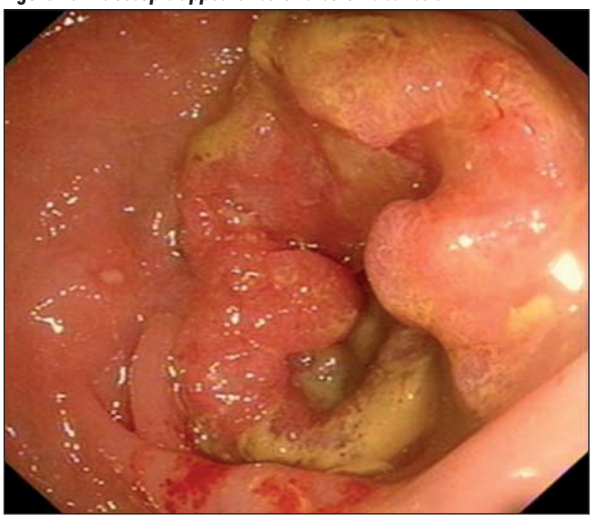
Stents and stentability: treatment for malignant bowel obstruction

Colonic stents offer a palliative treatment for patients with malignant bowel obstruction otherwise requiring surgery and possible stoma, or as a bridge to surgery for potentially curative malignant disease. This article reviews the indications, risks and benefits of stent insertion.

Colorectal cancer (*Figure 1*) is the third most common malignancy affecting men and women in the UK. Up to 29% of these patients present with large bowel obstruction, with the majority of these (70%) diagnosed with an advanced tumour stage (Alvarez et al, 2005). Prompt intervention is necessary to avoid complications such as ischaemic colonic perforation (Knop et al, 2004).

Gastrointestinal stents were initially developed to treat patients with upper gastrointestinal and biliary malignancies. In 1991, Dohmoto reported using a metal stent to treat a malignant rectal stricture. While oesophageal stents were initially used, over the years they have been redesigned specifically for use in the colon. Now commonly referred to as self-expanding metal stents or SEMS, their use has predominantly been reported in the left colon, where obstructing colorectal cancers are most frequently diagnosed (Aitken and Horgan, 2007). They can be used in the proximal colon as well, but may be technically more challenging to place successfully. This article provides an overview of colonic stent insertion for malignant bowel obstruction, outlining the risks and benefits of their use in different patient groups.

Figure 1. Endoscopic appearance of a colonic cancer.



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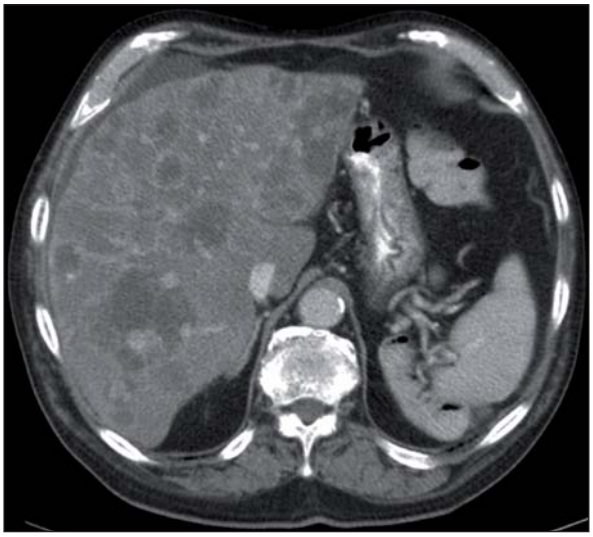
Indications

Self-expanding metal stents may be inserted as a definitive treatment in patients with incurable metastatic disease (*Figure 2*), extensive locally advanced disease and those who refuse surgery. In this group, technical success rates (successful stent placement at the first attempt with correct deployment confirmed radiologically) are reported at 93%, with clinical success rates (clinical and radiological evidence of colonic decompression within 48 hours of stent insertion without the need for reintervention) of 91% (Sebastian et al, 2004). On an intention-to-treat basis the clinical success of self-expanding metal stents at 6 months in palliative placement remains high at 81% (Repici et al, 2007).

Stents may also be used as a bridge to elective surgery or oncology intervention. In these cases technical success rates are reported at 92% with clinical success rates (ability to perform a single-stage surgery with primary anastomosis) of 72% (Sebastian et al, 2004). Stent insertion

Figure 2. Abdominal computed tomography image identifying multiple liver metastases.



may allow the conversion of emergency to elective operations with an associated reduction in mortality rates from up to 20% to 6% (Sebastian et al, 2004). This results from the ability to provide adequate bowel preparation, decompress the proximal colon, correct electrolyte imbalance and optimize coexisting medical conditions, reducing the likely need of a stoma to around 30% (Aitken and Horgan, 2007). It also allows patients to be operated on by experienced colorectal surgeons who may be able to perform a laparoscopic or open single-stage operation with primary colonic anastomosis, rather than a stoma. This can be achieved in 95% of cases following stent insertion, avoiding the morbidity and mortality rates associated with further surgery (Khot et al, 2002).

In instances where this is not feasible, a temporary stoma may be formed (e.g. Hartmann's procedure), but is associated with perioperative mortality rates of approximately 10% (Deans et al, 1994; National Bowel Cancer Audit Project, 2007). Many of these stomas (40%) are never reversed, resulting in physical and psychological morbidity (Vandervoort and Tham, 2006; Tsunoda et al, 2008).

Some concerns were raised following a recent Dutch prospective, randomized trial comparing colonic stents as a bridge to surgery with emergency surgery for acute left-sided stage IV colorectal cancer. It excluded patients with proximal colonic obstruction and an American Society of Anesthesiology score of IV or V. However, only a small number of patients were enrolled into this trial because there was a high number of adverse events in the stent group, leading to early study closure (van Hooft et al, 2008). Further prospective randomized trials ascertaining the role of stent insertion before surgery are clearly required before it is accepted as the gold standard intervention in this setting.

Self-expanding metal stents also play a role in treating bowel obstruction secondary to extracolonic malignancy. This results from extrinsic compression as a result of mass effect, peritoneal involvement, intraluminal invasion, adhesions or secondary motility disorders (Carter et al, 2002). Up to 50% of patients with ovarian cancer present with symptoms of bowel obstruction, with around 35% of patients receiving only limited benefit from surgical intervention, dying within 2 months of surgery (Carter et al, 2002; Ripamonti et al, 2008). Stent insertion provides an alternative treatment option. Technical success of stent insertion in this patient group is as high as 87%, but is associated with reobstruction in approximately 25% of cases or stent migration in approximately 9% of cases (Shin et al, 2008). Bowel obstruction may reoccur in a quarter of patients at either the same or additional sites within the small or large bowel (Miyayama et al, 2000).

Following stent insertion, appropriate radiological investigations can be performed to exclude significant proximal colonic pathology and stage disease before discussion at local multidisciplinary team meetings. This helps identify patients inappropriate for radical surgery as a result of extensive local or widely metastatic disease. Magnetic resonance imaging (MRI) and computed tomography (CT) scans can be safely performed in stented patients with minimal imaging artifact (Aitken and Horgan, 2007). Colonoscopy has been performed through inserted stents to exclude synchronous proximal colonic pathology with no reported colonoscope damage or dislodgement of the stent (Vitale et al, 2006).

Stent contraindications

An absolute contraindication to stent insertion is colonic or tumour perforation with clinical signs of peritonitis. A relative contraindication includes low rectal tumours, as stents inserted less than 2 cm from the anal margin can result in tenesmus and faecal incontinence (Baron and Kozarek, 2004). In these circumstances palliative surgery or oncology interventions should be considered first line.

The ability to pass an endoscope through a stricture indicates that it is unlikely to retain a stent, resulting in stent migration. The authors would advise against stent insertion in this scenario.

Stent types

A variety of self-expanding metal stents are now commercially available. They are manufactured in a mesh design from stainless steel or nitinol, a nickel–titanium alloy. Nitinol has a property called 'memory' helping it to retain its shape and position within the colon. The stents expand over 24–72 hours, becoming incorporated into the tumour and surrounding mucosa by pressure necrosis which helps them to maintain their position (Shim et al, 2004).

Covered stents have a polytetrafluoroethylene (PTFE) or silicone lining. Uncovered and covered stents have similar technical and clinical success rates. The main disadvantage of covered stents is late migration in 40% of cases, because of their reduced ability to cause pressure necrosis (Lee et al, 2007). This complication occurs more commonly than with uncovered stents whether inserted for a primary colonic or extracolonic malignancy.

Uncovered stents are also at risk of either tumour ingrowth through the mesh (approximately 19% of cases) or tumour overgrowth. Insertion of a second, covered stent is recommended as the standard treatment. However, laser therapy or argon beam photocoagulation may be used as an alternative (Lee et al, 2007).

One oncological concern has been the possible spread of malignant cells during stent insertion. However, Saidi et al (2003) have shown no significant difference in 5-year survival in patients receiving self-expanding metal stents as a bridge to surgery compared with surgery alone.

Stent insertion

A water-soluble enema (e.g. gastrografin or omnipaque) before stent insertion excludes obvious tumour perfora-

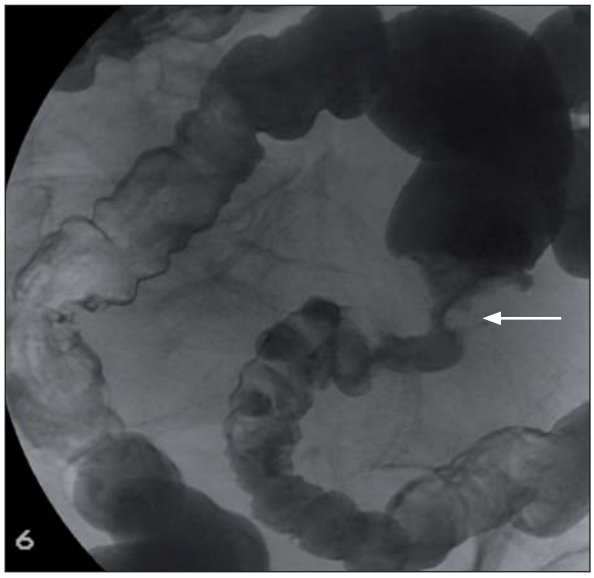


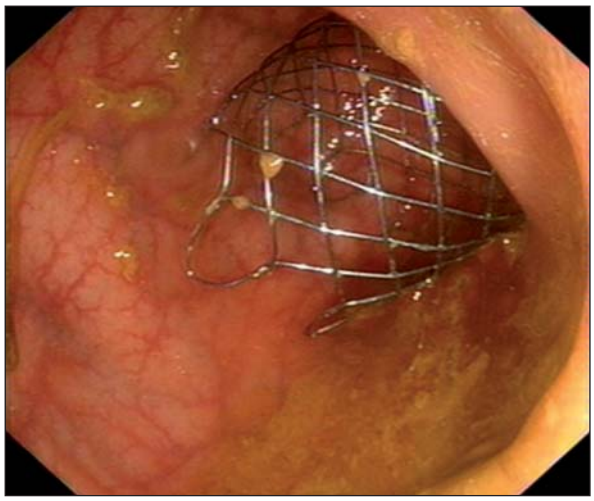
Figure 3. Gastrografin enema performed before stent insertion, indicating an 'apple core' stricture (arrow) in the sigmoid colon.

tion, provides a guide to the anatomy of the stricture (*Figure 3*) and a degree of bowel preparation (Vandervoort and Tham, 2006). Barium enema has been used as an alternative but can result in contamination of the peritoneal cavity in cases of perforation and may impair endoscopic views of the stricture during stent insertion. For these reasons the authors do not recommend their use.

A phosphate enema can be used to partially clean the colon and optimize views distal to lesions in the left colon before stenting. Full bowel preparation is avoided because of the potential for colonic perforation in obstructing lesions.

Stents are inserted using fluoroscopic guidance or endoscopy alone, but more commonly through a combination of the two (*Figure 4*). The method used varies between different centres and the location of the lesion within the colon. Use of endoscopy confers several advantages including the potential for biopsy, improved access to the proximal colon, better visualization and control of the guidewire through angulated strictures and the use of endoscopic clips in preventing stent migration (Repici et al, 2008). 'Through-the-scope' stents have been developed, which fit through colonoscope channels. For fluoroscopic insertion 'over-the-wire' devices may be used. The main factor limiting insertion is failure of placement of the guidewire across the stricture. *Figure 5* shows an abdominal X-ray with a colonic stent in the sigmoid colon, following successful deployment.

Figure 4. Endoscopic view of the stent following insertion.

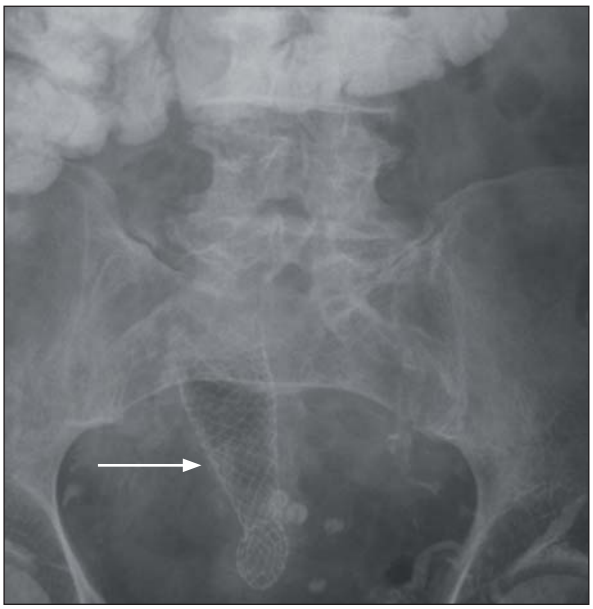


The majority of self-expanding metal stents are placed in the left colon distal to the splenic flexure, where 75% of obstructing tumours occur (Aitken and Horgan, 2007). Insertion in the proximal colon was first reported by Campbell et al (1997), but can be more technically difficult as a result of colonoscope looping and reduced visibility from faecal residue. Failure of stent insertion is more common in the proximal colon (15.4%) than the rectosigmoid (5.8%) (Sebastian et al, 2004).

Post-stent care

In the absence of diarrhoea, patients are advised to eat a low residue diet and regularly use a laxative (stool softener) to minimize the risk of faecal impaction that accounts for a quarter of stent occlusions (Khot et al, 2002). There is limited information regarding bowel function, with most studies only reporting the clinical success of stent insertion. Davies et al (2005) studied the bowel function of 21 patients, with a reported median bowel frequency of 3.5 times per day. They found that 14% of patients required regular laxative, 38% always passed liquid stool and 4.7% (one patient) described severe continuous diarrhoea requiring a stoma. However, it was difficult to establish whether these symptoms were related to the underlying malignant process or stent insertion.

Figure 5. Abdominal X-ray showing a colonic stent (arrow) following insertion.



Complications

Pooled data report mortality rates of less than 1% related to self-expanding metal stents insertion. Perforation rates are approximately 4%, but increase to 10% with the use of dilatation (Khot et al, 2002). As a result it is now recommended that these strictures are not dilated before stent insertion. Stent-related tumour perforation usually results from inadvertent guidewire misplacement or stent expansion. Perforations or fistulae may also occur with tumour growth and infiltration of surrounding structures. Stent-related complications are reported in *Table 1*.

Bleeding is reported in 5% of cases and is usually self limiting (Khot et al, 2002). It often results from the underlying malignancy or erosion of the colonic mucosa by the stent margin, causing ulcer formation (Wai et al, 2005).

Overall, stent migration occurs in 10% of cases, with only half of these requiring further intervention (Khot et al, 2002). They are either expelled spontaneously through the anus or sometimes require manual removal. Oncology treatments such as chemoradiotherapy can result in tumour shrinkage further increasing the potential for stent migration.

Cost comparison

Limited data exist studying the costs of stent insertion *vs* surgery. Self-expanding metal stents are presently reported to be more cost effective than surgery in both the palliative setting and as a bridge to surgery, mainly as a result of the shorter length of hospital stay. This shorter stay has additional importance in patients with a limited life expectancy. Osman et al (2000) reported the cost effectiveness of stents, with savings of £685 when stents were used as a bridge to surgery and £1760 when palliative stent insertion was compared with surgery. Self-expanding metal stents also offer an additional saving when outpatient costs such as stoma care are considered.

Table 1. Complications of stent insertion

Complications	Incidence
Stent migration	10%
Stent occlusion secondary to tumour ingrowth or overgrowth or faecal impaction	9%
Abdominal or rectal pain	5%
Bleeding	5%
Fistula formation	4%
Perforation	4%
Stent fracture	3%
Tenesmus	3%
Faecal urgency	1%
Sedation risks	Not reported

Adapted from Khot et al (2002); Baraza et al (2008)

The length of hospital stay following surgery is falling annually (National Bowel Cancer Audit Project, 2007). If this trend continues, the inpatient costs for these two treatment options may potentially equalize in the future.

Conclusions

Overall self-expanding metal stents have a high technical and clinical success rate. They deliver an effective method of treating malignant bowel obstruction, with reduced hospital stay in the palliative setting. Covered stents provide a useful treatment for tumour ingrowth and overgrowth, but are associated with higher rates of migration.

High technical success rates for self-expanding metal stents insertion as a bridge to surgery are also reported. However, their role in this setting is controversial, with concerns surrounding the potentially higher risk of stent-related colonic perforation. Collaboration between the patient, colorectal surgical team and person responsible for stent placement is essential, with careful explanation of the potential risks and benefits of stent insertion. In patients fit enough for surgery, a single-stage minimally invasive operation is most desirable. If stent insertion is considered the most appropriate initial treatment, surgical intervention should be readily available in case of complications or failure to decompress the colon. Further prospective randomized trials are required to compare self-expanding metal stents as a bridge to surgery *vs* emergency surgery in the treatment of acute malignant bowel obstruction. **BJHM**

Conflict of interest: none.

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KEY POINTS

- Colonic stents can be used as a palliative treatment for patients with malignant large bowel obstruction who have advanced, surgically inoperable disease or those unfit for surgery.
- They may also be used as a bridge to surgery, to allow optimization of comorbid conditions, complete radiological staging and discussion at multidisciplinary meetings in patients presenting acutely.
- Technical success rates of greater than 90% are quoted for the use of stents as both a palliative treatment of malignant bowel obstruction and when used as a bridge to surgery.
- Colonic stents reduce the morbidity associated with surgery and stoma formation in the palliative group.
- They are easier to insert in the left colon.
- There are reported complication rates of up to 10%, with stent migration occurring most commonly.

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