist Device	0 (0.0%)	3 (10.0%)	0.127

Patient demographic and comorbidities were comparable between mild or less MR and moderate-severe MR. However, those with moderate-severe MR tend to weigh less and underwent more concomitant tricuspid valve repairs with LVAD implantation.

Transcriptomic Analysis of Mild or Less MR versus Moderate-Severe MR



1A) Compared to donor hearts, there were 3754 differentially expressed genes (DEGs) for mild or less MR and 4663 DEGs for moderate-severe MR. Of these, 293 DEGs were specific for mild or less MR and 1202 were specific for moderate-severe MR. 1B) On GSEA, the common regulated genes showed increased adaptive and innate immune gene expression. 1C) Of the 1202 specific for moderate-severe MR, GSEA showed more inflammation and reduced cell proliferation genes.

ADULT CARDIAC SURGERY POSTERS

AC-P9. TEMPORAL CLUSTER ANALYSIS OF DEEP STERNAL WOUND INFECTION IN A REGIONAL QUALITY COLLABORATIVE

AUTHORS
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OBJECTIVES:
Deep sternal wound infection (DSWI) is a rare complication that is associated with high mortality. Seasonal variability in surgical site infections have been demonstrated, however these patterns have not been applied to DSWI. The purpose of this study was to assess temporal clustering of DSWIs.

METHODS:
All cardiac surgery patients who received a sternotomy were queried from a regional Society of Thoracic Surgeons database from 19 centers from 2001-2019. All patients with the diagnosis of deep sternal wound infection were then identified. Cluster analysis was performed at varying time intervals (monthly, quarterly, and yearly) at the hospital and regional level. DSWI rates were calculated by year and month, and compared using mixed-effects logistic regression.

RESULTS:
A total of 134,959 patients were identified as having underwent a sternotomy for cardiac surgery. Of the total cohort, 469 patients had a postoperative course complicated by DSWI (0.35%). Rates of DSWI per hospital across all years ranged from 0.12% to 0.69%. Rates of DSWIs were the greatest in September (0.44%) and the lowest in January (0.30%). No clustering was seen from quarter to quarter ($p=0.39$) (fig. 1a). There were yearly differences in the DSWI Rates ($p<0.001$) (fig 1b), with a downward trend in DSWI rates from 2001 to 2013, but an upward trend from 2014 to 2019.

CONCLUSIONS:
Deep sternal wound infections are a rare event within our region. These infections demonstrated no temporal clustering, suggesting no seasonal patterns of increased risk. Variation between hospitals was greater than variation across time, providing an opportunity for quality improvement.

Figure 1: Heat Map of Deep Sternal Wound Infection Occurrences per Hospital by Quarter

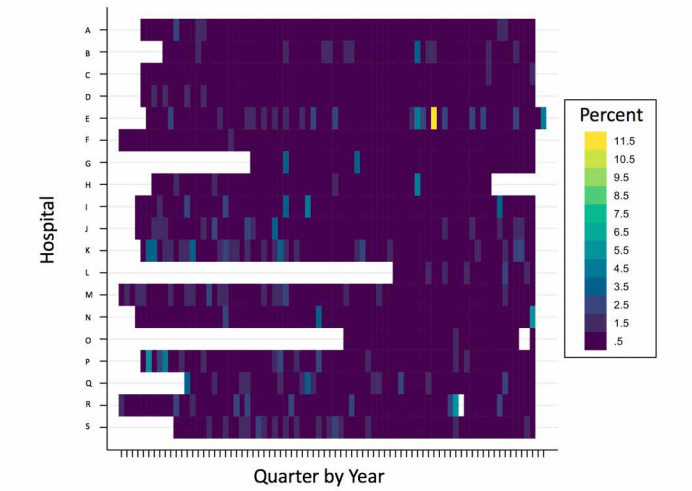

Figure 1: Heat map demonstrating deep sternal wound infection percentages per quarter by Hospital. (Quarter 1 = March-April-May; Quarter 2 = June-July-August; Quarter 3 = September-October-November; Quarter 4 = December-January-February)

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ADULT CARDIAC SURGERY POSTERS

AC-P9. TEMPORAL CLUSTER ANALYSIS OF DEEP STERNAL WOUND INFECTION IN A REGIONAL QUALITY COLLABORATIVE

CONTINUED

Figure 2: Marginal Probabilities of DSWI from a Mixed Effects Logistic Regression Model

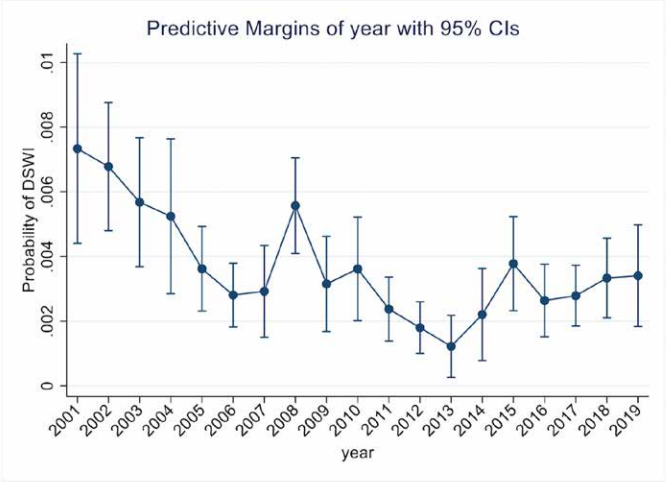

Figure 2: Marginal probabilities of DSWI from a mixed effects logistic regression model adjusting for hospital clustering. Looking across all hospitals there are yearly differences in deep sternal wound infection rates across the region. ($p<0.001$)

CONGENITAL POSTERS

CONG-P1. HOSPITALIZATIONS OF CHILDREN AND ADULTS WITH HYPOPLASTIC LEFT HEART SYNDROME IN TEXAS FROM 2009 – 2019

AUTHORS
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AUTHOR INSTITUTION(S)
[1]University of Texas at Austin Dell Medical School, Austin, TX; [2]Texas Center for Pediatric and Congenital Heart Disease, Austin, TX

OBJECTIVES:
Hypoplastic Left Heart Syndrome(HLHS) comprises a small but potentially medically complex percentage of all congenital heart disease(CHD). With advances in medical and surgical care, many children born with HLHS are surviving into adulthood. As survival has improved, greater emphasis has been placed on the long-term experiences of this population. This study seeks to evaluate the number and characteristics of discharges of HLHS patients in later childhood and adulthood over the last decade in the state of Texas.

METHODS:
This was a retrospective review of the Texas Inpatient Discharge Dataset, an administrative dataset containing most hospital discharges. The dataset was queried from 1/1/2009 through 12/31/2019. All non-trauma discharges from acute care hospitals of patients ≥5 years without missing data were included. HLHS was identified by an ICD-9/10 diagnosis code consistent with HLHS listed. Discharges of patients between 5-9 years of age with ICD9/10 procedure codes consistent with the Fontan operation were excluded. Number of discharges, reason for admission, and procedures performed were assessed. Descriptive and univariate statistics were utilized.

RESULTS:
A total of 1,027 HLHS discharges were identified with 50 discharges in 2009, increasing to 143 in 2019 an overall 186% and an annual 17% increase. The greatest increases were found in the 20-24 year group (1,400%) and the ≥25 years group (400%). Median length of stay (LOS) was 4[2-8] days and no differences were found between the age groups (p=0.270). There were 17 in-hospital mortalities (1.7%) and no differences were found by age group (p=1). The most common admitting and principal diagnoses are found in the Table. Five (0.5%) discharges included placement on extracorporeal membrane oxygenation(ECMO), 5(0.5%) placement of a ventricular assist device(VAD), 23 (2.2%) underwent heart transplantation and 37 (3.6%) a pacemaker intervention.

CONCLUSIONS:
Discharges of patients with HLHS have increased in number over time. As HLHS patients are surviving longer, there is a significant increase in the number of discharges of patients 20 years and older. Interestingly, pregnancy was the most frequent reason for admission in patients 20 years and older. No differences were seen in rates of ECMO, VAD, transplant or pacemaker intervention by age. As the focus in HLHS shifts from survival to Fontan, to long-term outcomes, it will be important to understand the burden of hospitalizations as well as the interaction between HLHS and other common acquired medical conditions.

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CONGENITAL POSTERS

CONG-P1. HOSPITALIZATIONS OF CHILDREN AND ADULTS WITH HYPOPLASTIC LEFT HEART SYNDROME IN TEXAS FROM 2009 – 2019

CONTINUED

Table

Age Group	Total Discharges	Most Common Admitting Diagnosis Category	Number (%)	Most Common Principal Diagnosis Category	Number (%)
5 – 9 Years	505	HLHS	80 (15.8%)	Respiratory Infection	70(13.9%)
10 – 14 Years	266	Gastrointestinal	51 (19.2%)	Gastrointestinal	58 (21.8%)
15 – 19 Years	145	Gastrointestinal	21 (14.5%)	Arrythmia	21 (14.5%)
20 – 24 Years	70	Pregnancy	8 (11.4%)	HLHS	8 (11.4%)
25+ Years	41	Pregnancy	12 (29.3%)	Pregnancy	14 (31.4%)
	Total Discharges	Extracorporeal Membrane Oxygenation	Ventricular Assist Device	Heart Transplant	Permanent Pacemaker Intervention
5 – 9 Years	505	3 (0.6%)	1 (0.2%)	9 (1.8%)	19 (3.8%)
10 – 14 Years	266	1 (0.4%)	2 (0.8%)	8 (3.0%)	8 (3.0%)
15 – 19 Years	145	1 (0.7%)	2 (1.4%)	4 (2.8%)	4 (2.8%)
20 – 24 Years	70	0	0	2 (2.9%)	2 (2.9%)
25+ Years	41	0	0	0	4 (9.8%)

Frequencies of Admitting and Principal Diagnoses and Select Procedures Across Ages

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CONGENITAL POSTERS

CONG-P2. IMPACT OF GRAFT SIZE ON PULMONARY FUNCTIONS TESTS IN A PEDIATRIC LUNG TRANSPLANTATION COHORT

AUTHORS
Carlos Diaz-Castrillon[1], Melita Viegas[2], Eric J. Hyzny[1], Mario Castro-Medina[2], Geoffrey Kurland[1], Victor Morell[2]

AUTHOR INSTITUTION(S)
[1]University of Pittsburgh Medical Center, Pittsburgh, PA; [2]UPMC Children's Hospital of Pittsburgh, Pittsburgh, PA

OBJECTIVES:
To describe pulmonary function tests (PFTs) during the first year of pediatric lung transplantation accounting for donor-recipient predicted total lung capacity (pTLC) matching.

METHODS:
PFTs were retrospectively reviewed among pediatric lung transplanted patients from 2005 and 2020 at a single center. We included FVC, FEV and FEV/FVC at 6 months and 1 year after lung transplantation. pTLC was estimated using the validated formula by by Weng and Levison for children older than 3 years (pTLC =0.160 x exp (0.021 x height).

RESULTS:
36 patients were included, with a median age of 13.9 years (IQR 10.7, 15.6), 55,5% (n=20) female patients, and 52% (n=19) Cystic Fibrosis (CF) patients. Overall, 16.6% (n=6), 41.6% (n=15), and 41.6% (n=15) patients had a donor/recipient pTLC ratio <0.9 (undersized), 0.9-1.1 (normal) and >1.1 (oversized), respectively. Recipients of oversized grafts tend to have higher force vital capacities; however no significant differences were observed in the PFT's among the groups. FEV1/FVC ratios were smaller in patients with oversized graft at 6 months and 1 year. (Table 1).

CONCLUSIONS:
PFT's in pediatric lung transplant patients are variable and dynamic, with several factors affecting its interpretation. No significant clinical differences in the PFT's were observed during the first year in our cohort of patients accounting for size mismatch.

PFTs by donor-recipient pTLC matching.

Donor/Recipient pTLC ratio PTFs	Undersized (<0.9) N=6	Normal (0.9 -1.1) N=15	Oversized (>0.1) N=15	p-value
FEV1 at 6 mo, Lt	1.76 (0.94 - 2.67)	1.18 (.985-1.46)	1.49 (.96-2.14)	0.39
Predicted (%)	84 (71 - 88)	65 (53 - 73)	59 (55 -71)	0.23
FVC at 6 mo, Lt	1.99 (1.07-2.78)	1.565 (1.25-1.995)	2.25 (1.34-3.04)	0.18
Predicted (%)	81 (77 - 88)	71 (53 - 87)	72 (65 - 84)	0.47
FEV1/FVC at 6 mo, (%)	91 (84 – 95)	86 (71 - 91)	76 (67 – 82)	0.03
FEV1 at 1 yr, Lt	1.7 (1.06-2.82)	1.39 (1.13-2.05)	2.13 (1.34-3)	0.38
Predicted (%)	89 (86 - 97)	81 (55 – 105)	74 (65 - 81)	0.38
FVC at 1 yr, Lt	2.02 (1.1-2.9)	1.6 (1.4 - 2.4)	2.6 (1.91 - 3.6)	0.08
Predicted (%)	86 (64 - 97)	87 (64 - 104)	84 (79 - 91)	0.94
FEV1/FVC at 1 yr, (%)	91 (82 - 92)	84 (77 - 94)	75 (67 - 86)	0.05

PFTs by donor-recipient pTLC matching.

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CONGENITAL POSTERS

CONG-P3. OUTCOMES OF MITRAL VALVE REPLACEMENT WITH A HANDMADE VALVE USING PORCINE EXTRACELLULAR MATRIX IN NEONATES AND INFANTS

AUTHORS
Frank Scholl[1], Mark Ruzmetov[1], Immanuel Turner[1], Steve Bibevski[1]

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REGULATORY DISCLOSURE
This presentation describes the off-label use of porcine sub intestinal submucosa extracellular matrix marketed under the trade names CorMatrix and ProxiCor for the use of custom handmade mitral valve constructs in neonates and infants.

OBJECTIVES:
Mitral valve replacement (MVR) is the only option for infants with severe mitral valve disease that is not reparable; however outcomes are generally not favorable. There are currently no prostheses available with a diameter <15 mm, stented valve constructs have longevity issues and there is little potential for growth. These circumstances create a clinically challenging scenario in caring for these fragile patients. This study reports our experience with MVR using a decellularized extracellular matrix (ECM) handmade valve in neonates and infants requiring mitral valve replacement.

METHODS:
Custom, systemic atrioventricular valves using porcine small intestinal submucosa (SIS) ECM were handmade for neonates and infants requiring MVR with an annulus of <15mm. Since May 2013, six patients underwent MVR with an SIS-ECM valve at our institution. Mean patient age was 3.1+2.5 months (range, 17 days to 7 months) and a mean weight of 5.2+2.1 kg (range, 3-9.4 kg) at the time of MVR. Two patients (33%) had undergone a previous surgical mitral valvuloplasty prior to MVR.

RESULTS:
All implants were technically successful, with no significant regurgitation and stenosis (one early patient required revision on post op day 1 for ventricular suture dehiscence). The mean diameter of implanted valve was 13.0+1.6 mm (range, 11-15). There were 2 early deaths from low cardiac output, in patients with significant associated lesions. All surviving patients were followed up, and the mean follow-up period was 35.0+27.7 months (range, 9-70). During follow-up period, three patients had mitral valve replacement with a larger diameter mechanical valve (n=2) or SIS-ECM valve (n=1). One patient expired 9 months after MVR due to pulmonary complications (pneumothorax with intrapulmonary hemorrhage). One patient continues to do well with her second SIS-ECM valve more than 1 year after surgery.

CONCLUSIONS:
A handmade custom mitral valve using decellularized SIS extracellular matrix is innovative, safe, and feasible without technical issues and demonstrates acceptable short-term function. It is useful as a "bailout" in challenging situations and allows for somatic growth and future implantation of a reasonably-sized mechanical prosthesis in the mitral annulus.

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CONGENITAL POSTERS

CONG-P4. BIVENTRICULAR CONVERSION AFTER LEFT VENTRICULAR RECRUITMENT PROCEDURE IN PATIENTS WITH HYPOPLASTIC LEFT HEART VARIANT

AUTHORS
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OBJECTIVES:
Patients with hypoplastic left heart structures undergo single ventricle palliation. Fontan complications have led some centers to look for alternatives to the traditional pathway. The objective of this study is to present a case series of patients preparing for or who have undergone biventricular conversion (BiV) after left ventricular (LV) recruitment procedure patients with hypoplastic left heart variant.

METHODS:
The Children's Memorial Hermann Heart Institute medical record was retrospectively reviewed between July 2017 and July 2020. Values were expressed as median and range. The nonparametric Mann-Whitney test was used to compare parameters. Differences were considered statistically significant when the P value was less than .05.

RESULTS:
Four patients met inclusion criteria and have hypoplastic left heart variant, had a left ventricular recruitment procedure, and were candidates for BiV conversion. 2 (40%) patients had a ventricular septal defect. 4 (100%) patients had already undergone a superior cavo-pulmonary anastomosis before their LV recruitment operation. During the LV recruitment procedure, 3 (75%) patients received a 6 mm Sano. The other patient received an 8 mm Sano. The atrial septal defect was tightened to approximately 4 mm in 3 (75%) patients. A band was placed to restrict flow between the Sano and the superior cavo-pulmonary anastomosis in all patients. The median number of interventions between LV recruitment and final BiV conversion operation was 0.5 (0 to 2). The median left ventricular long axis z-score increased from -4.65 (-4.9 to -3.4) to -1.75 (-4.7 to -1.3) after LV recruitment ($p < 0.05$). At catheterization after left ventricular recruitment, the median left ventricular end-diastolic pressure after balloon occlusion of the atrial septal defect was 14.5 mm Hg (7 to 24 mm Hg). 2 (50%) patients have undergone BiV conversion after their LV recruitment procedure. The other two patients are waiting for their LV to be favorable after recruitment. In the 2 patients after BiV conversion the right ventricular systolic pressure was estimated as 50% and 70% of systemic blood pressure. At a median follow-up from left ventricular recruitment of 18 months (9 to 37 months), 4 (100%) patients are alive.

CONCLUSIONS:
BiV conversion is feasible after left ventricular recruitment in patients with hypoplastic left heart variant with reasonable short-term clinical outcomes. As others have found there is the potential for increased re-interventions and elevated left ventricular diastolic pressures. Continued follow up will elucidate how this strategy compares to the long-term Fontan outcomes in the modern era.

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THORACIC POSTERS

GT-P1. TISSUE PLASMINOGEN ACTIVATOR ALONE WITH PROLONGED DWELL TIME EFFECTIVELY EVACUATES COMPLEX PLEURAL EFFUSIONS

AUTHORS
Alexandra Townsend[1], Harsha Raju[1], Krystina Serpa[2], Rachel Pruett[2], Syed Razi[2], Francisco Tarrazzi[2], Catherine Tami[2], Mark Block[2]

AUTHOR INSTITUTION(S)
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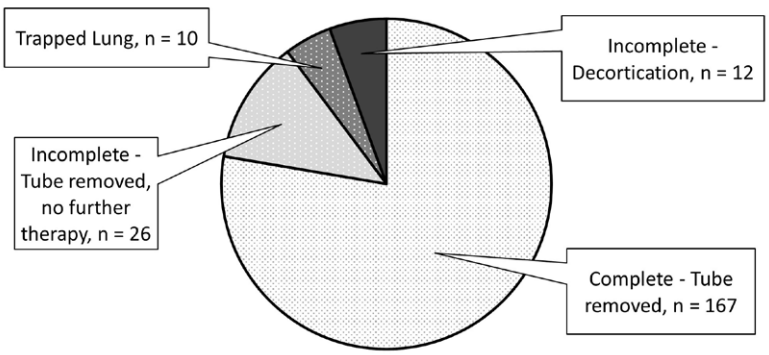
OBJECTIVES:
Intrapleural fibrinolytic therapy can be an effective alternative to surgery for management of complex pleural effusions. A current standard is based on the MIST II trial: tissue plasminogen activator (tPA, 10 mg) and DNAse with a dwell time of one hour, given every 12 hours for 3 days. With this regimen 6% of effusions required surgery. The half-life of tPA in the pleural space is unknown, and may be hours. We used a lower dose of tPA (4 mg) without DNAse but with a longer dwell time of 12 hours, repeated daily. We reviewed our results for comparison of outcomes.

METHODS:
Charts were reviewed for patients given tPA for a pleural effusion during 2018-2020. Demographics, chest tube data and treatment information were abstracted. Outcomes were assessed based on radiographic findings and need for surgery.

RESULTS:
215 effusions in 207 patients (8 bilateral) were identified. 85% were either infectious (parapneumonic or empyema, n = 139) or malignant (n = 44). 249 chest tubes were used: 84% (210) were 10 Fr or 12 Fr pigtail catheters and 7% (18) were PleurX catheters. 531 doses of tPA were given. The median number of doses per effusion was 2 (range 1 to 10), and 84% (180/215) of effusions were treated with three or fewer doses. 92% of the doses (486) were 4 mg and all but 10 doses (98%) had a dwell time of 12 hours.There were no significant bleeding complications. Median time from first dose of tPA to removal of all chest tubes was 6 days (range 1 to 98, IQR 4 to 10). Drainage was considered complete for 78% of effusions (167/215), while 6% (12) required decortication (Figure 1).

CONCLUSIONS:
Low dose tPA daily with a prolonged (12 hour) dwell time was as effective as the standard MIST-II regimen of tPA and DNAase twice daily. For the large majority of patients only three doses were required, and small pigtail catheters were sufficient. Duration of chest tube drainage was often extended but can likely be shortened with a streamlined protocol. This regimen uses less medication than MIST II and is logistically much easier. A randomized trial comparing the two regimens is planned.

Outcome Following Low Dose tPA with Prolonged Dwell Time for Complex Pleural Effusions



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THORACIC POSTERS

GT-P2. SINGLE INSTITUTION EXPERIENCE WITH COVID-19 PATIENTS SUFFERING FROM PNEUMOMEDIASTINUM

AUTHORS
John Waters[1], Tanya Pothini[1]

AUTHOR INSTITUTION(S)
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OBJECTIVES:
Pneumomediastinum in COVID-19 patients has unclear significance. Multiple groups have described this finding. This process is believed to be caused by the Macklin effect, resulting from increased intrathoracic pressure, which drives air exit from the alveolus into the mediastinum. The natural history is unclear. The majority of cases have been managed with observation and supportive care. Isolated case reports describe patients developing tension pneumomediastinum, treated with mediastinal decompression. We retrospectively reviewed the COVID-19 patient population with pneumomediastinum at two academic teaching hospitals with the intention of understanding the natural history and outcome of this disease.

METHODS:
Retrospective chart review was performed on patients identified to have COVID-19 and pneumomediastinum at two teaching hospitals in a single health care system. One hospital was a 900-bed county hospital; the other was a 600-bed traditional academic teaching hospital. Patient demographic and clinical data was abstracted from the medical record, de-identified, stored, and analyzed in a password protected Excel Spreadsheet.

RESULTS:
One-hundred and nine patients were identified to have COVID-19 associated pneumomediastinum: 96 in the county hospital, 13 in the traditional teaching hospital. Seventy-four (74) were men (67.9%). Mean age was 58.8 years (range 27-81). Mean BMI 31.94 (range 16.9-54.3). Twenty three (23) patients were former smokers, 5 current smokers. Six patients had underlying asthma, 1 patient had underlying COPD. In the county hospital patient population, 62 patients had pneumothorax with associated pneumomediastinum (64.5%). Fifty two patients developed pneumothorax after identification of pneumomediastinum (39 within 0-5 days, 6 within 6-10 days, 7 from 10-23 days). Ten patients developed pneumomediastinum after pneumothorax was identified (7 within 0-7 days). The death rate in patients who developed pneumomediastinum at the county hospital was 69.8%. In the traditional teaching hospital, ten patients developed pneumomediastinum following intubation (range day 0-13). Seven patients had associated pneumothorax. The death rate in patients with pneumomediastinum was 69.2% (date range 3-42 days after pneumomediastinum was identified).

CONCLUSIONS:
Pneumomediastinum is a serious finding in patients with COVID-19 and appears to a harbinger of poor patient outcome. At our center, there appeared to be a correlation between positive pressure ventilation use, smoking history, and obesity and development of pneumomediastinum. Interestingly, patients with known underlying lung disease did not appear to suffer disproportionately from this complication from COVID-19. There also was an association between development of pneumomediastinum and pneumothorax, suggesting a decompressive interplay between the mediastinum and pleural spaces. The death rate in patients with pneumomediastinum and COVID-19 approximated 69%. Treatments to decompress pneumomediastinum are controversial and were used sparingly at the academic teaching hospital with no survival improvement. The presence of pneumomediastinum should alert the health care team of the severity of a patient's condition and high likelihood of death. This series is the largest report to date in the literature.

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THORACIC POSTERS

GT-P3. NOVEL ROBOTIC APPROACH TO LUNG VOLUME REDUCTION SURGERY RESULTS IN EXCELLENT SHORT-TERM OUTCOMES

AUTHORS
Kristen Walker[1], Mindaugas Rackauskas[1], Mauricio Pipkin[1], Olusola Oduntan[1], Abbas Shahmohammadi[1], Sravanthi Nandavaram[1], Andres Pelaez[1], Tiago Machuca[1]

AUTHOR INSTITUTION(S)
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OBJECTIVES:
Despite clinical trial evidence supporting the survival and quality of life benefit derived from lung volume reduction surgery for well-selected patients with severe emphysema, current implementation has been hampered by the morbidity associated with the procedure. The current study describes a novel robotic approach to lung volume reduction surgery and reports on early outcomes.

METHODS:
Retrospective review of all consecutive patients who underwent robotic bilateral lung volume reduction surgery from July 2017 to March 2021 at a single institution. Approval was obtained by the Institutional Review Board and consent was waived due to the nature of the study. Patients were selected based on the National Emphysema Treatment Trial criteria and had performed preoperative supervised pulmonary rehabilitation. All procedures were performed robotically, with patients positioned supine and three ports inserted on each side. Intra-thoracic CO2 insufflation was utilized from 8-12 cmH2O as tolerated, robotic staplers buttressed with bovine pericardium were used and an apical pleurectomy was performed from 1st to 4th interspaces. Pain was controlled with an epidural catheter and more recently we have utilized an opioid-sparring postoperative protocol.

RESULTS:
During the study period, eight patients underwent robotic bilateral lung volume reduction surgery. Median age was 64 (IQR 55-65) years and six (75%) patients were female. Preoperative median FEV1 was 26% predicted (IQR 22%-32%), TLC was 118% predicted (IQR 116%-132%), RV was 224% predicted (IQR 207%-241%) and DLCO was 40% predicted (IQR 34%-45%). Five patients were on continuous supplemental O2 at rest while 3 were only using at night. There were no intraoperative complications. Postoperatively, one patient required pigtail insertion due to pneumothorax post-chest tube removal and one patient experienced prolonged air leak and was discharged with a Heimlich valve. The median length of hospital stay was 7 days and the median chest tube duration was 3.5 days. The 90-day survival was 100%. At the same timepoint, the median improvement in FEV1 was 300 ml or 37.5% increased from baseline. The median decrease in TLC was 510 ml or 8% lower than baseline. Lastly, the RV decreased by a median 1.19L or 30% lower than baseline. All patients transitioned to being on room air at rest and reported a favorable functional outcomes.

CONCLUSIONS:
This single-center series suggests that the proposed novel robotic approach results in excellent short-term outcomes with low morbidity. The long-term implications and reproducibility of the method remain to be determined.

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THORACIC POSTERS

GT-P4. CLINICAL SNAPSHOT: CURRENT PRACTICE PATTERNS IN GENERAL THORACIC SURGERY

AUTHORS
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AUTHOR INSTITUTION(S)
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OBJECTIVES:
Modern thoracic surgical practice is defined by evidence-based approaches to all phases of perioperative care. New data is continuously challenging traditional paradigms of perioperative management, but the actual current practice patterns have not been fully defined. Limited information exists on whether or not there is an established standard of care for common perioperative elements.

METHODS:
A web-based multiple-choice questionnaire was distributed by email to the 314 current and provisional members of the General Thoracic Surgery Club (GTSC). The questionnaire was created after discussion with focus groups consisting of surgical residents and attending surgeons. Basic demographic data consisting of location, place of practice, years of experience, and practice setting were obtained.

RESULTS:
80 unique responses were recorded for an overall response rate of 25%. 91% were practicing thoracic surgeons and 9% were currently thoracic trainees or general surgeons. Most respondents (55%) were attending surgeons in an academic setting or practicing in a primarily private practice or hospital employed setting (35%). Of attending surgeons (non-trainees), 79% reported using ERAS or other fast track protocol. ERAS or fast track protocols were more commonly used by academic surgeons (93%) than primarily private practice/hospital employed surgeons (50%). The typical approach for a standard, non-complicated wedge resection or lobectomy was VATS in 53%, versus 32% of respondents who used the robotic platform.

The majority of respondents (82%) reported the absolute effluent volume guided chest tube removal, with 52% utilizing 400cc of non-bloody output in the preceding 24-hours as the cutoff for removal. Digital chest drainage devices were available at 30% of respondents' facilities with a 63% utilization rate if available. 73% reported trialing patients on water seal prior to removal with most (59%) not obtaining a chest radiograph after placement to water seal.

Post-removal chest radiographs were obtained routinely by 54% of respondents, with the majority (78%) having no set time preference for obtaining a chest radiograph on day of removal. 57% prefer to pull chest tube after a full inspiration versus 25% after expiration and 18% have no preference.

CONCLUSIONS:
The axioms of modern surgical care are decreased length of stay, improved cost-effectiveness, and improved patient outcomes. Our study provides insight into the current behaviors of practicing general thoracic surgeons. This data has the potential to identify areas for improvement, generate discussion around what constitutes the standard of care, and encourage future research regarding the perioperative management of thoracic patients.

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THORACIC POSTERS

GT-P5. PARALYSIS SECONDARY TO INTRACRANIAL VENOUS HYPERTENSION FOLLOWING VV ECMO DUAL- LUMEN JUGULAR CANNULATION: A SENTINEL REPORT.

AUTHORS
Fatima Wilder[1], Zachary Enumah[1], Jinny Ha[2], Bo Soo Kim[1], Sung-Min Cho[1], Michael Grant[2], Stephen Broderick[1], Stephanie Cha[1], Ferdinand Hi[1], Errol Bush[1]

AUTHOR INSTITUTION(S)
[1]Johns Hopkins University Medical Center, Baltimore, MD; [2]Johns Hopkins University School of Medicine, Baltimore, MD

OBJECTIVES:
Veno-venous extracorporeal membrane oxygenation (VV-ECMO) has become established as standard adjunctive therapy for patients with severe ARDS secondary to COVID-19. We report the first case of self-limited neurologic sequelae secondary to intracranial venous hypertension in a patient with COVID-19 respiratory failure bridged to transplant using a dual lumen internal jugular venous ECMO cannula. The identification of this potential complication associated with dual lumen ECMO cannulae may assist in earlier intervention for patients presenting with these symptoms.

METHODS:
Case Report: A 60 year old healthy male was found to be COVID-19 positive with associated Klebsiella pneumonia. Despite maximal medical therapy (remdesivir, decadron, mechanical ventilation, prone positioning, and neuromuscular blockade), his disease progressed and his hospital course was complicated by disseminated HSV and right pneumothoraces secondary to a bronchopleural fistula caused by barotrauma. Due to inadequate ventilation, he was subsequently cannulated with VV-ECMO via a dual lumen right internal jugular cannula. During his 63-day ECMO course, he experienced recurrent episodes of transient neurological deficits such as facial droop, encephalopathy, quadriplegia, and sensory loss that would self-resolve within hours. Head/spine computed tomography, spinal angiography, and lumbar puncture were unremarkable. Cerebral angiography/venography demonstrated an elevated venous pressure (15 mmHg) at the torcula along with a lack of blood flow in the right internal jugular vein (RIJV). A loss of intracranial venous pulsatility was observed in the cerebral venous system that was restored at the superior vena cava.

RESULTS:
The patient ultimately underwent successful bilateral orthotopic lung transplantation (80 days since diagnosis) and was successfully decannulated on post-transplant day 1. Interval cerebral venography demonstrated occluded RIJV but with restored venous pulsatility after the decannulation. RIJV blood flow was restored by venous angioplasty with stenting. He had no further neurologic events.

CONCLUSIONS:
VV-ECMO associated neurologic events have been previously reported in the literature. However, intracranial venous hypertension is a unique but potentially underrecognized case of neurologic consequences of cerebral venous stasis secondary to an ECMO cannula that should be further investigated. This sentinel report will inform patient care for surgeons and critical care providers and may lead to earlier identification of this process in the clinical setting. This may in turn lead to an alteration of cannulation strategy leading to overall improvement in patient management.

Cerebral angiography demonstrating absent flow in the right internal jugular vein (RIJV) (A), restored with stenting (B)

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THORACIC POSTERS

GT-P6. LOBECTOMY PROVIDES BEST SURVIVAL FOR STAGE I LUNG CANCER PATIENTS DESPITE ADVANCED AGE

AUTHORS
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AUTHOR INSTITUTION(S)
[1]Houston Methodist Hospital, Houston, TX

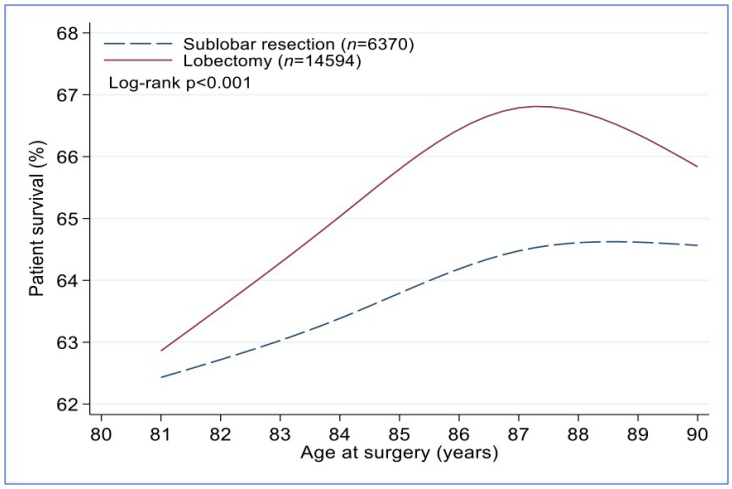
OBJECTIVES:
The Lung Cancer Study Group has shown that lobectomy provides the best survival in a patient with non-small cell lung cancer. However, as patients get older, we wanted to determine at what age cut-off, lobectomy no longer provides a survival advantage compared to sublobar resection.

METHODS:
We analyzed the National Cancer Database (NCDB) for octogenarians with pathologic stage I lung cancer from 2004 to 2015. We then evaluated the patients who underwent lobectomy or sublobar resection for the treatment of cancer. We analyzed the 5-year survival rates between the groups. We then performed a cubic spline plot for patient survival by age to determine the possible age cut-offs at which the benefit of lobectomy was no longer found compared to sublobar resection.

RESULTS:
There were 227,134 octogenarians (14.8%) out of 1,535,577 patients in the NCDB database. Among the octogenarians, there were 25,362 (26%) who had pathologic stage I lung cancer. There were 6,370 (30%) patients who had sublobar resections while 14,594 (70%) patients had a lobectomy. There was significantly improved survival at five years with lobectomy compared to sublobar resection (48.5% vs. 41.1%, p<0.001). The cubic spline plot provided evidence that there was no age where sublobar resection provided better or equal survival to lobectomy (p<0.001).

CONCLUSIONS:
In octogenarians with pathologic stage I lung cancer, lobectomy provided better five-year survival compared with sublobar resection regardless of their age at surgery. Older age should not prevent a patient with stage I lung cancer from having a lobectomy. Hence, all stage I cancer patients should be considered for a lobectomy if they are medically able to tolerate such a procedure.

Cubic Spine Splot Survival by Age at Surgery



There was no age cut-off where survival after sublobar resection was equal to survival after lobectomy in patients with stage I lung cancer (p<0.001)

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THORACIC POSTERS

GT-P7. WHERE DOES THE TIME GO? TRANSITIONING FROM VATS TO ROBOTIC LUNG RESECTION: OPPORTUNITIES FOR IMPROVEMENT IN EFFICIENCY

AUTHORS
Michael Weyant[1], Anna Gergen[2]

AUTHOR INSTITUTION(S)
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OBJECTIVES:
Opponents of robotic lung resection list increased operative time and the resultant increase in cost as an important obstacle to the adoption of robotic lung resection. Several authors have reported approaches to increase the efficiency of the specific steps of a robotic operation, however, few reports have examined where additional time is used during robotic surgery cases compared to VATS cases outside the actual procedure time. Identifying and standardizing these factors may help to illustrate areas where efficiency can be improved for robotic lung resection.

METHODS:
We compared VATS lung resection cases in the 18 months prior to adopting robotic lung resection to the first 100 robotic lung resections performed robotically by a single, VATS proficient surgeon. Cases were grouped to allow appropriate comparison of operative times: Group 1) Lobectomy + mediastinal lymph node dissection Group 2) Mediastinoscopy followed by lobectomy Group 3) Wedge followed by completion lobectomy Group 4) Lobectomy alone. Only anatomic lung resections were included in this study. Time variables recorded for all VATS and robotic cases included: Skin to Skin time (SS), Induction to Extubation or total case time (TCT), TCT-SS (an approximation of time for anesthesia), Console time, and SS-console time (a measure of time spent docking and targeting surgical robot).

RESULTS:
Group 1 robotic cases were longer than VATS cases by an average of 26.5 minutes Table 1. Group 2, 3, and 4 cases did not demonstrate a statistical difference in time Table 1. Total case time (induction to extubation) for robotic cases were significantly longer in Group 1 but not in groups 2,3 and 4. Total case time minus skin to skin time (an approximation of anesthesia time) was longer in Group 1 robotic cases (157.3 vs 193min) (p=0.0002). Mean console time for robotic cases was 117.7 ± 29.8 min. The mean skin to skin time minus console time (robotic docking time) was 43.4 ± 10.4 min. in Group 1 robotic cases. When comparing Group 1 VATS cases and overall robotic console time, console time was significantly shorter than VATS cases (117.7 vs 133.9min)(p=0.05).

CONCLUSIONS:
Introduction of robotic lung resection added at most 26.5 minutes of time to the overall skin to skin time when compared to VATS. The addition of staging and diagnostic procedures negated this difference. These findings indicate that categorizing similar cases will be of value when future comparisons of these approaches are made. The use of console time as a comparison to VATS cases suggests higher level of efficiency in the robotic approach but should be used with caution. The extraprocedural time and anesthesia time in robotic cases represent high-yield targets for improvement in efficiency in robotic cases.

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THORACIC POSTERS

GT-P7. WHERE DOES THE TIME GO? TRANSITIONING FROM VATS TO ROBOTIC LUNG RESECTION: OPPORTUNITIES FOR IMPROVEMENT IN EFFICIENCY

CONTINUED

Table 1. Comparison of Time Segments in VATS and Robotic Lung Resection Cases

Procedure Time (minutes)	VATS (n=77)	Robotic (n=100)	Time Δ(min)	p
All Procedures	164.6±48.5	164.8±44.3	0.2	0.96
Group 1 (Lobectomy +MLND)	n=33	n=69		
Skin to Skin time	130.2±43.2	156.7±35.8	26.5	0.003
Induction to Extubation Time (TCT)	157.3±44.7	193.1±38.8	35.8	0.0002
TCT-SS time(anesthesia time)	26.1±10.3	36.7±17.3	10.6	0.0001
Group 2 (Medistinoscopy + Lobectomy)	n=33	n=14		
Skin to Skin time	199.3±31.1	224.6±47.0	25.3	0.08
Induction to Extubation time (TCT)	224.4±35.6	249.4±46.1	25.0	0.08
Group 3 (Wedge + Lobectomy)	n=7	n=14		
Skin to Skin time	162.9±29.3	148.8±36.9	-14.1	0.36
Induction to Extubation Time (TCT)	194.1±23.8	188.6±36.7	-5.5	0.58
Group4 (Lobectomy Alone)	n=4	n=3		
Skin to Skin time	164.3±37.8	142.3±20.6	-22	0.37
Induction to Extubation time (TCT)	184.5±36.0	190.7±21.6	6	0.79

THORACIC POSTERS

GT-P8. ANALYSIS OF ADJUVANT TREATMENT FOR LOCALIZED PRIMARY PULMONARY CARCINOSARCOMA

AUTHORS
Arian Mansur[1], Larisa Shagabayeva[1], Alexandra Potter[2], Lana Schumacher[2], Chi-Fu Yang[2]

AUTHOR INSTITUTION(S)
[1]Harvard Medical School, Boston, MA; [2]Massachusetts General Hospital, Boston, MA

OBJECTIVES:
Data on optimal adjuvant therapy for patients with primary pulmonary carcinosarcoma are limited. The objective of this study is to determine the potential benefits of adjuvant therapy in patients who undergo complete resection for localized primary pulmonary carcinosarcoma.

METHODS:
Overall survival of patients with localized primary pulmonary carcinosarcoma who underwent complete resection in the National Cancer Data Base from 2004 to 2017, stratified by adjuvant therapy regimen, was evaluated using Kaplan-Meier and Cox proportional hazards analysis. Patients treated with induction therapy and those who died within 30 days of surgery were excluded from analysis.

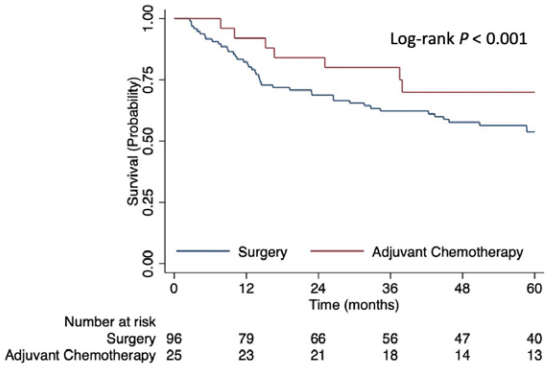
RESULTS:
Of 139 patients who had localized primary pulmonary carcinosarcoma during the study period, 133 patients (95.7%) underwent complete R0 resection with a 5-year survival of 55.2%. Adjuvant therapy was administered to 27.1% of patients (n = 36), including chemotherapy alone (n = 25), chemoradiation (n =9), radiation alone (n = 2) and no adjuvant treatment (n = 97). In unadjusted analysis, compared with surgery alone, adjuvant chemotherapy was associated with significantly improved survival (Table 1). In addition, multivariable Cox modeling demonstrated that treatment with adjuvant chemotherapy (hazard ratio [HR], 0.072; 95% CI, 0.13 to 0.39) was associated with improved survival when compared with no adjuvant therapy.

CONCLUSIONS:
In this national analysis, surgery followed by adjuvant chemotherapy was found to be associated with a survival benefit when compared to surgery alone in treatment of primary pulmonary carcinosarcoma.

Table 1. Unadjusted and Multivariable-Adjusted Analyses

Unadjusted Analysis			
Staging	*Surgery*	*Adjuvant Chemotherapy*	*P Value*
Localized	53.8% (43.0%-63.4%)	70.0% (46.8%-84.6%)	0.0259
Multivariable Cox Model			
Staging	*Adjuvant Chemotherapy VS Surgery (ref) Hazard Ratio*	*95%CI*	*P Value*
Localized	0.072	0.13-0.39	0.002

Overall survival of patients with localized pulmonary carcinosarcoma, stratified by treatment



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THORACIC POSTERS

GT-P9. CHANGE IN TOTAL PSOAS AREA IN PATIENTS UNDERGOING ESOPHAGECTOMY

AUTHORS
AlleaBelle Gongola[1], Jace Bradshaw[2], David Strain[2], Kevin Sexton[2], Jason Muesse[2]

AUTHOR INSTITUTION(S)
[1]University of Kentucky College of Medicine, Lexington, KY; [2]University of Arkansas for Medical Sciences, Little Rock, AR

OBJECTIVES:
Patients with esophageal cancer who undergo esophagectomy are at high risk for malnutrition and subsequent complications. Radiographic indicators of muscle mass have been used for these patients and may be useful for predicting outcomes, but few studies have measured change in their muscle mass over time. Our primary objective was to quantify muscle mass change over the course of treatment for esophageal cancer patients undergoing neoadjuvant chemotherapy followed by esophagectomy. Our secondary objectives were to determine the prevalence of sarcopenia and to compare muscle mass change alongside other outcomes between patients who received or did not receive nutritional interventions.

METHODS:
We retrospectively reviewed patients who underwent esophagectomy for esophageal cancer at a single center between 2014 and 2019. Data were collected using our institutional clinical data repository and chart review. Our patients usually have three CT scans: first, at the scan at the time of the initial diagnosis (pre-treatment); second, after completion of neoadjuvant treatment prior to surgical resection (post-treatment); and third, at the 6-month postoperative visit (6-month). We used CT scans to measure total psoas area (TPA) at the L3 level and then used normalized measurements to determine sarcopenia prevalence and muscle mass change over the course of treatment. Sarcopenia was defined by previously established TPA cutoffs.

RESULTS:
We included 103 patients. At the time of diagnosis, the average normalized TPA was 594 mm2/m2, and 42% of patients had a TPA that was below the cutoff for sarcopenia. The mean change between the pre-treatment and 6-month postoperative scans was -101.9 mm2/m2, indicating an average loss of muscle mass over the course of treatment (Figure 1). The prevalence of sarcopenia increased from 42% at pre-treatment to 60% at 6-months. When comparing patients in groups based on nutritional counseling or tube feeding intervention, there was a significant improvement in muscle mass with the combination of nutritional interventions ($p<0.05$) (Table 1). Other measured outcomes were not different based on nutritional interventions.

CONCLUSIONS:
Using CT scans to measure TPA change, we observed an average loss of muscle mass over the course of treatment for esophageal cancer. We found that nutritional intervention was associated with a decreased loss of muscle mass. These findings suggest the possible use of muscle mass as a way to evaluate the effectiveness of nutritional interventions.

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GT-P9. CHANGE IN TOTAL PSOAS AREA IN PATIENTS UNDERGOING ESOPHAGECTOMY

CONTINUED

Change in total psoas area between pre-treatment, post-treatment, and 6-month scans.

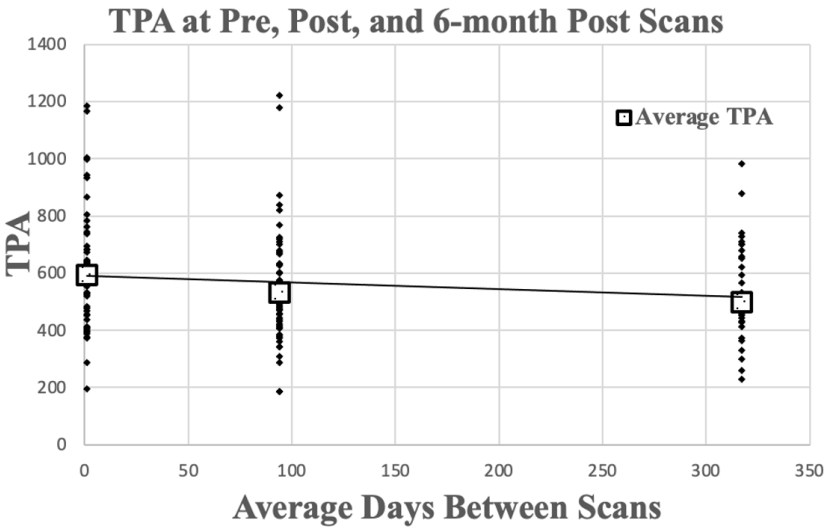

Table 1

	Preoperative Nutritional Counseling (46)	Preoperative Tube Feeding (34)	None (51)	*P* value
Total TPA change* (n=47)	-8.4 (404)	54.4 (369.9)	-214.0 (464)	0.01
Length of stay, days, median (IQR)	18 (13, 20)	20 (13, 21)	21 (13, 27)	0.67
30-day readmission, *n* (%)	13 (28)	10 (29)	12 (24)	0.80
90-day mortality, *n* (%)	3 (7)	1 (3)	4 (8)	0.64

Outcomes comparing patients who received either preoperative nutritional counseling, preoperative tube feeding, or no specific nutritional intervention.

THORACIC POSTERS

GT-P10. VEIN-FIRST VS. ARTERY-FIRST ROBOTIC LOBECTOMY OUTCOMES IN NON-SMALL CELL LUNG CANCER

AUTHORS
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AUTHOR INSTITUTION(S)
[1]UAB School of Medicine, Birmingham, AL; [2]University of Alabama at Birmingham, Birmingham, AL

OBJECTIVES:
Little is known about whether the order of pulmonary vessel division affects surgical outcomes in patients undergoing robotic lobectomy for non-small cell lung cancer (NSCLC). Some authors have suggested that ligation of the pulmonary veins should be conducted first in order to minimize the spread of tumor cells secondary to manipulation of the lung cancer. This study examines whether there is a difference in outcomes between patients who undergo robotic lobectomies for NSCLC using a vein-first (V-first) vs. artery-first (A-first) technique.

METHODS:
A retrospective review of electronic medical record data was performed for patients who underwent robotic lobectomies from January 2013 to May 2019. Patients were separated into two groups based on the sequence in which the pulmonary vessels were divided: V-first or A-first. Baseline characteristics and postoperative events were recorded and subsequently compared between groups using Chi-square and Student's t-tests. Kaplan-Meier survival curves for overall and recurrence-free survival were constructed and compared with log-rank tests.

RESULTS:
Of the 390 patients, 100 V-first and 290 A-first patients were identified. There were no significant differences in demographic or clinical characteristics between the two groups. V-first patients were more likely to have undergone a right upper lobectomy (52% (n=52) vs. 35.5% (n=103); p=.024) or right middle lobectomy (19% (n=19) vs. 2.8% (n=8); p<.001), whereas A-first patients were more likely to have undergone a left upper lobectomy (23.1% (n=67) vs 2% (n=2); p<.001). Tumors ≤ 2cm made up 47.4% (n=37) of V-first operations compared to 30.0% (n=80) of A-first operations (p=0.02). Mean operative duration was higher in the V-first group (175 min vs. 144 min, p=0.04). There was no significant difference between the two groups with regards to pathologic stage, postoperative complications, length-of-stay, recurrence-free survival, or overall survival (Figure 1).

CONCLUSIONS:
Our study suggests that choosing a vein-first vs. artery-first technique for a robotic lobectomy does not significantly impact overall survival or cancer recurrence for patients with NSCLC. We found a significant difference with technique selection based on tumor size and location. Tumors ≤ 2cm, and those located in the right upper or middle lobes were more likely to be resected with removal of the vein first, whereas tumors in the left upper lobe were more likely to be resected with removal of the artery first. Further studies are needed to evaluate whether the order of pulmonary vessel resection affects outcomes for patients with NSCLC.

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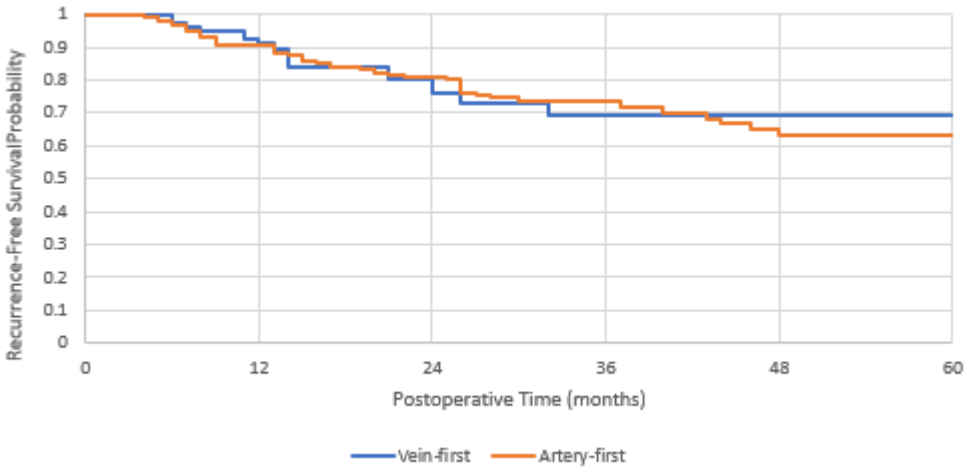
THORACIC POSTERS

GT-P10. VEIN-FIRST VS. ARTERY-FIRST ROBOTIC LOBECTOMY OUTCOMES IN NON-SMALL CELL LUNG CANCER

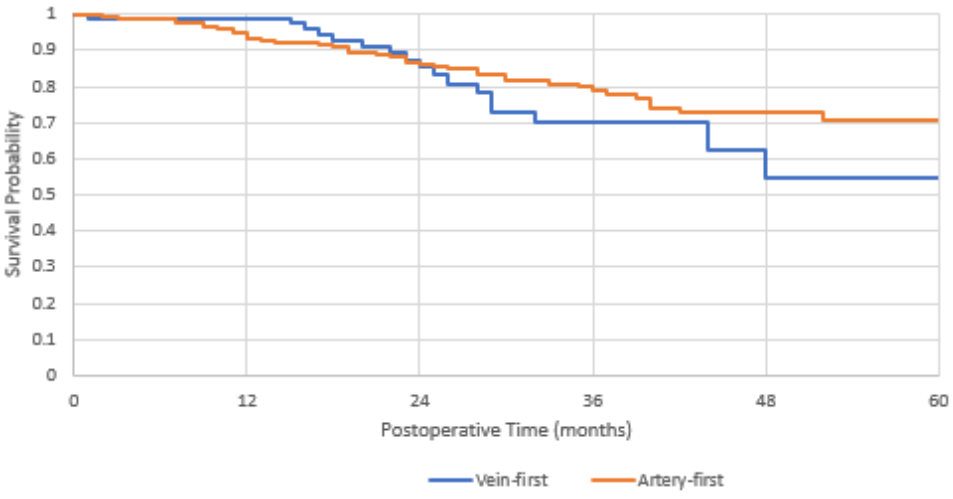
CONTINUED

Kaplan-Meier Recurrence-Free Survival Curve



Kaplan-Meier recurrence-free survival curve for vein-first and artery-first robotic lobectomy groups

Kaplan-Meier Overall Survival Curve



Kaplan-Meier overall survival curve for vein-first and artery-first robotic lobectomy groups

THORACIC POSTERS

GT-P11. MODELING THE COVID PANDEMIC: DO DELAYS IN SURGERY JUSTIFY USING STEREOTACTIC RADIATION TO TREAT EARLY STAGE NON-SMALL CELL LUNG CANCER?

AUTHORS
Lifen Cao[1], Philip Linden[1], Stephanie Worrell[2], Tithi Biswas[3], Jillian Sinopoli[1], Megan Miller[1], Robert Shenk[1], Christopher Towe[1]

AUTHOR INSTITUTION(S)
[1]University Hospitals Cleveland Medical Center, Cleveland, OH; [2]University Hospital and Case Western Reserve University, Cleveland, OH; [3]University Hospitals Seidman Cancer Center, Case Western Reserve University, Cleveland, OH

OBJECTIVES:
European Society for Medical Oncology (ESMO) guidelines for non-small cell lung cancer care during the COVID19 pandemic suggests that stereotactic radiation (SBRT) is an "alternative if no surgical capacity is available". Although SBRT has been compared to surgery in high risk patients, there have not been comparisons among young and healthy patients. The purpose of this study was to compare the oncologic outcomes of surgical resection and stereotactic radiation among patients with early stage lung cancer and limited comorbidities. We hypothesized that stereotactic radiation would be associated with inferior survival.

METHODS:
The National Cancer Database was queried for patients with T1AN0M0 NSCLC underwent surgery or stereotactic radiotherapy from 2010-2016. Patients with age above 80 or Charlson Comorbidity Score above 0 were excluded. Surgery was defined by lobectomy or sub-lobectomy resection. The outcome of interest was overall survival. A 1:1 propensity match with replacement was performed to reduce bias between the groups. Survival was analyzed using stratified multivariable Cox proportional hazard regression analyses.

RESULTS:
Of 6,967 patients, 6,008 (86.3%) underwent surgery and 959 (13.8%) were treated with stereotactic radiotherapy. Stereotactic radiotherapy patients were more likely to present as older age (median age 71 vs. 66, p<0.001), male gender (42.5% vs. 36.9%, p=0.001) and non-private insurance holders (82.8% vs. 61.9%, p<0.001). Among surgery patients, 7.3% (423/5,810) also received chemotherapy and 89.6% (5,071/5,660) lymph nodes removed. Propensity matching reduced the median bias between the study cohorts from 10.3 to 2.1, and allowed 4,420 pairs for analysis. After match, surgery was associated with superior overall survival compared with stereotactic radiotherapy (5-year survival 80.5% vs. 41.0%, P<0.001), the improved survival benefit was also demonstrated by multivariate cox regression after controlling age, gender, race, insurance and facility type (surgery vs. stereotactic radiotherapy, HR=0.2, P<0.001, table).

CONCLUSIONS:
This analysis of the National Cancer Database suggests that relative to surgical resection, stereotactic radiation is associated with inferior long-term survival among younger patients without significant comorbidity. Although the COVID-19 pandemic has disrupted access to surgical resection, stereotactic radiation is an inferior modality to treat early stage lung cancer in medically operable patients. We advocate for use of surgical resection except in dire circumstances.

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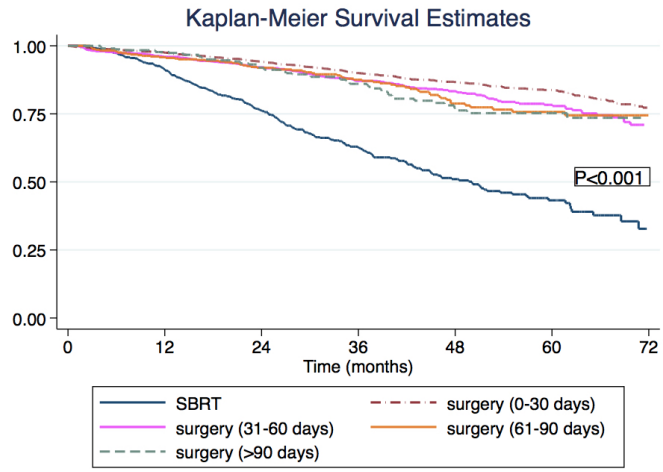
THORACIC POSTERS

GT-P11. MODELING THE COVID PANDEMIC: DO DELAYS IN SURGERY JUSTIFY USING STEREOTACTIC RADIATION TO TREAT EARLY STAGE NON-SMALL CELL LUNG CANCER?

CONTINUED

Kaplan-Meier analysis of overall survival of T1AN0M0 NSCLC patients comparing SBRT versus surgery 0-30 days, 31-60 days, 61-90 days and >90days.



Comparison of groups performed using log-rank test. Overall survival was superior in surgery occurred at all time points evaluated: 0-30days, 31-60 days, 61-90 days and >90 days versus SBRT (5-year survival 83.8%, 78.3%, 75.7%, 75.3% vs. 43.2% respectively, P<0.001).

Cox proportional hazard regression for overall survival among a propensity matched cohort of patients with T1AN0M0 NSCLC

Cofactor	Hazard Ratio	95% Conf. Int.		*P*-value
Surgery vs. Stereotactic radiotherapy	0.246	0.224	0.270	<0.001
Age	1.024	1.017	1.031	<0.001
Male	1.258	1.162	1.362	<0.001
Caucasian	1.894	1.624	2.208	<0.001
Private insurance	0.687	0.632	0.747	<0.001
Academic facility	0.246	0.224	0.270	<0.001

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THORACIC POSTERS

GT-P12. FINAL DISTENSIBILITY INDEX AFTER LINX PLACEMENT DOES NOT CORRELATE WITH POST-OPERATIVE DYSPHAGIA

AUTHORS
Shawn Purnell[1], Duc Nguyen[1], Edward Chan[1], Ray Chihara[1], Edward Graviss[1], Min Kim[1]

AUTHOR INSTITUTION(S)
[1]Houston Methodist Hospital, Houston, TX

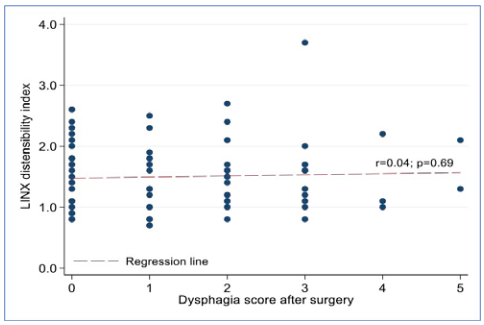
OBJECTIVES:
Magnetic sphincter augmentation or LINX provides a barrier between the esophagus and stomach to treat patients with symptomatic gastroesophageal reflux (GERD) with or without hiatal hernia. Endoscopic functional lumen imaging probe (EndoFLIP) measures changes in esophageal volume and pressure to calculate distensibility index (DI), which can help tailor closure of the crus and provide final objective measurement after placement of LINX. The aim of our study was to examine the relationship between EndoFLIP measurements and postoperative outcomes in the patient that underwent the LINX procedure. We hypothesized that the final DI would correlate with dysphagia after surgery.

METHODS:
We performed a retrospective analysis of prospectively collected data on consecutive patients who underwent LINX from 2017-2021. We excluded patients who did not have completed preoperative and postoperative GERD health-related quality of life (GERD-HRQL) assessment. We then analyzed the overall GERD-HRQL score, dysphagia score, and bloat score before and after the surgery. We performed Pearson's correlation test to determine the correlation between dysphagia and the final distensibility index (DI) after LINX. We also used the generalized linear model (GLM) to determine the characteristics associated with the dysphagia score.

RESULTS:
There were 117 patients who underwent a LINX procedure during the time period, and 91 patients met the criteria. The median age of the cohort was 60, with the majority of the patients being female (71.4%), white (92.3%), and with Type I hiatal hernia (56.7%). The final median DI after LINX placement was 1.5 with IQR (1.1, 1.8) with 30 cc in the 8 cm EndoFLIP balloon. There was a significant decrease in the GERD-HRQL score (0-50 scale) from 21.4 to 5.9 ($p<0.001$) and bloat score (0-5 scale) from 2.6 to 1.8 ($p=0.03$), but there was no significant difference in dysphagia score (0-5 scale) from 1.7 to 1.4 ($p=0.34$) before and after placement of the LINX. Pearson's correlation test showed no correlation between dysphagia and final DI after LINX placement ($p=0.69$). The GLM analysis suggested that the only factor significantly associated with increased dysphagia was younger age ($p=0.02$).

CONCLUSIONS:
There was no correlation between final DI after placement of the LINX device and dysphagia score. This could be due to low rates of significant dysphagia in the group with keeping DI after the closure of crus > 0.5. Further studies are needed to elucidate the correlation between DI and dysphagia.

Correlation between final distensibility index after LINX placement and post-operative dysphagia score



There is no correlation between the final distensibility index after LINX placement and dysphagia score after surgery

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SCIENTIFIC VIDEOS

ADULT CARDIAC SURGERY VIDEOS

AC-V1. THE SUPPORTED ROSS PROCEDURE

AUTHORS
William Brinkman[1], William Ryan[1], Katherine Harrington[1]

AUTHOR INSTITUTION(S)
[1]Baylor Scott & White, The Heart Hospital, Plano, TX

OBJECTIVES:
We are pleased to present a video of a Supported Ross procedure in a 41 year old male with a Sievers Type 1 bicuspid aortic valve with severe aortic insufficiency, degenerated calcific aortic leaflets, and dilated left ventricular diameters. The autograft is fully supported in a 28 mm Cardioroot dacron graft. Right ventricular outflow tract reconstruction was performed with a 32mm male PA homograft.

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ADULT CARDIAC SURGERY VIDEOS

AC-V2. ROBOTIC REDO MITRAL VALVE REPLACEMENT AND LEFT VENTRICULAR PSEUDOANEURYSM REPAIR SECONDARY TO ATRIOVENTRICULAR DISSOCIATION

AUTHORS
Panos Vardas[1], Raymond Lopez[1], Richard Stephens[1], Charles Tyndal, Jr[1], James Davies, Jr[1], Clifton Lewis, T.P.[1]

AUTHOR INSTITUTION(S)
[1]University of Alabama at Birmingham, Birmingham, AL

OBJECTIVES:
We report a case of a 73 year-old female with a chronic contained atrioventricular groove separation, associated with left ventricular (LV) pseudoaneurysm after two prior mitral valve operations via sternotomy, which was repaired with robotic assisted re-operative surgery. She was presented with decompensated heart failure, secondary to severe perivalvular leak associated dehiscence of the mitral annulus.

METHODS:
Under general double-lumen endotracheal anesthesia and systemic heparinization, peripheral cannulation was performed. A 5 mm incision was made for initial thoracoscopy in the right fourth intercostal space, and later expanded and used for the robotic camera. A 2 cm working port was placed 2 cm lateral to this and three 8 mm ports were created for the left, right, and third arm retractors in the second, sixth, and fifth intercostal spaces respectively. After institution of cardiopulmonary bypass (CPB), an aortic cross-clamping obtained with an intraortic balloon giving a brisk diastolic cardiac arrest with antegrade standard cardioplegia.

RESULTS:
The pericardium was opened and the mitral valve was exposed through a vertical left atriotomy. The prosthesis had dehisced along its margin near the aortic mitral curtain, swinging up and around to the right side. The valve was excised using a combination of the Bovie electrocautery and robotic scissors, exposing the pseudoaneurysm. The defect began from the A2-A3 junction and swinging around to the mid-P2 area, creating a contained rupture along most of the right side of the annulus about 4.5-5 cm by 3 cm in size. We sized the defect's orifice and depth with a 2 cm length of suture and fashioned a gelatin-impregnated knitted Dacron patch into a 4.5-cm by 2.5-cm ellipse. This was secured to the edges of the defect with 2-0 Ethibond pledgeted mattress sutures, passed first through the heart and then through the patch. It was secured with COR-KNOT, effectively excluding the pseudoaneurysm. 2-0 Ethibond pledgeted, everting sutures were placed around the neo-annulus, brought through the wound, and then placed through a 29 mm Medtronic mechanical prosthesis. This was seated and secured with COR-KNOT, and the left atrium was closed over an LV vent with a running Gore-Tex suture. The patient, after 115 and 154 minutes of cross-clamp and bypass time respectively, was weaned without difficulties. The patient had an uneventful recovery and currently she is well and free of symptoms.

CONCLUSIONS:
The presence of a pseudoaneurysm secondary to a chronic atrioventricular dissociation posed extra challenges in this patient's third mitral valve replacement. With the successful outcome of this totally-endoscopic and robotic-assisted repair, we demonstrate the flexibility of robotic approaches to address complicated anatomy as well as a surgical field scarred by multiple prior operations.

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ADULT CARDIAC SURGERY VIDEOS

AC-V3. SEVERE MITRAL REGURGITATION FOLLOWING MIGRATION OF PERCUTANEOUS OCCLUDER DEVICE FOR POST-INFARCT VENTRICULAR SEPTAL DEFECT

AUTHORS
Kirsten Freeman[1], John Spratt[1], Tyler J. Wallen[1], Tomas Martin[1]

AUTHOR INSTITUTION(S)
[1]University of Florida, Gainesville, FL

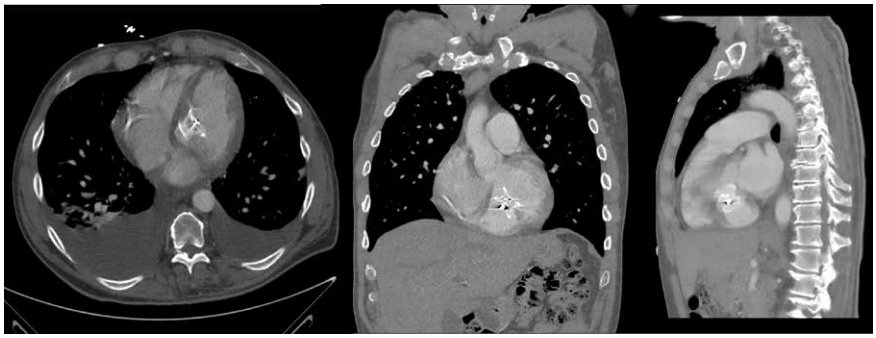
OBJECTIVES:
Acute ventricular septal defect (VSD) following myocardial infarction is often a highly lethal condition. Percutaneous occlusion devices have been used on rare occasions in to manage this condition in patients in extremis who are unfit for surgery. These devices may serve as a bridge to operative intervention but are not necessarily a durable solution when placed in the acute setting.

METHODS:
We present a case of a 56-year-old man that presented with acute decompensated heart failure with a post-infarct VSD. Four days prior to presentation, he suffered an acute myocardial infarction due to right coronary artery occlusion, which was recanalized following angioplasty and stenting. His VSD was treated with a percutaneous occlusion device, which prevented further shunting and allowed physiologic recovery and eventual discharge. Heart failure symptoms led to an echocardiography 6 months later which demonstrated device migration into the left ventricle with entanglement in the subvalvular apparatus of the mitral valve leading to severe mitral regurgitation, along with recurrent left-to-right shunting through a moderate size VSD, an inferobasilar left ventricular aneurysm, and a mildly-reduced left ventricular ejection fraction (LVEF).

RESULTS:
The patient underwent operative device retrieval, patch repair of the VSD and left ventricular aneurysm, and mitral ring annuloplasty. Post-bypass echocardiography revealed improvement in mitral regurgitation, resolution of VSD, and ventricular restoration with persistently depressed LVEF. The patient discharged home on post-operative day 6 following an uneventful recovery.

CONCLUSIONS:
Occlusion devices may not be durable therapy for post-infarct VSD, but may be considered in salvage situations as a bridge to stabilization for future traditional open repair.

Migrated Occlusion Device



CT Imaging showing occlusion device in the left ventricle.

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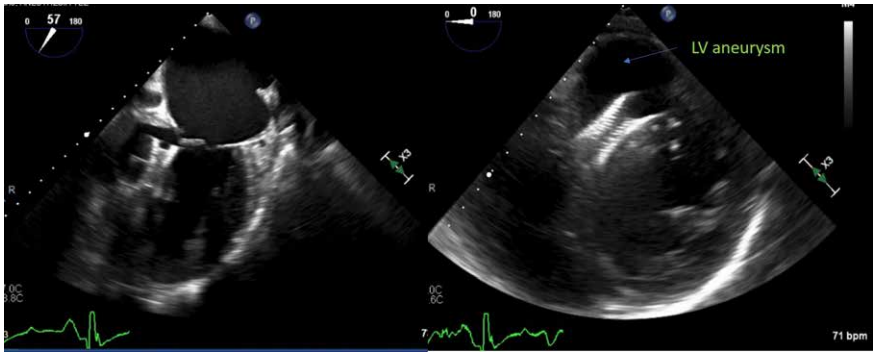
ADULT CARDIAC SURGERY VIDEOS

AC-V3. SEVERE MITRAL REGURGITATION FOLLOWING MIGRATION OF PERCUTANEOUS OCCLUDER DEVICE FOR POST-INFARCT VENTRICULAR SEPTAL DEFECT

CONTINUED

Pre-Operative TEE Image



Pre-Operative TEE Image showing Device in the LV and LV aneurysm

ADULT CARDIAC SURGERY VIDEOS

AC-V4. OPEN REPAIR OF AORTIC ARCH MYCOTIC PSEUDOANEURYSMS WITH DISTAL PERFUSION

AUTHORS
Jeffrey Clemence, Jr.[1], Bo Yang[1]

AUTHOR INSTITUTION(S)
[1]*University of Michigan, Ann Arbor, MI*

OBJECTIVES:
To determine the effectiveness of open repair of mycotic arch pseudoaneurysm with distal perfusion.

METHODS:
A 80-year-old man presented with a fast expanding 9.5 cm mycotic arch pseudoaneurysm, a contained rupture, and MSSA bacteremia. Both the right axillary and femoral artery were cannulated. The large pseudoaneurysm was distal to the left common carotid artery (LCC), encasing the left subclavian artery (LScA), and extended to the T4 level. Circulatory arrest was started with unilateral antegrade cerebral perfusion. A 30-millimeter Coda balloon was inserted into the descending aorta through the open arch and inflated. Circulation to the lower body was resumed through the femoral artery. A reverse zone 2 arch resection was performed from distal of the LCC to the ascending aorta. A 28-mm rifampin-soaked multi-branch arch graft was divided between the LCC and LScA branches and anastomosed to the zone 2 arch. Circulation to the brain and heart was then resumed with proximal circulatory arrest and aortic cross-clamp time of 33 minutes. At this point, whole body circulation was resumed except for the LScA to allow for the debridement of the mycotic pseudoaneurysm. The calcified distal arch was resected, the infected pseudoaneurysm was debrided extensively; and irrigated with 2-3 liters of normal saline, Betadine and vancomycin solution.

RESULTS:
When the pseudoaneurysm sac looked clean, a 28-mm rifampin-soaked Dacron was anastomosed to the proximal-descending aorta at the T4 level. The coda balloon was reinserted through the Dacron graft after the distal anastomosis was completed with a short period of time of lower body circulatory arrest. The LScA was dug out from the pseudoaneurysm and anastomosed to the 8-mm side branch of the proximal Dacron graft. Finally, the proximal and distal Dacron grafts were anastomosed together with 4-0 Prolene suture. The patient left the operating room with good hemostasis. One-year post-operative CTA showed an intact arch repair with no pseudoaneurysm. The patient is still doing well 2 years after surgery. We have performed 5 similar cases with or without distal perfusion through cannulation of femoral artery. The postoperative renal failure, stroke, cardiac arrest, and operative mortality were all 0%. In the follow-up time of 6 years, there were no recurrent graft infection and 100% survival.

CONCLUSIONS:
Hypothermic circulatory arrest with antegrade cerebral perfusion and distal perfusion is an excellent option for complex aortic arch surgery for mycotic aortic aneurysm/pseudoaneurysm. A rifampin-soaked Dacron graft is a valid choice for mycotic aortic aneurysm repair.

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ADULT CARDIAC SURGERY VIDEOS

AC-V5. MINIMALLY INVASIVE TRICUSPID VALVE REPAIR

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OBJECTIVES:

The aim of this surgical video submission is to provide a clear visual example of minimally invasive tricuspid debridement and repair utilizing a transparent plastic cuff to enhance visualization. It is intended for trainees new to minimally invasive cardiac surgery and clearly displays the relevant anatomy and surgical steps. It demonstrates side-by-side TEE and operative correlates, placement of a tricuspid ring annuloplasty, and debridement and reconstruction of chordae tendineae. In addition, this video demonstrates a cost-effective alternative for tricuspid valve annulus exposure.

METHODS:

The patient is positioned supine with a right upper body bump. Access is achieved through a 4th intercostal space (ICS) anterior thoracotomy and a 6th ICS utility port. The camera is placed in the 4th ICS and the cross clamp through the second. Peripheral cannulation is achieved through the right femoral vessels. The pericardium is incised and retracted. Vessel loops are placed around the superior and inferior vena cava. An antegrade cardioplegia needle vent is placed and the venous cannula is retracted into the IVC. The aorta is cross clamped and cardiac arrest is established. The right atrium is opened and the tricuspid valve visualized. An atrial lift system is not compatible with the patient's anatomy so anterior wall retraction sutures are placed. A 10cm transparent visor is crafted from the sterile cannulation packaging with the wider end measuring 2.5 cm and the narrow 2cm. The visor is inserted into the tricuspid annulus then rotated to create arch like retraction. Annuloplasty sutures are placed. Neo chords are created and a 28 mm incomplete tricuspid annuloplasty ring is placed. The neo chords are sized for leaflet cooptation. The cross clamp is removed and the atrium is closed in two layers.

RESULTS:

Minimally invasive tricuspid debridement and reconstruction through a right anterior thoracotomy offers a less invasive approach for surgical management of infective endocarditis.

CONCLUSIONS:

Operative exposure is a critical aspect of this approach and can be accomplished using a simple, inexpensive flexible visor tailored to the patient anatomy.

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ADULT CARDIAC SURGERY VIDEOS

AC-V6. KONNO PROCEDURE FOR PATIENT-PROSTHESIS MISMATCH

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OBJECTIVES:
Occasionally, the aortic valve annulus may not be large enough to allow implantation of the appropriate size prosthesis during surgical valve replacement. When the annulus must be enlarged by three or four valve sizes, the Konno annular enlargement procedure can be utilized to avoid patient-prosthesis mismatch. We present a video to illustrate this technique.

METHODS:
We present a case of a 50 year old male who underwent aortic valve replacement with a 19mm bioprosthetic valve three years prior. He subsequently developed severe prosthetic stenosis with a gradient of 53mmHg across the valve and preserved ejection fraction noted on his preoperative transesophageal echocardiogram. He also had a patent foramen ovale.

RESULTS:
A redo sternotomy was performed along with Konno annular enlargement. The existing 19mm bioprosthetic valve was removed and the annulus was debrided. A 25mm mechanical aortic valve was implanted, and the venctricular septum was reconstructed with a dacron patch. The right ventricular outflow tract was reconstructed using bovine pericardium. The patent foramen ovale was then closed primarily and the chest was closed. The patient did well and was discharged seven days later.

CONCLUSIONS:
This video illustrates the Konno annular enlargement technique as a treatment for a patient with patient-prosthesis mismatch. This method allows for significant annular enlargement.

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THORACIC SURGERY VIDEOS

GT-V1. ROBOT-ASSISTED THORACOSCOPIC LOBECTOMY OF T4 LUNG CANCER

AUTHORS
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OBJECTIVES:
A clinical T4 tumor is a relative contraindication to VATS lobectomy. We want to determine if the use of a robot will allow for resection of a large T4 tumor in a minimally invasive fashion.

METHODS:
A 79-year-old male with remote 15 pack-year former smoking history was discovered to have right upper lobe lung mass when he had symptomatic COVID19. CT guided biopsy showed adenocarcinoma of the lung, with the size of the tumor being 7.1 cm. The CT of the brain, PET/CT, and EBUS staged the patient as clinical T4N0M0 or clinical stage IIIA lung cancer. The patient underwent total portal robot-assisted thoracoscopic right upper lobectomy with mediastinal lymph node dissection using four thoracoscopic incisions.

RESULTS:
Flexible bronchoscopy showed a tongue of the tumor protruding through the right upper lobe orifice that was seen on the CT of the chest and during EBUS. Four ports were placed, and the robot was docked. There was some adhesion of the right upper lobe to the mediastinum and the posterior chest that was taken down. The right upper lobe branches of the superior pulmonary vein were identified, dissected, and divided using the robot vascular stapler. The truncus anterior branch of the pulmonary artery was identified, dissected, and divided using the vascular stapler. It was not possible to expose the posterior ascending artery from the anterior approach due to the bulk of the tumor. Thus, we freed the posterior hilum then dissected in the fissure to identify the main pulmonary artery. The posterior fissure was identified and divided. We then identified, dissected, and divided the posterior ascending artery. We then divided the anterior fissure with the stapler. Next, we mobilized the right upper lobe bronchus. Since there was an endobronchial lesion, we divided the right upper lobe bronchus with scissors with enough cuff so that we can staple the stump if there was a negative margin. Grossly, the tumor was able to be removed from the orifice. We placed a 2-0 Ethibond suture on the stump of the right upper lobe and stapled the bronchus with a robot green load stapler. The staple line was sent to pathology, and it came back negative for the tumor. We performed mediastinal lymph node dissection. The specimen was placed in a bag and removed through an enlarged anterior inferior port incision. The patient went home on postoperative day 3, and his final pathology was T4N0M0 final tumor size of 7.5 cm or pathologic

CONCLUSIONS:
Robot facilitates resection of clinical T4 lung cancer with tumor extending into the airway. The ability to perform thoracoscopic dissection of critical structures working around the tumor allows for successful minimally invasive robot-assisted resection of the tumor.

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THORACIC SURGERY VIDEOS

GT-V1. ROBOT-ASSISTED THORACOSCOPIC LOBECTOMY OF T4 LUNG CANCER

CONTINUED

Right Upper Lobe T4 Lung Cancer

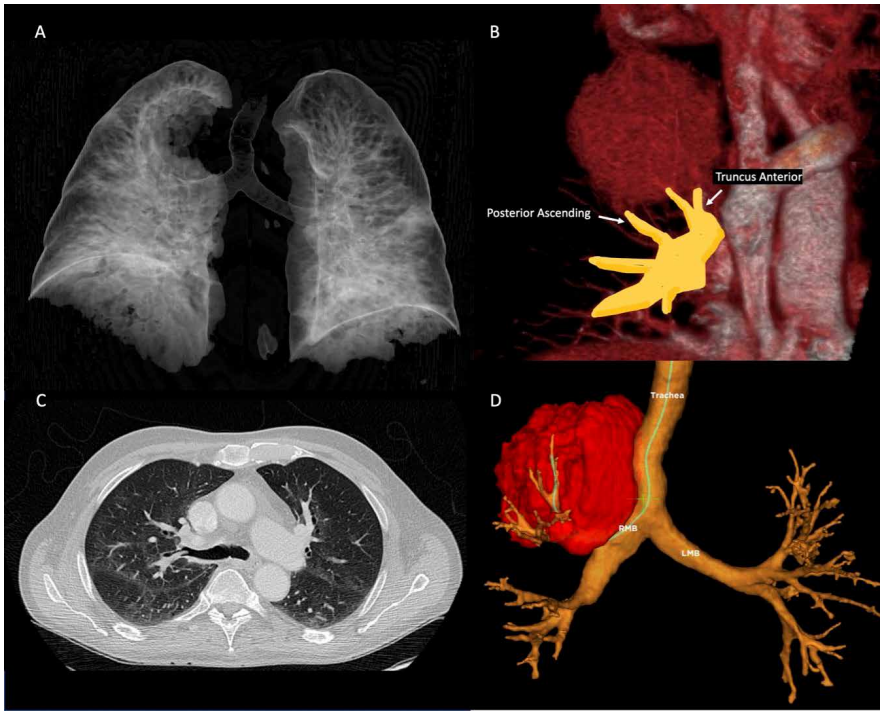

Image of the lung around the right upper lobe lung cancer (A). There is separated from the main truncus of the pulmonary artery (B). There is a tongue of the tumor in the orifice of the right upper lobe bronchus (C). The tumor is surrounding the right upper lobe bronchus.

THORACIC SURGERY VIDEOS

GT-V2. COMPLEX TRAUMATIC HIATAL HERNIA REPAIR WITH THE ROBOTIC PLATFORM

AUTHORS
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OBJECTIVES:
Traumatic diaphragmatic and hiatal hernias historically pose a challenge for the thoracic surgeon. Thoracic, abdominal, as well as combined approaches have been described to establish normal anatomy back to the abdomen as well as lyse thoracic adhesions. We describe a complex case of a traumatic right-sided hernia repaired laparoscopically with the robotic platform.

METHODS:
In this video, we describe a patient with long standing traumatic hernia following a motor vehicle accident who presented with abdominal pain. He was found to have half of the liver, gallbladder, the right colon and its mesentery in the right chest. He did not have any bowel comprise and thus, repaired electively. We describe our abdominal port placements for this case. We also review key elements of the repair, including eversion of the hernia defect to lyse adhesions, valsalva maneuver to reduce contents into the abdomen, and constant awareness of the inferior vena cava when repairing the defect.

RESULTS:
The patient did well after his surgery and was discharged home on postoperative day two.

CONCLUSIONS:
Traumatic hernias into the thoracic cavity may contain several visceral organs, including their vasculature. They also may have an indolent nature, allowing creation of thick adhesions to the lung parenchyma to form. This milieu of vital structures adhered to the thoracic cavity makes choice of exposure a debated topic. The use of the robotic-assist laparoscopic technique, can provide an effective method of safely reducing abdominal contents as well as repair of the defect itself.

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