Future research will focus on delivery of diagnostic and therapeutic modalities through natural orifices.

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Minimally Invasive and Robotic Surgery
Michael J. Mack, MD
JAMA. 2001;285:565-572

*Future research will focus on delivery of diagnostic and therapeutic modalities through natural orifices.*

Intraoperative Esophageal Perforation
- 14 year old male
- "Unventured" laparoscopic Mesh fundoplication
- Postoperative esophageal leak
- Admitted day 2
- Two attempted repairs: Primary repair, thoracoscopic reconstruction

Clinical Course
- Transferred to ICU facility with multi-system organ failure: Renal, Respiratory, coagulopathy
- Bacteremia
- Continued esophageal fistula
- Intra-abdominal compartment syndrome

Current Esophageal Stents
- Ultraflex
- Alvedos
- Z stent
- Polytex
- Waitflex

Non-Operative Therapy
- Cameron et al / Modified by Abiose et al
  - Early diagnosis
  - Contain the leak with a stent
  - Shrinkage of the esophagus
  - Perforation is not in a malignancy or proximal to an obstruction
  - Absence of mediastinitis/sepsis

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**Follow-up**
- Stent removed endoscopically on day 20
- Transferred to pediatric rehabilitation tolerating a regular diet
- Has required no subsequent surgery

**Hybrid Operative and Endoscopic Treatment Strategy**
- Ideal treatment for an esophageal perforation or fistula:
  - Fulfill traditional goals of operative therapy
  - Closure of the perforation
  - Drainage of the mediastinum and pleural spaces
  - Stable enteral nutrition
  - Maintain bronchial continuity
  - Avoid thoracotomy and celiotomy

**Esophageal Stent Placement**
- Confirm and localize the perforation or fistula by esophagram
- CT scan of chest/abdomen
- Identify need for other procedures

**Esophageal Stent Placement**
- Performed in the operating room
  - General anesthesia
  - Associated procedures
  - Fluoroscopy
  - Endoscopy, stent placement and any associated procedures performed by a thoracic surgeon

**Esophageal stent placement**
- Using the esophagram as a guide, identify the target area at esophagoscopy
- Assess the possibility of using a stent
- Place a PEG before attempting stent placement

**Polyflex Esophageal Stent**
- Silicone coated polymer
- Non-porous
- Can be repositioned
- Substantial radial force / low frequency of migration
- Does not "fracture"
- Easily removed

**Endoscopic stent placement**

**Endoscopy After Stent Placement**

**Post-Stent Treatment**
- Care for the patient as if they had required operative repair
  - ICU environment
  - Volume resuscitation
  - Directed antibiotic therapy
  - Respiratory support if needed
- NPO
- PPIs
- Gastric drainage
- Nutrition (preferably enteral)
**Post-Stent Treatment**
- Esophagogram 48 hrs after placement (or when the patient can participate) to confirm occlusion
- Oral intake initiated ("soft mechanical" diet)
- Discharge when drain(s) are removed
- Remove stent at 2-4 weeks
  - OR/general anesthesia
  - EGD

**Spontaneous Esophageal Perforations**

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>n</td>
<td>13</td>
</tr>
<tr>
<td>Age (mean yrs)</td>
<td>48 ± 18 (range 26-67)</td>
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<tr>
<td>Perforation to stent (mean hrs)</td>
<td>22 ± 33 (range 6-78)</td>
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<tr>
<td>Associated procedures</td>
<td>9/17 (53%)</td>
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<tr>
<td>Leak occlusion</td>
<td>17 (89%)</td>
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<tr>
<td>Length of stay (median days)</td>
<td>9 ± 12</td>
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<td>Mortality</td>
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**Findings**
- Stent migration remains a concern
- More frequent in the proximal cervical esophagus and near the gastroesophageal junction
- May be reduced by over sizing stent width & length
- Late migration (> 7-10 days) may signal healing

**Malignant Perforation**
- 85 year old female presents to the ED with four hours of chest pain after an EGD
- CXR: 0.8 cm mass (30%)
- CT: 3.0 cm mass in the mid esophagus - "likely malignancy"
- Severe hypotension

**Esophageal Fistulae**

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<tr>
<td>n</td>
<td>10</td>
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<tr>
<td>Age (mean yrs)</td>
<td>54 ± 20 (range 17-91)</td>
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<tr>
<td>Interposed repair</td>
<td>10 (100%)</td>
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<tr>
<td>Associated procedures</td>
<td>8 (80%)</td>
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<tr>
<td>Leak</td>
<td>5 (50%)</td>
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<td>Length of stay (median days)</td>
<td>12 ± 14</td>
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**Iatrogenic Esophageal Perforation**

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<tbody>
<tr>
<td>n</td>
<td>12</td>
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<tr>
<td>Age (mean yrs)</td>
<td>59 ± 20 (range 14-93)</td>
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<td>9 (75%)</td>
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<td>Leak</td>
<td>6 (50%)</td>
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<td>Length of stay (median days)</td>
<td>12 ± 30</td>
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**Postoperative esophageal leak/wrists can be effectively treated in the majority of patients using an oblitative esophageal stent as part of a hybrid operative approach**
- Repaired leak of back
- Feeding tube & nutrition & hydration
- Alternatively: esophageal diversion / esophagectomy
- Aids in reducing hospital length of stay

**Malignant Perforation**
- Polyflex stent & PEG placed
- Repeat esophagogram 60 hours later
- Clear liquids initiated
- Home on hospital day 5
- Stent removed 19 days after placement
- Went on to undergo chemo/radiation as definitive therapy
**Intra-Thoracic Leak Following Esophagogastronomy**
- Occurs in 3 – 18% of patients
  - Higher incidence following neoadjuvant chemotherapy/radiation therapy
- Small leaks managed non-operatively
  - Delayed oral nutrition and discharge
- Larger leaks require re-operative therapy
  - Significant prolongs post-operative course
  - Sometimes results in diversion

**Findings**
- Esophageal stent placement for a postoperative intra-thoracic leak following esophagogastronomy
  - Safe and effective
  - Avoids re-operation in the majority of patients
  - Possible with most types of anastomoses
  - Results in earlier oral nutrition
  - May decrease hospital stay

**Stent Placement for Esophagogastronomy Leak**

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<tr>
<td>Associated procedures</td>
<td>16 (94%)</td>
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<tr>
<td>Leak occlusion</td>
<td>16 (100%)</td>
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<tr>
<td>Total readmission within 30 days</td>
<td>1 (9%)</td>
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<tr>
<td>Readmission</td>
<td>1 (9%)</td>
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<tr>
<td>Mortality</td>
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