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Colorectal stenting as an effective therapy for preoperative and palliative treatment of large bowel obstruction: 9 years' experience

Abstract Background Since their introduction, self-extending metal stents (SEMS) have established themselves as an option in the treatment of obstructive colorectal cancer. Thanks to stenting, patients traditionally treated with emergency surgery can now be converted to scheduled surgery with mechanical preparation of the colon and primary anastomosis. Stenting represents a valid one-step surgical alternative for intestinal obstruction of the colon. **Methods** We performed a prospective study of 95 patients (mean age, 68 years; range 48–94) with large bowel obstruction due to colorectal cancer treated with SEMS placed under fluoroscopic guidance, some as a bridge to surgery (group A) and others with palliative intent (group B). Computed tomography was performed for diagnostic purposes and to study the extent of disease. **Results** Treatment was palliative in 28 cases (group B) and as a bridge to surgery in 67 (group A). The latter group underwent mechanical preparation of the colon and elective surgery. No patients died as a result of the procedure. In 90 cases (95%), treatment was effective and the obstruction resolved. Complications were 4 cases of perforation, 1 of tenesmus, 4 obstructions and 4 migrations. In 7 cases, a second stent was inserted to allow subsequent scheduled surgery. **Conclusions** Self-extending stents resolve colorectal cancer obstruction and allow optimal patient staging and scheduled surgical treatment. Stenting is also a useful option in advanced or irresectable tumors, avoiding the need for surgery and offering good palliation.

Key words Colorectal cancer • Colorectal stents • Large bowel obstruction • Palliation

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Introduction

Large bowel obstruction due to colorectal cancer still represents a major challenge for colorectal and emergency surgeons alike. In the West, 300 000 new cases are diagnosed annually and lead to 150 000 deaths [1, 2]. Between 8% and 30% of colorectal cancers occlude [3] at some point in their evolution, accounting for 85% of colonic emergencies [4]. Of these occlusions, 70% are located in the left colon and the rectosigmoid junction [5]. It has also been reported that emergency surgery patients have poorer prognosis than those operated electively [6], higher rates of metastasis and lower long-term survival according to Dukes stage [5, 7, 8]. However, this poorer prognosis may be influenced by the emergency situation and by the fact that the intervention may not be carried out by an expert in coloproctology [5, 9].

The surgical treatment of these patients is a controversial issue. Mortality in emergency surgery ranges between 15% and 20% and morbidity between 45% and 50%, compared with a 0.9%–6% mortality rate in elective surgery [10, 11]. These differences are due not only to the more advanced stage of illness, but also to the electrolytic alterations and the fecal contamination of an unprepared, obstructed colon [10]. The most widely used technique is Hartmann's procedure (primary resection with terminal colostomy), but the inter-

vention has a number of associated problems. Only 60% of patients with Hartmann procedure are eventually reconstructed because of the stage of the disease and the high risk; the reconstruction may be challenging because of adhesion syndrome and the difficulty of locating the rectal stump. Psychological problems in ostomized patients and the high economic cost are other reasons to avoid a stoma.

We evaluated the effectiveness of stenting in relieving acute obstruction due to colorectal cancer in 95 consecutive patients.

The aim of our study is to show our experience with colorectal stent and discuss complications and indications with an overview on literature.

Materials and methods

This was a prospective, observational study of consecutive patients who received colonic stenting under fluoroscopic control after diagnosis of colonic or rectal obstruction between November 1997 and November 2006. The sample included patients with an emergency clinical diagnosis of obstruction of the left transverse colon, splenic flexure, left-sided colon, rectosigmoid junction and the upper two-thirds of the rectum after clinical and radiological suspicion (simple abdominal radiograph). Patients with clinical and radiological suspicion of perforation or necrosis, hemodynamic instability (hypotension and tachycardia), sepsis or acute peritonitis were excluded.

In the first stage of the study, the stent was inserted only for palliative treatment in 9 patients with high morbidity and disseminated disease, in order to avoid the creation of a stoma. From 1999 onwards, stenting was applied in all patients with acute obstruction of the left colon and upper two-thirds of the rectum. Stents were therefore inserted in two groups: group A (patients requiring intestinal decompression and resolution of the obstruction to allow mechanical preparation of the colon for elective surgery with tumoral resection and primary anastomosis) and group B (patients who received definitive, palliative treatment instead of surgical resection or diverting surgery due to associated morbidity or advanced stage of neoplastic disease). For the first 23 cases, we also included patients with incomplete bowel obstruction defined as bowel dilatation seen at computed tomography (CT) with some contrast medium (diatrizoate meglumine and diatrizoate sodium solution; Gastrografin, Bracco Diagnostics) passing through the tumor. After 4 cases of stent migration, all occurring in patients with incomplete obstruction, we modified the protocol to include only patients with complete obstruction defined as bowel dilatation seen at CT and complete obstruction on Gastrografin enema.

The aim of the study was to evaluate the effectiveness of stenting in relieving acute obstruction due to colorectal cancer, avoiding an emergency surgery and a colostomy. Ethical committee approval was obtained for the study.

The protocol for patients with obstruction of the left colon and rectum is shown in Fig. 1. Patients suspected of having large bowel obstruction from evidence on a simple abdominal radiograph were enrolled and underwent abdominal CT to obtain a reliable diagnosis of the aetiology of the obstruction, its localization, and local and distant staging, with an evaluation of possible liver involvement. After ruling out perforation of the hollow viscera, and once the complete obstruction was confirmed, the stent was inserted after assigning the patient to one of the two study groups. Patients were transferred to the X-ray unit where the location of the lesion and the total obstruction were confirmed with a Gastrografin enema under fluoroscopic control. The stent was inserted and patients were then moved to the ward for clinical and radiological monitoring and follow-up with serial radiographs 24 and 48 hours after stenting. In the case of complications during insertion (e.g. perforation, or if placement was technically impossible) emergency surgery was performed.

On admission to the study, patients received intravenous hydration and antibiotics (ceftriaxone, 1 g over 12 h; metronidazole, 500 mg over 8 h). Those allergic to penicillin were admin-
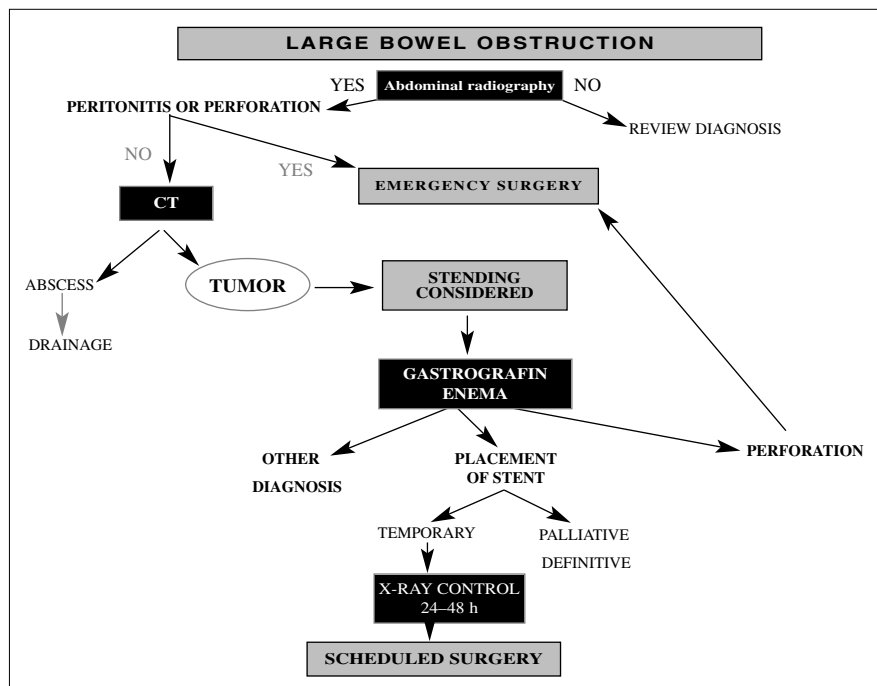

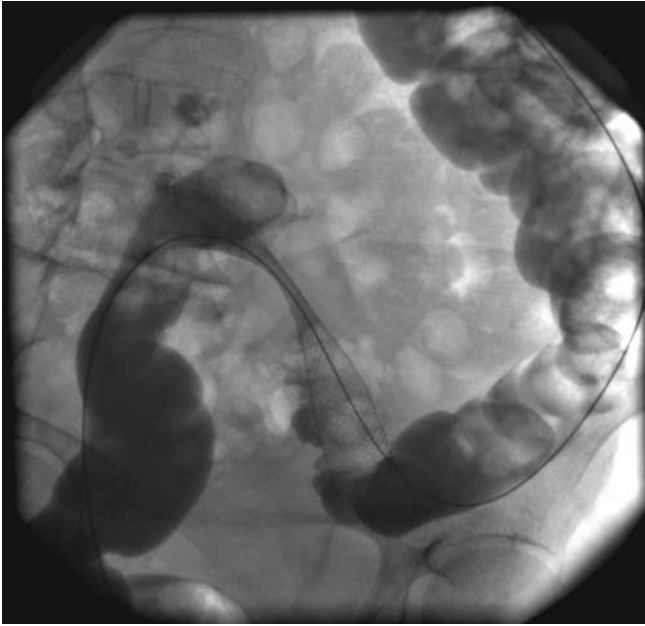Fig. 1 Action protocol in patients with large bowel obstruction

Fig. 2 X-ray image of stent in obstructive sigmoid neoplasia during expansion

istered gentamycin (240 mg over 24 h) and metronidazole. If the obstruction resolved, elective surgery was scheduled with mechanical preparation of the colon (phosphosoda or Bohm's solution) by surgeons from the Coloproctology Unit in the bridge to surgery group (group A). Patients with a tumor in the upper two-thirds of the rectum received a protective ileostomy.

In January 2004 the protocol was modified in order to perform a comparative study of stent insertion and elective surgery versus emergency surgery with on-table colonic lavage and primary anastomosis. As a result, some patients initially scheduled for stenting were converted to another type of treatment.

In group A, patients were followed until discharged from the hospital. In group B, patients were referred to a palliative care unit and we received information only in case of stent complications.

Stent placement

Stenting was performed under fluoroscopic control in the interventional radiology unit at our institution. In all cases, a Gastrografin enema examination was performed to describe stricture location and length and to exclude bowel perforation. In the early treatment sessions, intravenous sedation was used in a few patients. Later, intravenous sedation was given only if patients preferred. Angiography catheters and guide wires were used to negotiate the stricture. This technique was later replaced by a stiff guide wire, and the stent delivery system was then deployed over the guide wire (Fig. 2). Anteroposterior abdominal radiographs were taken at 24 and 48 h to check that the stent had fully deployed and that the colon had decompressed. All stents were inserted after admission of patients with large bowel obstruction as an emergency procedure. Clinical success was identified as colonic decompression within 48 h of successful stent placement.

Initially, enteral stents were used: Enteral Wallstents (Boston Scientific-Microinvasive) were used in 21 cases, Esophacoil

(Medtronic) stents were used in 5 cases and Hanaro colorectal stents (MI Tech) were used in 32 cases. Later, these were replaced by a modified form of Enteral Wallstents (Wallflex, Boston Scientific-Microinvasive), used in 45 cases, in which the steel mesh with pointed end was replaced by a new design of Ninitol without this structure, thus avoiding microperforation in the colorectal mucosa.

Results

Ninety-five patients (42 men) of mean age 68 years (range, 48–94) were prospectively enrolled in the study. In 67, the aim of the stenting was to deal with the obstruction and to allow elective surgery with mechanical preparation and primary anastomosis of the colon. The stent was inserted for definitive palliative treatment in the other 28 patients. In most of the patients, malignant tumor was confirmed; the stricture was benign in only three cases of diverticulitis. The locations of the stenoses are shown in Table 1.

The occlusion resolved in 90 (95%) of the 95 patients. The complications associated with stenting are shown in Table 2. Of the 4 perforations of the colon (2 cases with Esophacoil and 2 with Enteral Wallstent), two were in group A and two were in group B. In all four cases, dilation

Table 1 Location of stenotic lesions prior to stenting

Location	Patients, n (%)
Left transverse colon	2 (2)
Splenic flexure	5 (6)
Descending colon	16 (17)
Sigmoid colon	24 (25)
Rectosigmoid junction	28 (29)
Rectum	20 (21)
Total	95 (100)

Table 2 Complications due to stenting and their outcomes

	Patients, n (%)
Complication	
Perforation	4 (3.8)
Migration	4 (3.8)
Obstruction	4 (3.8)
Fecaloma	3
Tumor progression	1
Tenesmus	1 (1)
Resolution	
Successful re-insertion of stent	
Migration	3 of 4
Obstruction	4 of 4
Emergency surgery	
Perforation	4
Migration	1

Table 3 Results of the 67 patients who underwent stenting as "bridge to surgery" (group A)

Clinical and technical success	64 (95%)
Deferred surgery (n=64)	
Resection and primary anastomosis	59 (92%)
Hartmann's procedure	5 (8%)
Abscessed neoplasia	2
Incomplete resection	2
Prior radiotherapy	1
Emergency surgery (Hartmann) (n=3)	
Migration of stent	1
Perforation from stent	2

was necessary; all perforations happened in the first 2 years of the study. Migration of the stent occurred in 4 cases (2 cases with Enteral Wallstent and 2 cases with Hanaro colorectal stent) in group A. The insertion of a second stent was required in 7 cases: in 4 cases with obstruction (3 in group A and 1 in group B) and in 3 cases due to migration. Stenting was considered to have failed in 5 cases (4 perforations and 1 migration in group A with Hanaro colorectal stent in which the second stent could not be inserted). These cases were resolved surgically using Hartmann's procedure. In total, 103 stenting procedures were performed and there was no difference between type of stents in rate of perforation and migration (data not shown).

Of the 67 patients who received temporary stenting prior to surgery (group A), scheduled surgery was possible in 64. In the other three, emergency surgery (Hartmann's procedure) was required, in two cases due to perforation during radiography and in one case due to migration of the stent and the impossibility of re-insertion. Of the 64 cases that underwent scheduled surgery, resection of the tumor and primary anastomosis was possible in 59, but in the other five Hartmann's procedure had to be performed. In those 5 patients, Hartmann procedure was not performed because of persistent obstruction, but was preferred because of neoplastic abscess (n=2), incomplete resection (n=2) and radiation damage (n=1) (Table 3). In 57 cases, the surgical approach was mid-laparotomy and in two laparoscopy was used. The median time between stenting and scheduled surgery was 5 days (range, 3–30 days). One patient initially refused surgery but later consented; the intervention was performed 30 days later. The mean post-surgery hospital stay was 10 days. There were no cases of anastomotic dehiscence or mortality related to the procedure or later surgery. In 3 cases anatomical examination showed benign pathology in the form of complicated diverticular disease.

In 28 cases stenting was used as definitive palliative treatment, due to the presence of one or more of the following: advanced stage, disseminated disease and severe co-morbid disease. The complications in this group were noted earlier: 2 cases of perforation during placement and one case of re-occlusion by the tumor after 6 months, which was resolved with the insertion of a new stent. Survival data in this group are not available because of the difficulty in following these patients admitted to a palliative care unit and because it was not the aim of the study.

Discussion

Whereas in obstructive tumors of the right-sided and transverse colon emergency resection and primary anastomosis are universally accepted, the situation in tumors of the left colon and the rectosigmoid junction is less clear. Classically, various alternatives have been proposed for the surgical treatment of large bowel obstruction (e.g. Hartmann's procedure, on-table colonic lavage with primary anastomosis or subtotal colectomy with primary anastomosis) but emergency surgery for obstructive colorectal cancer is associated with high rates of morbidity and mortality [12–15] although improved results have been reported in recent years [16]. An audit of 8077 patients showed that the surgery-associated mortality rate was 16.5%, whereas series of published cases present mortality rates of up to 40% [17]. The risk of death increases with age, Dukes stage and ASA (American Society of Anaesthesiologists) class, and depends on the degree of resectability of the tumor. An eighty-year-old patient with an unresectable lesion, major comorbidity and metastasis has a mortality risk of 70% and in some cases may reach 100% [17]. The chance to replace emergency surgery with an elective intervention after resolution of the occlusion will improve results and scoring systems to predict mortality from surgery [18, 19]. This is feasible today thanks to the insertion of colonic stents.

Initially stenting was used for palliation of symptoms [20–22], but in light of the positive results obtained it began to be used to allow elective surgery. The results were excellent again, allowing resolution of the occlusion without the need for emergency surgery and ensuring that the patient could be operated later in optimal conditions. Stenting also permits a good recovery of the patient's general state and adequate mechanical preparation of the colon for later resection and primary anastomosis in a single surgical procedure [23–26].

Three systematic review articles have analysed the results of the use of self-expanding stents in colorectal obstruction [27–29]. The first examined the results of 34 publications, focusing on clinical and technical success and complications [27]. A total of 896 patients were reviewed, 98% of whom had malignant stenoses. Total decompression was accomplished in 726 patients, with a technique-associated mortality rate of 0.4%; 460 procedures were considered palliative and 266 as bridge to scheduled surgery which, in 92% of cases, achieved the resection of

the tumor and anastomosis in a single surgical intervention. The second review included 54 publications with 1198 patients, recording mortality rates of 0.58%, a clinical success rate of 94% (90%–100%) and a technical success rate of 91% (84%–94%) [28]. The clinical success rate when the stent was used as bridge to surgery was 71.7%. Finally, the third review included 88 articles, 15 of which were comparative [29]. The median rate of technical success was 96.2% and of clinical success was 92%. Samples sizes in the studies reporting these efficacy parameters varied widely, from 3 to 89 patients, with a median sample size of 15 patients. In our series, the obstruction resolved with stenting in 95% of cases (90 of 95 patients) in a total of 103 procedures; re-insertion of a second stent was attempted in 8 cases (4 with migration and 4 with obstruction) and was successful in seven. These success rates compare favorably with those reported in the literature.

The complications associated with stenting can be divided into major and minor [30]. In some cases major complications should be treated with emergency surgery and in others the insertion of a second stent is required, while minor complications can be treated conservatively. The most important major complication is intestinal perforation (4%) [30]. Perforation occurs mainly in cases in which pneumatic dilatations are performed and less frequently after recanalization with laser endoscopy and subsequent stenting. In most cases perforation requires emergency surgery (64%) though conservative antibiotic treatment has also been reported [28]. In our series we recorded 4 perforations (3.8%), all during the first two years, and all associated with dilatations. For this reason we advise against dilatation, especially when the tumor is located in the possibly tortuous rectosigmoid junction. The two other complications in this group were migration and obstruction. In both cases, the insertion of a new stent was a valid option. Migration occurs in 12% of cases and is usually distal; the further from the distal third of the rectum the stent is inserted, the greater the chances of migration (10% in the rectum, 27% in the left colon) [28]. Migration is more frequent in the palliative group and when the stent is coated, since the coating may hinder proper anchoring in the mucosa affected by the tumor [28, 31]. In our series, 4 patients (3.8%) presented migration; a second stent was inserted in three, while the other required emergency surgery. All our cases with stent migration were in the bridge to surgery group (group A) and in all cases incomplete obstruction was observed. For this reason after those cases in the beginning of the study we decided to include only patients with complete obstruction and we considered incomplete obstruction a contraindication to stenting. Obstruction of the stent occurs in 7.34% of cases, mainly due to fecal impaction, tumor growth, and mucosal prolapse [30]. We observed 4 cases of obstruction (three due to fecal impaction and one due to tumor growth) which resolved with the placement of a second stent.

Minor complications include hemorrhage, tenesmus and transitory incontinence. In the first case, the evolution of the neoplastic disease itself increases the possibility of bleeding. In the other two cases the stent is placed very near the anorectal line and so these complications are to be expected. In our series, there was one case of tenesmus and transitory incontinence in a patient with neoplasia 8 cm from the anal margin who was treated medically until the day of surgery.

In the bridge to surgery group (group A), we found that the longer the time between stenting and surgery the greater the technical difficulty involved in removing the tumor, especially in the rectosigmoid junction, due to the inflammatory response to the stent [32]. We recommend performing surgery promptly, if possible within three days of stenting. Initially the absence of an efficient treatment pathway resulted on occasion in a delay of up to ten days in performing surgery. Thanks to the existence of these treatment pathway today, surgery is performed within 48 h of admission. In most cases the intervention used is a mid-laparotomy. However, recent reports have stressed the advantages of laparoscopy [33–35], and since the introduction of laparoscopic colon surgery at our Coloproctology Unit we have used this approach twice, achieving good results in both cases.

In the palliative intent group (group B) the main advantage is the avoidance of surgery and the creation of a terminal colostomy which has favorable repercussions for the patient's quality of life. Stenting also shortens hospital stay and facilitates the transfer of patients to palliative care units [28], allowing the use of palliative chemotherapy if required [30]. The only drawback is that the stent cannot relieve other symptoms such as bleeding or pain, which must be controlled medically.

Whenever a promising new technique or treatment appears, the best way to evaluate it is the prospective randomized study. A prospective randomized trial of stenting and surgery for palliative means compared efficacy, safety and cost in two groups of 15 patients [36]. The stenting was performed correctly in 14 patients and, although the creation of the stoma was more cost effective than the stenting, the stent provided better quality of life for patients. Two other non-randomized studies have compared stenting with emergency surgery [37, 38]. One found an increase in the proportion of successful primary anastomoses and a reduction in the creation of stomas [37]. The other study found no differences in survival at 3 and 5 years, suggesting that stenting does not increase the risk of dissemination, a concern that has sometimes been raised [38]. Both studies reported a reduction of morbidity associated with stenting and provide persuasive evidence in favor of the use of the stent in the palliative treatment of obstructive colorectal cancer. However, more randomized studies are required before we can reach the same conclusion with regard to its routine use as a bridge to scheduled surgery with primary anastomosis [39].

In conclusion, our series confirms previous reports that the placement of self-extending stents for treatment of obstructive colorectal cancer is a safe, effective procedure with low morbidity and mortality. Stenting avoids the need for surgery in patients with dissemination of malignant disease or high comorbidity, and can be used as a bridge to surgery with primary anastomosis avoiding the need for temporary or definitive colostomies and the problems they cause, morbidity, reduced quality of life and need for reconstructive surgery with its associated morbidity and mortality.

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