History of Gastrointestinal Stenting

• Prior to stenting, surgery was the only option
  – Esophagectomy
  – Internal division of a stricture
  – Esophagostomy (a permanent fistula in the neck; 81% 17-day mortality; no advantage over gastrostomy)
  – Surgical gastrostomy (29% mortality)

• Mid-1800’s
  – Nasogastric and orogastric (external-internal) tube placement
  – Long esophageal tubes made of gum elsastic or natural rubber (black caoutchouc)
  – No relief of dysphagia, uncomfortable, did not improve toleration of secretions

• 1845
  – James Leroy d’Etoilles suggested a short, internal esophageal tube
  – Developed one of decalcified ivory which failed

• 1885
  – First successful stent developed by Sir Charles James Symonds
  – Rigid, short esophageal tube placed over a malignant stricture

• 1959
  – Celestin first describes palliation of an obstructive esophageal cancer with a plastic prosthesis placed via laparotomy
History continued

• 1970’s
  – The introduction of fiberoptic endoscopy
  – Atkinson and Ferguson developed endoscopic insertion of plastic tubes
  – Development of the Celestin tube which was made commercially available
  – Complication rates high (18% complication rate and 9% mortality rate)

• 1990’s
  – Development of the self expanding metal stents (SEMS) which were adopted from biliary stents already in use for the past decade
  – RCT by Knyrim et al NEJM 1993 showed significantly higher rates of complications from rigid stents compared to SEMS

• Developing ideas
  – Plastic stents and biodegradable stents
  – Drug or chemotherapy laced therapeutic stents
Examples of rigid prostheses

From top to bottom: Celestin tube, Celestin tube with distal flange, Atkinson’s tube, Rigid prosthesis by Cook (low profile and high profile)
Indications/Uses

• Malignant esophageal obstruction
  – Inoperable, poor surgical candidate, contraindication to chemoradiation
  – Recurrence at anastomosis of previous resection
• Extrinsic esophageal compression
• Refractory or recurrent esophageal strictures
• Tracheoesophageal fistula (malignant or benign)
• Esophageal perforation or leak (iatrogenic or spontaneous)
• Achalasia not responding to conventional treatment and not a good surgical candidate
Contraindications

- Curable malignant esophageal strictures
- Terminally ill patients with limited life expectancy
- Stricture within 2 cm of the upper esophageal sphincter
- Risk of airway compression (unless addressed first)
- Recent high-dose chemoradiation (within 3-6 weeks)
- Unaddressed gastroduodenal or small bowel obstruction
- Sepsis
- Uncorrected coagulopathy
Alternatives to stenting

- Gastrostomy tubes
- Dilation
- XRT/Chemo
- Neolumen creation (photodynamic therapy or Nd-YAG laser)
Types of stents

• Uncovered
  – Tumor ingrowth is major disadvantage
• Fully covered
  – Higher risk of migration
• Partially covered
• Braided or non-braided
• Different materials
• Self Expanding Metal Stents (SEMS)
SEMS taken off of the market
From left to right: EsophaCoil (Medtronic), Uncovered Ultraflex (Boston Scientific), Partially Covered Wallstent (Boston), Partially Covered Flamingo Wallstent (Boston), Fully Covered Z-Stent (Cook)
Types of stents continued

• Current FDA-approved stents
  – Ultraflex (Boston Scientific) – Nitinol, length 10/12/15 cm, diameter 18/23 and 23/28 mm, NC/PC
  – Wallflex (Boston) – Nitinol, length 12/12/15 cm, diameter 12/28 and 23/28 mm, PC/covered
  – Esophageal Z (Cook) – Stainless steel, length 8/10/12/14 cm, diameter 18/25 mm, PC
  – Evolution (Cook) – Nitinol, length 8/10/12.5/15 cm, diameter 20/25 mm, PC
  – Alimaxx-E (Alveolus) – Nitinol, length 7/10/12 cm, diameter 18/22 mm, covered
  – Niti-S (TaeWoong Medical) – Nitinol, length 8/10/12/14 cm, diameter 16/20, 18/23, and 20/25 mm, covered
  – Polyflex (Boston) – Polyester, length 9/12/14 cm, diameter 16/20, 18/23 and 21/28 mm, covered
Other types available

- Gianturco Z (Cook) – stainless steel, length 18/10/12/14 cm, diameter 18/25 mm, PC/shaft bars
- FerX-Ella (Ella-CS) – stainless steel, multiple lengths, covered
- Dostent (MI Tech) – nitinol, length 6/9/12 cm, diameter 18/30 mm, covered
- Flamingo Wallstent (Boston) – stainless steel, length 12/14 cm, diameter 20/30 mm, PC
Partially covered SEMS

Left to right: Ultraflex (Boston Scientific), Wallflex (Boston), Antireflux Z-stent (Cook), and Evolution (Cook)
Fully covered SEMSs

Left to right: Alimaxx-ES (Merit), Wallflex (Boston), Evolution (Cook), Niti-S (Taewoong Medical), double-type Niti-S (Taewoong)
Stent Selection

• Uncovered vs. Partially covered
  – Vakil et al – higher reintervention rates at 6 months in uncovered vs partially covered (27% vs 0%, P<0.005); dysphagia relief, performance status, survival at 6 months, and migration rates were comparable (7% vs 12%, P=0.043)
  – Stent migration higher in partially covered group (10% vs 0%, P<0.05)
  – Partially covered metal stents are superior to uncovered metal stents

• Three different RCTs have shown no significant difference in dysphagia scores, complication rates, performance status, and survival between different brands of partially covered stents (Vakil et al, Siersema et al, Sabharwal et al)

• Stent migration is associated with smaller stents rather than brand of stent.
• Cost between stents not significant enough to determine brand of stent used.
• SEMSs are associated with fewer complications than SEPSs when used for malignant dysphagia
• No good evidence for the use of anti-reflux stents
• Covered SEMS are the treatment of choice for malignant esophageal fistulas

• For benign strictures
  – Stent should be easily retrievable and repositionable, technically easy to place, designed to have a small-caliber delivery device with minimal shortening, low migration rates, removal with minimal complications
  – Partially covered metal stents should not be used
Placement of Esophageal Stents

- Patient selection (clinical, radiographic, and endoscopic data)
- Accurate assessment of the stricture length and stent selection
- Dilation of the stricture to 2-4 fr wider than the intended stent
- Endoscopic placement
- Confirmation of placement
Esophageal Stent Placement for Palliation of an Obstructing Esophageal Cancer

Gottamukala Raju, MD
University of Texas Medical Branch
Palliative esophageal stent placement for esophageal cancer following gastric bypass

Patrick Yachimski, MD
Fully-Covered Wallflex™
Esophageal Stent for Treatment of a Tracheo-Gastric Fistula

Jonathan M. Buscaglia, MD
Stony Brook University Medical Center
<table>
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<th><strong>Table 6. Complications of esophageal self-expandable metal stents</strong></th>
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<td>Complication</td>
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<td>Migration (UC vs PC)</td>
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<td>GERD/aspiration</td>
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Aftercare

• Short Term
  – NPO x 2 hours
  – Hourly observation with assessment for pain
  – Clear fluids after 2 hours
  – Liquid diet after 4 hours
  – Soft diet after 24 hours

• Long Term
  – Dietician – avoid lumpy foods, cut up and chew foods well
  – Position while eating – sit up straight while eating
  – Patient information packets
  – Carbonated drinks after each meal