Overview of stents

- Esophageal
- Gastroduodenal
- Colonic
Esophageal stents

- Malignant obstruction is main indication
- Stents for intrinsic tumors highly effective
  - Esophageal adenocarcinoma
  - Esophageal squamous cell carcinoma
  - GE junctional tumors
- Stents for extrinsic tumors less effective
  - Lung cancer and metastatic cancer
- Tracheo-esophageal (TE) fistula closure

Esophageal stent types

- Self expandable metal stents (SEMS)
  - Various metals and alloys
  - **Covered**: resist tumor ingrowth but more migration
    - Fistulas and perforations
  - **Partially covered**: uncovered at ends, less migration
  - **Uncovered**: more ingrowth, less migration
- Various lengths (6-20 cm) and widths (10-23 mm)
- Self-expandable plastic stents: rarely used
Technique of stent placement

- Review existing studies
  - Endoscopies
  - X-rays (CT scans and barium swallow studies)
- Define stricture during endoscopy
- Most use fluoroscopic guidance and guidewire
- Stent choice 4 cm longer than stricture length
- Potential for compression of trachea and airway compromise in proximal tumor

Esophageal stent goals

- Minimize dysphagia symptoms
- Allow oral hydration
- Allow oral nutrition
  - Liquids and soft mechanical
  - Need to avoid certain foods
    - Fibrous (broccoli)
    - Dense (large pieces of meat)
- Allow oral medication delivery
Esophageal stent efficacy

- Most with malignant esophageal obstruction undergoing stents will tolerate liquids (>95%)
- Dysphagia scored 0 (no dysphagia) to 4 (inability to swallow saliva)
- In patients with potentially resectable tumor undergoing neoadjuvant chemotherapy dysphagia scores improve from 2.4 to 1
- Effective for anastomotic recurrence post surgery
- Less effective if extrinsic, as dysphagia score decreases from 3 to 2 compared to 1 in intrinsic

Siddiqui AA. Gastrointest Endosc 2012;76:44-51

Complications

- Chest pain
- GERD (stents across GE junction)
- No improvement in dysphagia/stent malposition
- Tumor overgrowth or ingrowth (11%)
- Migration
  - Overall 7%
  - With neoadjuvant chemotherapy 30%
- Bleeding (0.6-4%)
- Perforation (0.6%)
- Airway compression
- TE fistula formation
- Death (related to stent in 0.5-2%)

Ramirez FC. Gastrointest Endosc 1997;45:360-4;
Siddiqui AA. Gastrointest Endosc 2012;76:44-51
Esophageal SEMS-induced pain

• Extremely common (10-15%)
• Multifactorial
  – Radial stent expansion
  – GERD
  – Primary tumor pain
• Stent pain typically resolves in 7 days
• Rarely intractable

Early vs. late stent placement in esophageal cancer

<table>
<thead>
<tr>
<th>Early</th>
<th>Late</th>
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<tr>
<td>Relieve dysphagia</td>
<td>Unresectable disease</td>
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<tr>
<td>Allow oral hydration</td>
<td>Treatment failures</td>
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<tr>
<td>Allow oral nutrition</td>
<td>TE fistulas</td>
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<tr>
<td>Allow oral medication</td>
<td>Same goals as for early</td>
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<tr>
<td>Obviates feeding tubes</td>
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</tbody>
</table>
Fully covered stents (FCSEMS)

- Malignant dysphagia
  - Consider in patients undergoing neoadjuvant therapy
- Benign refractory stenoses
- Benign TE fistulas
- Iatrogenic perforations
- Bariatric complications
- Boerhaave’s syndrome
- Variceal bleeding (SX-ELLA biodegradable stent)

Talreja SP. Surg Endosc 2012;26:1664-9;
Bège T. Gastrointest Endosc 2011;73:238-44;
Adler DG. Gastrointest Endosc 2009;70:614-9

FCSEMS migration in esophageal cancer

- Migration is *usually* associated with tumor response (not a bad outcome)
  - Loss of tumor bulk
  - Less severe esophageal stricture
  - Dislodgement of stent
- If patient has intact pylorus → stent unlikely to migrate
- If patient has had gastrectomy → migration
**TE fistulas**

**Benign**
- Iatrogenic
- Post surgical
- Post XRT
- Post intubation

**Malignant**
- Esophageal cancer
- Lung cancer
- Lymphoma

**TE fistulas and stents**

- Data mostly from case reports and small series
  - Mostly malignant TE fistulas
  - Publication reporting bias
- Success rates with dysphagia reported 70-100%
  - Most malignant TE fistulas not expected to close
  - Stents may not make an “airtight” seal
  - Some ongoing aspiration risk

Hagendorn J. *Nat Rev Gastroenterol Hepatol* 2010;7(12):702-6;
Hürtgen M. *Thorac Surg Clin* 2014;24:117-27
FCSEMS for benign fistulae or perforation

- Data from small series and case reports
- Overall success rate variable: 38-80%
- Outcomes best if stent placed early
  - Boerhaaves
  - Bariatric
  - Endoscopic
- Avoid mediastinal contamination

Bakken JC. Gastrointest Endosc 2010;72:712-20;
Senousy BE. Dig Dis Sci 2010;55:3399-403;

Stents for refractory benign esophageal strictures

- Usually reserved for treatment failures
  - Typically after dilation +/- steroids fail
- May need long term stenting or serial SEMS
- Surgery often not an option for these patients
- Overall effective in about 40%
- Migration rate of about 30%
- Not FDA approved for this indication

Fuccio L. Endoscopy 2015;Nov 3
**Gastric stents**

- Malignant gastric outlet obstruction (GOO)
- Inability of the stomach to empty
  - Gastric obstruction
  - Proximal small bowel obstruction
  - Functional
- Due to upper GI malignancy
  - Pancreatic cancer (most common in USA)
  - Gastric cancer (more common in Asia)
  - Metastatic cancer
  - Cholangiocarcinoma
  - Ampullary cancer

**Symptoms of GOO**

- Nausea
- Intractable vomiting
- Esophagitis
- Electrolyte imbalances
- Poor nutrition
- Dehydration
- Poor quality of life
GOO treatment selection and goals

- Treat patients with unresectable malignancy or recurrent malignancy
- Most appropriate in patients with short life expectancy (2-6 months)
- Relieve symptoms of obstruction
- Allow adequate nutrition and hydration
- Allow oral feeding
- Improve quality of life

Technique of stent placement

- Review existing studies
  - Endoscopies
  - X-rays (CT scans and upper GI series)
- Suction stomach completely and then define stricture by endoscopy if possible or by contrast injection and/or balloon insertion
- Use fluoroscopic guidance and guidewire
- Uncovered stent placed through a therapeutic scope (channel diameter ≥ 3.7 mm)
- Stent choice 4 cm longer than stricture length
GOO stent efficacy

- Most with malignant gastric obstruction will have technical success in stent placement (>90%)
- Clinical success in 80-90%
- Long-term success rates lower
- Liquid and soft food intake improves rapidly
- Complications are not infrequent but primarily stent obstruction and migration
- Improved quality of life
- Reintervention rates of 15-40% for recurrent symptoms or biliary obstruction post stenting

Dormann A. Endoscopy 2004;36:543-50;
van Halsema EE. World J Gastroenterol 2015;21(43):12468-81

Endoscopic stents vs. surgery

<table>
<thead>
<tr>
<th></th>
<th>Technical success (%) E/S</th>
<th>Clinical success (%) E/S</th>
<th>Tolerance of oral intake (days) E/S</th>
<th>Hospital stay (days) E/S</th>
<th>Complications (%) E/S</th>
<th>30-day mortality (%) E/S</th>
<th>Survival (days) E/S</th>
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*E=Endoscopic SEMS; S=Surgery
Other treatment options

• Radiation therapy (XRT)
  – Can be effective, but takes time
• PEG with J tube
  – Allows nutrition, but no peroral feedings
• Direct PEJ
  – Allows nutrition, but no peroral feedings
• TPN
  – Not a great option for patients with advanced malignancy, and no peroral feedings

Bile duct obstruction and GOO

• Combined duodenal and biliary obstruction very common
  – Type 1: GOO above ampulla
  – Type 2: GOO at ampulla
  – Type 3: GOO distal to ampulla
• 44% of patients with GOO will develop jaundice before dying
  – Combined duodenal stenting with biliary stenting is an endoscopic gastrojejunostomy with biliary bypass
  – Place biliary stent first if accessible and strictured
Colonic stents

• All FDA approved devices are uncovered metal stents and not removable

• Indications
  1. Malignant large bowel obstruction for the palliation of advanced disease
  2. Benign/malignant strictures with obstruction to allow pre-op preparation and one-stage surgery

Kaplan J. World J Gastroenterol 2014;20:13239-45

Colonic stent treatment selection

• Patients with metastatic disease or who are poor operative candidates → stent

• Patients with metastatic disease who are good operative candidates → stent → surgery via one stage procedure

• Patients with resectable disease → stent → surgery via one stage procedure
  – Preoperative patients who undergo stenting first are less likely to have anastomotic leaks and dehiscences

Cheung HY. Arch Surg 2009;144:1127-32
Technique of stent placement

- Review existing studies
  - Endoscopies
  - X-rays (CT scans and barium enema studies)
- Consider intubation of patient
- Use fluoroscopic guidance and guidewire
- Uncovered stent placed through a therapeutic scope (channel diameter $\geq 3.7$ mm)
- Stent choice 4 cm longer than stricture length

Diet post colonic stent

- Patients placed on soft solid or low residue diet
- Take mineral oil or laxatives regularly
- Avoid high fiber foods
- Patents with proximal colonic stents can consume a normal diet
Colonic stent efficacy

- Most reports for left-sided colonic obstruction
- Review of 88 studies:
  - Technical success in 96% (66-100%)
  - Clinical success in 92% (46-100%)
  - Duration of patency 106 days (68-288 days)
  - Reintervention rate 20% (0-100%)


Proximal colonic stenting

- Stents can be effectively placed anywhere in colon including the proximal colon
- Proximal vs. distal colon stents similar in:
  - Technical success
  - Clinical success
  - Complications

Repici A. Gastrointest Endosc 2007;66:940-944
Complications

• Abdominal pain common for about 5 days
• Migration: 11%
  – Uncommon in malignant obstruction
• Tumor overgrowth or ingrowth: 7-12%
• Perforation: About 5%
  – Much higher with bevacizumab (15-50%)
• Bleeding
  – Uncommon

Small AJ. Gastrointest Endosc 2010;71:560-72;
Manes G. Arch Surg 2011;146:1157-62

Colonic stents versus surgery

• Colonic stents:
  – Faster
  – Cost less
  – Shorter hospital stay
  – Shorter ICU stay
  – In operable patients, avoids colostomy

Law WL. Br J Surg 2003;90:1429-1433;
Sebastian S. Am J Gastroenterol 2004;99:2051-2057
**FCSEMS for benign colonic strictures**

- Very limited data
- Possible indications
  - Anastomotic strictures
    - Initial success in 100% (16 patients)
    - Prolonged success in 56% (better with 24-26 mm stent)
  - Possibly IBD and diverticular strictures
- Migration expected outcome
- Not FDA approved indication

Caruso A. *Surg Endosc* 2015;29:1175-78;  
Vanbiervliet G. *Endoscopy* 2013;45:35-41

**The future of luminal stenting**

- Biodegradable stents
- Radioactive stents
- Drug-eluting stents
- Novel lumen approximating devices
Conclusions

• Self expanding metal stents have important roles in malignant luminal strictures
  – Esophageal, gastroduodenal and colonic
• Often obviates the need for surgery
• SEMS placement is safe and effective
• Colonic SEMS are effective bridges to surgery
• Surgery good option for those with expected prolonged survivals or for treatment failures