Colonic stenting: everything that a resident needs to know

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Learning objectives

Based on our experience with more than 850 colonic stents, the purpose of the pictorial review is the following:

- To familiarize radiology residents with the accepted indications and contraindications of colonic stenting
- To give the residents an overview of the stenting procedure and its technical tricks and tips, and to provide an overview of all radioprotection concerns.
- To illustrate the post-procedure management, possible complications, and ways to deal with them.
- To emphasize uncommon indications and new technical developments in the field.

Background

Colonic obstruction is usually due to colorectal cancer. Up to 85% of patients who present with colonic obstruction have colorectal cancer, and 10% to 30% of patients with colorectal cancer present with total or partial intestinal obstruction. Most malignant colonic obstructions occur in the descending or sigmoid colon or in the rectum. Some benign colorectal processes (diverticulitis, anastomotic stricture…) may also cause obstruction. It is often difficult to distinguish whether obstruction is caused by diverticulitis or a tumor, but it is not essential to establish the cause before decompression.

Acute colonic obstruction is considered a surgical emergency. Failure to treat the obstruction expeditiously predisposes the patient to perforation, metabolic and electrolyte disturbances, intestinal ischemia, and sepsis. Emergency surgery (Hartmann) without proper colon preparation is associated with higher morbidity and mortality than elective surgery.

Self-expanding metal stents (SEMS) may be used as a bridge to surgery, making it possible to perform one-stage surgery at a later date, avoiding an emergency colostomy. Patients with diverticulitis and obstruction can be treated with metallic stents to permit elective colon cleansing prior to resection. SEMS can also be used for palliation; stenting is useful in many patients with inoperable tumors, as it avoids a colostomy and improves the quality of life. As a bridge to surgery, SEMS have several advantages over emergency surgery. SEMS enable medical stabilization and a complete staging workup, so that the surgical procedure can be done electively in a single stage using a laparoscopic approach to make a primary anastomosis.
The outcome of the procedure is evaluated from two viewpoints:

- Technical success (crossing the obstruction with a guidewire and SEMS placement). Reasons for technical failure (in order of frequency: impossibility of passing the guidewire through the lesion, tortuous anatomy, the presence of a broad lesion and perforation during placement).
- Clinical success (resolution of obstructive symptoms within 72 hours of SEMS implantation). Reasons for clinical failure (in order of frequency: stent migration and inadequate functioning, incorrect positioning, incomplete expansion, presence of undetected synchronous obstructive tumors, peritoneal carcinomatosis involving the small bowel, fecal impaction and motility disorders).

SEMS implantation is feasible and reproducible in everyday clinical practice.

Tumors that are too long or kinked or that are too proximal or too distal in the colon, and lesions in tortuous portions of the colon, are more difficult to treat with SEMS.

Compared to surgery, palliative SEMS placement in advanced disease results in: shorter hospital stays, fewer complications, lower mortality, and good patency.

**Findings and procedure details**

**Indications and contraindications**

The main indications are:

- For temporary colonic decompression in patients with acute malignant obstruction as a "bridge" to elective surgery.
- For long-term colonic decompression in patients with obstruction due to an unresectable colonic carcinoma.
- For long-term colonic decompression in patients with benign colonic strictures due to fibrosis associated with surgery or radiotherapy.
- For temporary colonic decompression in patients with diverticulitis to permit elective surgical resection.
- As a palliative treatment, for closure of ileocolic, colovesical, or colocutaneous fistulae.

**Contraindications:**

- **Absolute:** clinical and/or radiological evidence of acute perforation of the colon.
• **Relative:** suspicion of a walled-off inflammatory mass, local abscess due to lined tumor perforation, or tumor necrosis. Coagulation disorders.

• **Implantation is not recommended (although not contraindicated) for:**

  - Asymptomatic stenosing lesions that are not occlusive on lower gastrointestinal series or that allow an endoscope to pass through, because of the risk of migration.

  - Stenosing masses at different levels with different grades of stenosis.

  - Tumors of the lower third of the rectum, due to the high risk of severe tenesmus or fecal incontinence

  - Manifest fecal incontinence for palliative purposes.

**Stent design:**

The ideal device should include:

- high expansion ratio.
- high flexibility.
- large diameter (>25 mm).
- mechanical stability.
- adequate radial expandable force (dumbbell shape).
- prevention of restenosis due to tumor ingrowth.
- prevention of restenosis due to hyperplasia.
- small delivery system.
- biodegradable or readily removable stent for benign strictures.
- lack of interference during imaging and tumor staging.

**Pre-procedure management:**

The physician in charge of the procedure must have sufficient knowledge about:

- The indications and contraindications of the procedure.
- How to evaluate the patient before and after the procedure.
- Possible complications and how to manage them.
• Technique, interpretation, and management of the contrast agents used to guide the procedures.
• Radioprotection concerns.
• Technique for performing the procedure and material used.
• Anatomy and physiology of the digestive tract and especially of the organ to be treated.

Supporting staff: A nurse with experience in interventional radiology to monitor the patient's heart rate, oxygen saturation, and blood pressure during the procedure and to help out if there are complications, as well as to provide appropriate care after the procedure.

A radiological technologist to manage the fluoroscopy equipment during the intervention.

**Stenting procedure: technical tricks and tips**

Stent placement in distal colonic and rectal lesions can be guided with fluoroscopy alone, endoscopy alone, or combined fluoroscopy and endoscopy.

There is no scientific evidence that one technique is better than others with respect to the duration, technical success, and complications of the procedure, although each approach has certain advantages.

• Procedures guided by fluoroscopy alone do not require sedation, insufflation of gas into the colon, or cleansing of the colon distal to the lesion. Methods of obtaining biopsies and approaches from the right through cecostomies are being introduced.

• Procedures guided by endoscopy alone make it possible to reach lesions in the left colon quickly and also facilitate access to the right and transverse colons. Endoscopy enables biopsies to be obtained safely. It reduces the dose of radiation and the number of staff involved. It is widely available. However, it increases the cost and requires sedation in all patients.

• Procedures guided by combined fluoroscopy and endoscopy are safer and more efficacious. This approach has advantages for stent placement in the descending colon due to the redundant course of more proximal portions of the colon, especially when associated with a tortuous sigmoid segment. Endoscopy is frequently used to cross colonic strictures and place stents, although it is not strictly necessary.

In our center, we do this procedure under fluoroscopic guidance alone.
Procedure:

It is important to plan the procedure based on the abdominal CT findings to take into account the size and length of the tumor and to ensure the best positioning of the patient and fluoroscopy tube and the best plane to view the obstructive lesion.

1- A water-soluble iodated contrast enema X-ray examination is done to locate and determine the length and caliber of the obstructive lesion (Fig. 1 on page 11, Fig. 2 on page 12). The enema is also useful for determining the best position in which to place the patient to display the lesion so that the stricture is perpendicular to the beam and easier to see during stent placement. The appropriate device and delivery system are selected according to the length of the stricture and its distance from the anus.

2- With the patient placed in a good position to visualize the obstructive lesion, an angiographic catheter or guiding catheter is placed into the colon.

3- A high-torque (70-125cm long catheters are often needed) angiographic catheter or guiding catheter is advanced over a 0.035-inch angled hydrophilic stiff guidewire to traverse the obstructive segment under fluoroscopic guidance (Fig. 3 on page 13). If an excessively tortuous or redundant rectosigmoid region is encountered, the use of a 0.035-inch extra-stiff guidewire is recommended to facilitate the progression of the angiographic catheter to the level of the obstruction. (Fig. 4 on page 15)

4- Following successful catheterization past the obstructive lesion under fluoroscopic guidance, contrast material is injected through the diagnostic angiography catheter to better define the lesion (length, location, optimal position) and to rule out perforation.

5- An exchange-length stiff guidewire is advanced well beyond the lesion (Fig. 5 on page 15)

6- Appropriately sized stent and delivery system are chosen based on the information obtained from the enema examination and abdominal CT.

7- The stent with an adequate length and diameter (20-24 mm) is advanced under fluoroscopic guidance and deployed so that the middle of the stent covers the lesion and 1-2 cm extends beyond each end of the lesion, extension beyond the proximal end is essential to avoid migration (Fig. 6 on page 17, Fig. 7 on page 19). Stent coverage is inadequate, an additional stent can be deployed to completely cover the lesion and its margins.
After stent deployment, additional balloon dilation is not recommended because it is associated with a high risk of perforation.

**Radioprotection concerns**

Radiation exposure is a very important issue. Transanal placement of metallic stents under combined fluoroscopic-endoscopic guidance may decrease fluoroscopy time.

Aprons, goggles, gloves, and thyroid shields should be worn by all staff members in the field of radiation scatter. Likewise, parts of patients’ bodies that do not need to be irradiated should also be protected.

**Post-procedure management**

SEMS expand slowly over time; the peristaltic movements of the colon after decompression may facilitate full expansion.

Immediately after stent placement, the contrast enema examination can be repeated to document post-stenting patency and correct positioning, although this is not always needed (Fig. 8 on page 21). The ends of the stent should not be covered by colonic folds. If this happens, the position of the stent should be adjusted after deployment. Some authors recommend a low-residue diet and mineral oil to prevent stent occlusion by impacted fecal material.

After the procedure is completed, the patient’s vital signs are monitored and electrolytes are checked repeatedly until they return to normal. During the recovery period, the patient is staged and surgical risk is determined.

Twenty-four hours after stent placement, a plain radiograph of the abdomen is obtained to evaluate the position of the stent and to assess changes in the radiographic appearance of the obstruction (Fig. 9 on page 21, Fig. 10 on page 22, Fig. 11 on page 23).

Tumors are staged by abdominal CT or US. If the patient recovers satisfactorily, the preoperative assessment can be performed on an outpatient basis. After discharge, the patient is instructed to contact the managing team if clinical deterioration occurs. Patients are followed up periodically to ensure stability. Follow-up X-rays should be taken when the patient develops obstructive symptoms or peritoneal signs. During physical examinations (digital rectal examination) and at surgery, special consideration should be given to the presence of a metallic stent to avoid injury to the examining physician.
Elective surgery is usually performed about 10 days after implantation of a SEMS (except in neoadjuvant treatments).

**Complications:**

It is unknown whether the insertion site, type of stenosis, or type of tumor affects the efficacy of the procedure or risk of complications.

Early complications include pain, perforation, and rectal bleeding; late complications include distal or proximal stent migration and stent obstruction after successful initial decompression.

Among the risk factors associated with complications are covered stents and a high degree of occlusion; complete colorectal obstruction may be associated with friable and damaged tissue.

Extracolonic malignancy also carries a risk of complications because of its possible relation to carcinomatosis or immobilized bowel.

Minor complications related to colon stent placement are mild-to-moderate rectal bleeding, transient anorectal pain, temporary incontinence, and fecal impaction.

1. **Mortality:** Colonic stenting is considered a relatively safe procedure; it is safer than the surgical procedure.

2. **Perforation (Fig. 12 on page 24, Fig. 13 on page 25, Fig. 14 on page 26):**
   This is the most severe complication and the one that most often results in death, although asymptomatic perforation has also been reported. Areas of tumor necrosis or healthy bowel wall can be perforated by angiographic catheters and guidewires during manipulation or by the sharp edge of the stent once it opens. The use of soft-tipped guidewires may help reduce perforation. There is a greater risk of perforation when dilating the stenosis before stent placement (additional balloon dilation is not recommended). If a patient complains of severe abdominal pain, perforation should be suspected, especially if the pain occurred immediately or shortly after the procedure. Although conservative treatment is usually attempted, surgical treatment is often required.

3. **Inadequate decompression (Fig. 15 on page 27):** Malpositioning of the stent or incomplete expansion should be suspected. Initial stent dilation might be insufficient on
the first day, and physicians should pay attention to the gradual expansion of the stent during the next couple of days.

Persistent colonic obstruction can also be related to undetected synchronous carcinomas.

4. Migration (Fig. 16 on page 28)

Stents can migrate during the placement procedure or anytime after successful implantation.

Stent migration occurs because of technical factors such as:

- inadequate expansion.
- technical error (typical in proximal migration and another stent could be placed) (Fig. 17 on page 29).
- failure of the stent to adhere due to insufficient stenosis or due to the characteristics of the stent (especially covered stents) (Fig. 18 on page 31).

Stent characteristics that favor migration include smaller diameter, which results in greater angulation of the colon, and insufficient length; stents that are not long enough are more susceptible to flaring.

Migration also occurs when radiation therapy and/or chemotherapy successfully reduce tumor mass and in patients with a benign etiology.

Most patients remain asymptomatic with stent migration, and further intervention is useless. However, some patients may complain of rectal irritation or symptoms of reobstruction.

Migration is more common when stenting is done for palliative purposes rather than as a bridge to surgery, because the stent remains in the colon longer, increasing the possibility of late migration.

Most migrations are distal and late. No action is required, especially when stenting is intended as a bridge to surgery. Migrated stents are often spontaneously expelled through the rectum; if not, they can be removed manually or endoscopically.

5. Obstruction after a successful decompression (Fig. 19 on page 31, Fig. 20 on page 32, Fig. 21 on page 33)
The most common cause of obstruction is tumor overgrowth (extension of tumor above or below the stent) or ingrowth. Other causes of recurrent obstruction are fecal impaction, stent migration, and obstruction by peritoneal implants.

In palliative decompression for a longer time, tumor ingrowth with restenosis can be problematic.

Covered stents can help address the problem of tumor ingrowth, but tend to be less flexible and more difficult to deploy in proximal locations; they are also more susceptible to migration.

Restenosis due to tumor ingrowth or overgrowth can be treated with a second stent. It is best prevented by deploying the original stent 2-3 cm above or below the lesion when possible.

Fecal impaction occurs often and is treated with a cleansing enema. Using 20-24-mm-diameter stents and prescribing a low-residue diet and a mineral oil supplement can help prevent impaction.

Other complications:

a. Rectal bleeding: Rectal bleeding can result from contact with the tumor (depending on its friability) when placing the stent. It usually occurs within hours of stenting. Bare stent wires injure the mucosa. Late bleeding (>3 days after the procedure) is usually caused by arterial erosion. Bleeding is more common in patients with coagulation disorders or treated with anticoagulants or antiplatelet drugs. Transient rectal bleeding generally requires no treatment.

b. Mild abdominal Pain: The most common complication after colonic stenting is abdominal and rectal pain. Stenting in the very low rectum may cause severe tenesmus and should therefore be avoided. Pain and tenesmus: these complications are common when the distal end of the SEM is near the anal canal, so a margin of at least 5 cm or 6 cm between the end of the stent and the anal canal is recommended.

c. Stent fracture followed by obstruction and colonic perforation

d. SEM malfunctioning: Failure to open correctly, incorrect placement, entry or exit cones against the wall of the colon.
Technical failure can have many causes; for instance, sharply angulated, tortuous, and fixed intestinal segments can make it impossible to pass a guidewire through the stricture or colonic immobilization due to adhesions and peritoneal seedings can make it difficult to access the obstructive lesion during stent insertion. Extensive compression by an extrinsic mass or multifocal strictures caused by carcinomatosis can result in failure to decompress bowel obstructions after successful stenting.

New developments in the technique: **cecostomies:**

In palliative cases when it is not possible to access the colonic tumor from a retrograde approach, antegrade placement of colonic stents through a cecostomy or colostomy is a feasible alternative.

**Images for this section:**
Fig. 1: 63 year-old man with intestinal obstruction due to colorectal cancer in the proximal descending colon. Fluoroscopy shows water-soluble iodinated contrast enema.
Fig. 2: 63 year-old man with intestinal obstruction due to colorectal cancer in the proximal descending colon. Fluoroscopy shows water-soluble iodinated contrast enema to locate and determine the length and caliber of the obstructive lesion.
**Fig. 3:** The same patient as in Fig. 1 and 2: the stiff hydrophilic guidewire is crossing the obstructive segment under fluoroscopic guidance.

**Fig. 4:** 63 year-old man with intestinal obstruction due to colorectal cancer in the proximal descending colon. The excessively tortuous or redundant rectosigmoid region in this patient required us to use an extra-stiff guidewire.
**Fig. 5:** 63 year-old man with intestinal obstruction due to colorectal cancer in the proximal descending colon. An exchange-length stiff guidewire is advanced well beyond the lesion.
**Fig. 6:** 63 year-old man with intestinal obstruction due to colorectal cancer in the proximal descending colon. Fluoroscopic images show the deployment process.
**Fig. 7:** 63 year-old man with intestinal obstruction due to colorectal cancer in the proximal descending colon. Fluoroscopic images show the deployment process.

**Fig. 8:** 63 year-old man with intestinal obstruction due to colorectal cancer in the proximal descending colon. Abdominal plain film obtained to document post-stenting patency and correct positioning; this documentation is not always necessary.
Fig. 9: Abdominal plain films show the evolution of an intestinal obstruction due to colorectal cancer in the sigmoid colon in a 74-year-old man. This x-ray shows the colonic obstruction before treatment.
Fig. 10: Abdominal plain films show the evolution of an intestinal obstruction due to colorectal cancer in the sigmoid colon in a 74-year-old man. This x-ray was obtained immediately after stent placement.
Fig. 11: Abdominal plain films show the evolution of an intestinal obstruction due to colorectal cancer in the sigmoid colon in a 74-year-old man. This x-ray was obtained 24h after treatment, shows the successful outcome.
**Fig. 12:** Colorectal cancer in the sigmoid colon in a 77-year-old man. Intracolonic contrast enema CT reveals extravasation of contrast enema among bowel loops, compatible with perforation.
**Fig. 13:** Colorectal cancer in the sigmoid colon in a 77-year-old man. Intracolonic contrast enema CT reveals extravasation of contrast enema among bowel loops, compatible with perforation.
Fig. 14: In the same patient as in Figs. 12 and 13, abdominal CT (lung window setting) shows pneumoperitoneum, confirming colonic perforation.
Fig. 15: Intracolonic contrast enema CT reveals incomplete expansion of the SEMS, due to a very obstructive colorectal cancer in the splenic flexure.
**Fig. 16:** Pelvic plain film shows distal migration of the SEMS in a patient with a tumor in the sigma; the SEMS was palpable at digital rectal examination.
**Fig. 17:** 56 year-old man with intestinal obstruction due to colorectal cancer in the rectosigmoid junction, after a successful decompression with SEMS. Fluoroscopy shows proximal migration and another stent being placed.

**Fig. 18:** Patient in whom a covered stent was deployed to treat a benign stricture involving sigmoidectomy anastomoses; 24h after the procedure distal migration was evident.
Fig. 19: 63 year-old man with intestinal reobstruction after a successful decompression due to colorectal cancer in the sigmoid colon. Coronal abdominal CT image reveals obstruction of the SEMS due to tumor ingrowth.
**Fig. 20:** In the same patient as in Fig 19, water-soluble iodinated contrast enema fluoroscopy confirms the restenosis.
Fig. 21: In the same patient as in Fig 19, fluoroscopy shows second stent being deployed to treat the obstruction.
Conclusion

In colonic obstruction, stenting is effective as a palliative treatment or as a bridge to one-stage oncology surgery.

This exhibit provides all the basic information that a radiology resident needs to know to understand the procedure.

Personal information

References


