ABSTRACT

Background: The use of self-expandable metallic stents in the management of obstructing colorectal cancer has been described with increasing frequency in the literature. Our goal was to evaluate the efficacy and associated morbidity of the use of self-expandable metallic stents to relieve colorectal obstruction at our institution.

Methods: A retrospective chart review of patients who underwent colorectal stent placement between December 2001 and December 2003 in a tertiary referral center was performed.

Results: Stents were placed successfully in 17 of 21 patients (81%) with colorectal obstruction. Placement was achieved endoscopically in 13 patients and radiologically in 4. Ten self-expandable metallic stents were used as a bridge to surgery, and 7 were used for palliation. The obstructions were located in the sigmoid colon (11 patients), the rectosigmoid (3), the splenic flexure, the hepatic flexure, and the rectum. Malignant obstruction was noted in 14 patients. One patient with malignancy experienced a sigmoid perforation, and 2 patients with benign disease had complications (1 stent migration and 1 reobstruction). Stent patency in obstruction secondary to colonic adenocarcinoma was 100% in our follow-up period (range, 5 to 15 months).

Conclusions: The use of stents as a bridge to surgery is associated with low morbidity, allows for bowel preparation, and thus avoids the need for a temporary colostomy. Long-term patency suggests that stents may allow for the avoidance of an operation in patients with metastatic disease and further defines their role in the palliation of malignant obstruction. Further prospective randomized studies are necessary to fully elucidate the use of stents in the management of colorectal cancer.

Key Words: Stent, Colorectal obstruction, Colorectal cancer, Surgery, Palliation.

INTRODUCTION

Colorectal obstruction poses a difficult problem for the surgeon and the patient. The need for emergent surgery in a patient with an unprepared colon leads to significant morbidity and mortality.1–6 In patients with advanced malignant disease or with prohibitive operative risk, surgical intervention for colorectal obstruction appears even less appealing. The need for a less morbid treatment modality has led to the use of self-expandable metallic stents (SEMS) to relieve colorectal obstruction. Since the first report by Dohmoto in 1991,7 this method has gained rapid popularity. The 2 main indications for SEMS are as a bridge to surgery or for palliation.8–21 The use of SEMS for treatment of benign colorectal disease in patients with prohibitive operative risk has also been described.22,23 SEMS placement can be achieved by radiological or endoscopic means.8–14 We report our experience with the use of SEMS in the management of colorectal obstruction, their efficacy, and associated morbidity.

METHODS

A retrospective chart review of patients undergoing SEMS placement for colorectal obstruction between December 2001 and December 2003 at the University of Texas Health Science Center at San Antonio was performed. Patients eligible for stent placement had clinical and radiographic evidence of large bowel obstruction. The on-call surgeon determined whether patients would be considered for stent placement on a case-by-case basis. The stent used was the Wallstent Colonic & Duodenal Endoprosthesis (Boston Scientific/Microvasive, Natick, MA) in all patients.
A covered stent was used in 1 patient. Two teams using 2 different techniques placed the SEMS. The interventional radiology team placed stents under fluoroscopic guidance, whereas the gastroenterology team used endoscopy in combination with fluoroscopy. These techniques have previously been described. The technique utilized was based on provider availability and surgeon’s preference. Postprocedure gastrograffin enemas were obtained to evaluate the proximal colon, and abdominal x-rays were performed at 24 hours after stent placement to confirm colonic decompression. Contraindication to stent placement was the presence of colonic perforation. The Institutional Review Board of our institution approved this study, and patient confidentiality has been maintained.

RESULTS

Stent placement was attempted in 21 patients with colorectal obstruction. Technical success was achieved in 17 (81%) patients (Figure 1). The 4 stent placement failures were due to inability to traverse the area of colonic obstruction with a guidewire. These patients underwent resection of their primary malignancies along with the creation of a stoma. The median age of the 17 patients was 61 (range, 49 to 76) years. Twelve patients were male and 5 were female. One patient had 2 stents placed for 2 synchronous obstructing lesions.

Thirteen of 16 patients had successful endoscopic stent placement by the gastroenterology team, and 4 of 5 patients had successful fluoroscopic stent placement by the interventional radiology team. The location of colonic obstruction was in the sigmoid colon (11 patients), the rectosigmoid (3 patients), the upper rectum (1 patient), the splenic flexure (1 patient), and the hepatic flexure (1 patient). Stents were placed as a bridge to surgery in 10 patients and for palliation in 7 patients (Table 1).

The colonic obstruction was due to malignancy in 14 patients (colonic adenocarcinoma in 13 patients and locally advanced prostate cancer in 1 patient), benign strictures in 2 patients, and the cause was unknown in 1 patient. The 2 patients with benign conditions included 1 with diverticular stricture and 1 with anastomotic stricture following colon resection who had had multiple failed dilations. Both patients were considered prohibitive operative risks.

Nine of the 10 patients in whom a stent had been placed as a bridge to surgery received bowel preparation and hydration and were then brought to the operating room. Median time to colon resection was 5 days (range, 1 to 12). All 9 patients were found to have achieved good bowel

Figure 1. (A) Abdominal x-ray showing a patient with colonic distention due to sigmoid obstruction. (B) Abdominal x-ray of the same patient showing colonic decompression after sigmoid stent placement.
preparation in the operating room and had primary anastomosis except for 1 patient who required a colostomy. This patient had a poor nutritional status and locally advanced disease that resulted in excessive blood loss during resection. One patient in the bridge to surgery group suffered a sigmoid perforation at the site of stent placement 4 days after insertion but did well after emergent surgical intervention with resection and colostomy formation.

Of the 2 patients with benign strictures, 1 had migration of a covered stent 3 days after placement, and 1 had occlusion 4 months after placement. The patient with stent migration refused to have another stent placed and continued to undergo dilations. The patient with stent occlusion had a colostomy performed without resection of the diverticular stricture to minimize operative time due to extensive comorbidities and did well. One patient with multiple medical comorbidities and sepsis had a colonic obstruction successfully stented but succumbed to sepsis 4 days later. His death was not related to the stent placement. The cause of his colonic obstruction was considered to be malignant, but no specimen could be obtained before his death and the family refused autopsy.

All patients who had their stents placed for palliation of a malignant colonic obstruction remained free from stent-related problems in the follow-up period (median, 11 months; range, 5 to 15). One patient died within that follow-up time with a clinically functioning stent.

### DISCUSSION

Ten percent to 25% of patients with colorectal cancer present with malignant obstruction.\(^1\)\(^-\)\(^6\) Emergency sur-

| Patient | Age/Sex | Method* | Location* | Obstruction Cause | Indication | Patency (Days) | Surgery | Follow-up |
|---------|---------|---------|-----------|-------------------|------------|----------------|---------|-----------|
| 1       | 72 M    | Endo    | SIG       | Colon cancer      | Bridge to surgery | 1          | Resection | No complications |
| 2       | 76 M    | Endo    | HF        | Colon cancer      | Bridge to surgery | 7          | Resection | No complications |
| 3       | 56 M    | Endo    | SIG       | Colon cancer      | Bridge to surgery | 12         | Resection | No complications |
| 4       | 54 M    | Endo    | SIG       | Colon cancer      | Bridge to surgery | 6          | Resection | No complications |
| 5       | 55 M    | Endo    | RSG       | Colon cancer      | Bridge to surgery | 8          | Resection | No complications |
| 6       | 61 M    | Endo    | SIG       | Colon cancer      | Bridge to surgery | 6          | Resection | No complications |
| 7       | 76 M    | Endo    | SIG       | Colon cancer      | Bridge to surgery | 4          | Resection | No complications |
| 8       | 57 M    | Endo    | SIG       | Colon cancer      | Bridge to surgery | 2          | Resection & stoma | No complications |
| 9       | 56 F    | Rad     | SIG       | Colon cancer      | Bridge to surgery | 4          | Resection & stoma | Sigmoid perforation, doing well today |
| 10      | 64 F    | Rad     | SIG       | Colon cancer      | Bridge to surgery | 2          | Resection | No complications |
| 11      | 62 M    | Endo    | RSG       | Prostate cancer   | Palliation       | 450        | None | Remained patent |
| 12      | 66 M    | Endo    | REC       | Metastatic colon cancer | Palliation | 325        | None | Remained patent |
| 13      | 57 F    | Rad     | RSG       | Metastatic colon cancer | Palliation | 360        | None | Remained patent |
| 14      | 58 M    | Rad     | SF        | Metastatic colon cancer | Palliation | 142        | None | Died w/patent stent |
| 15      | 75 M    | Endo    | SIG       | Unknown           | Palliation       | 4          | None | Died due to sepsis |
| 16      | 49 F    | Endo    | SIG       | Anastomotic stricture | Palliation | 3          | None | Stent migration, continues on dilations |
| 17      | 63 F    | Endo    | SIG       | Diverticular stricture | Palliation | 139        | Stoma | Stent occlusion |

*Endo = endoscopic; Rad = Radiologic; SIG = sigmoid colon; RSG = rectosigmoid; REC = rectum; SF = splenic flexure; HF = hepatic flexure.
Surgery for colorectal obstruction carries a higher morbidity than elective colon surgery and mortality of 10% to 28%. This difference in outcome is related to the poor medical condition of the patients as well as to the unprepared bowel resulting in increased infectious complications. Effective measures that will allow for the delay of surgery until patients can be medically optimized and undergo mechanical preparation of the colon could result in improved outcomes. In addition, patients who present with colorectal obstruction and widely metastatic cancer with poor survival rates and patients who are prohibitive operative risks would benefit from a minimally invasive method that would relieve their obstruction and spare them an unnecessary surgery.

Self-expanding metallic stents have been used widely for relief of luminal obstructions since their introduction in clinical practice and have also found application in the treatment of colonic obstruction. Since the first report by Dohmoto in 1991, multiple studies have appeared in the literature validating the role of SEMS in the treatment of colorectal obstruction.

Endoscopic and fluoroscopic placement have been the 2 main techniques used for the deployment of the stents with successful stent placement ranging between 63% to 100%. No available study compares these 2 approaches. In our study, the 2 techniques performed by 2 different teams in a nonrandomized fashion appeared to be equally effective with success rates similar to those previously reported.

The Wallstent (Boston Scientific/ Microvasive, Natick, MA) is the most commonly used stent for colorectal obstruction. It combines excellent radial expansile force with longitudinal flexibility and can be delivered thru the endoscope or over a guidewire due to its small delivery system.

In 2 patients, we used colonic stents to relieve colonic obstruction due to benign disease. The use of stents for benign diseases of the colon has been described previously. One of the patients with benign disease experienced stent migration 3 days after placement, and the other patient had obstruction of the stent 4 months after placement. Increased risk for migration has been suggested previously when stents were used for benign diseases, and this has been attributed to the lack of neoplastic ingrowth into the stent that would prevent its dislodgement. In addition, the stent that was used in the patient with migration was covered, and covered stents have also been found to have higher migration rates due to the prevention of tissue ingrowth.

Nine of 10 patients who were treated with stents as a bridge to surgery received bowel preparation and underwent resection with primary anastomosis in 8 of 9 cases with good perioperative outcomes. One patient had a perforation of her tumor at the distal aspect of the stent that became clinically apparent 4 days after stent placement. This patient had not been prepped immediately because of the patient’s desire to delay surgery for several weeks.

The use of stents as a bridge to surgery has been validated by studies that have shown less morbidity, less stoma formation, and shorter hospital stays compared to emergency surgery for colorectal obstruction. Three studies have also demonstrated that stent placement is cost-effective compared to surgery. Only 1 patient in our series was noted to have a perforation and this is within the published range (0% to 15%). The risk of perforation emphasizes the need for close monitoring of these patients after their procedure. If surgical intervention occurs in a timely fashion after perforation, good outcomes should be expected.

Stent placement for palliation of malignant colonic obstruction has been described and noted to be an effective treatment with good patency rates. However, published follow-up is limited because of the poor survival rates in this patient population and rarely approaches 1 year. The 100% patency rate observed in this study with a median follow-up of 1 year is the longest reported to date. In our series, the low associated morbidity compares favorably with that reported in the published literature.

CONCLUSION

This report supports the use of SEMS in patients who present with colorectal obstruction secondary to advanced malignancy (palliative), as a bridge to curative surgery or for patients who have prohibitive operative risks. The high technical success rate, the low morbidity associated with their use, and their excellent patency in patients with malignant disease make SEMS a very appealing initial treatment modality for patients who present with colorectal obstruction.

References:

1. Phillips RK, Hittinger R, Fry JS, Fielding LP. Malignant large bowel obstruction. Br J Surg. 1985;72:296–302.
2. Umpleby HC, Williamson RC. Survival in acute obstructing colorectal carcinoma. Dis Colon Rectum. 1984;27:299–304.
3. Kyllonen LE. Obstruction and perforation complicating colorectal carcinoma. An epidemiologic and clinical study with special reference to incidence and survival. *Acta Chir Scand.* 1987;153:607–614.

4. Runkel NS, Schlag P, Schwarz V, Herfarth C. Outcome after emergency surgery for cancer of the large intestine. *Br J Surg.* 1991;78:183–188.

5. Buechter KJ, Boustany C, Caillouette R. Surgical management of the acutely obstructed colon. *Am J Surg.* 1988;156:163–168.

6. Deans GT, Krukowski ZH, Irwin ST. Malignant obstructions of the left colon. *Br J Surg.* 1994;81:1270–1276.

7. Dohmoto M. New method—endoscopic implantation of rectal stent in palliative treatment of malignant stenosis. *Endosc Dig.* 1991;3:1507–1512.

8. Saida Y, Sumiyama Y, Nagao J, Takase M. Stent endoprosthesis for obstructing colorectal cancers. *Dis Colon Rectum.* 1996;39:552–555.

9. De Gregorio MA, Mainar A, Tejero E, et al. Acute colorectal obstruction: stent placement for palliative treatment—results of a multicenter study. *Radiology.* 1998;209:117–120.

10. Wholey MH, Levine EA, Ferral H, Castaneda-Zuniga W. Initial clinical experience with colonic stent placement. *Am J Surg.* 1998;175:194–197.

11. Mainar A, De Gregorio Ariza MA et al. Acute colorectal obstruction: treatment with self-expandable metallic stents before scheduled surgery: results of a multicenter study. *Radiology.* 1999;210:65–69.

12. Law WL, Chu KW, Ho JW, Tung HM, Law SY, Chu KM. Self-expanding metallic stent in the treatment of colonic obstruction caused by advanced malignancies. *Dis Colon Rectum.* 2000;43:1522–1527.

13. Liberman H, Adams DR, Blatchford GJ, Ternent CA, Christensen MA, Thorson AG. Clinical use of the self expanding metallic stent in the management of colorectal cancer. *Am J Surg.* 2000;180:407–411.

14. Carrunze F, Echenagusia A, Simo G, Turegano F, Vazquez J, Barreiro-Meiro I. Malignant colorectal obstruction treated by means of self-expanding metallic stents: effectiveness before surgery and in palliation. *Radiology.* 2000;216:492–497.

15. Mauro MA, Koehler RE, Baron TH. Advances in gastrointestinal intervention: the treatment of gastroduodenal and colorectal obstructions with metallic stents. *Radiology.* 2000;215:659–669.

16. Harris GJ, Senagore AJ, Lavery IC, Fazio VW. The management of neoplastic colorectal obstruction with colonic endolumenal stenting devices. *Am J Surg.* 2001;181:499–506.

17. Morgan R. Adam A. Use of metallic stents and balloons in the esophagus and gastrointestinal tract. *J Vasc Intervent Radiol.* 2001;12(3):283–297.

18. Dauphine CE, Tan P, Beart RW Jr., Vukasin P, Cohen H, Corman ML. Placement of self-expanding metal stents for acute malignant large-bowel obstruction: a collective review. *Ann Surg Onc.* 2002;9(6):574–579.

19. Saida Y, Sumiyama Y, Nagao J, Uramatsu M. Long-term prognosis of preoperative “bridge to surgery” expandable metallic stent insertion for obstructive colorectal cancer: comparison with emergency operation. *Dis Colon Rectum.* 2003;46(10):544–49.

20. Ely CA, Arregui ME. The use of enteral stents in colonic and gastric outlet obstruction. *Surg Endosc.* 2003;17(1):89–94.

21. Keymling M. Colorectal stenting. *Endoscopy.* 2003;35(5):234–238.

22. Paul L, Pinto I, Gomez H, Fernandez-Lobato R, Moyano E. Metallic stents in the treatment of benign diseases of the colon: preliminary experience in 10 cases. *Radiology.* 2002;223(3):715–722.

23. Davidson R, Sweeney WB. Endoluminal stenting for benign colonic obstruction. *Surg Endosc.* 1998;12(4):353–354.

24. Martinez-Santos C, Lobato RF, Fradejas JM, Pinto I, Ortega-Deballon P, Moreno-Azcoita M. Self-expandable stent before elective surgery vs. emergency surgery for the treatment of malignant colorectal obstructions: comparison of primary anastomosis and morbidity rates. *Dis Colon Rectum.* 2002;45:401–406.

25. Choo IW, Do YS, Suh SW, et al. Malignant colorectal obstruction: treatment with a flexible covered stent. *Radiology.* 1998;206:415–421.

26. Xinopoulos D, Dimitroulopoulos D, Theodosopoulos T et al. Stenting or stoma creation for patients with inoperable malignant colonic obstructions? Results of a study and cost-effectiveness analysis. *Surg Endosc.* 2004;18(3):421–426.

27. Binkert CA, Ledermann H, Jost R, Saurenmann P, Decurtins M, Zollkofer CL. Acute colonic obstruction: clinical aspects and cost-effectiveness of preoperative and palliative treatment with self-expanding metallic stents—a preliminary report. *Radiology.* 1998;206(1):199–204.

28. Osman HS, Rashid HI, Sathananthan N, Parker MC. The cost effectiveness of self expanding metal stents in the management of malignant left-sided large bowel obstruction. *Colorectal Dis.* 2000;2:233–237.

29. Clark JS, Buchanan GN, Khawaja AR, et al. Use of the Bard Memotherm self-expanding metal stent in the palliation of colonic obstruction. *Abdom Imaging.* 2003;28:518–524.

30. Diaz PL, Pabon PI, Lobato FR, Lopez MC. Palliative treatment of malignant colorectal strictures with metallic stents. *Cardiovasc Intervent Radiol.* 1999;22(1):29–36.

31. Bhardwaj R, Parker MC. Palliative therapy of colorectal carcinoma: stent or surgery? *Colorectal Dis.* 2003;5:518–521.
32. Law WL, Choi HK, Lee YM, Chu KW. Palliation for advanced malignant colorectal obstruction by self-expanding metallic stents: prospective evaluation of outcomes. *Dis Colon Rectum*. 2004;47(1):39–43.

33. Johnson R, Marsh R, Corson J, Seymour K. A comparison of two methods of palliation of large bowel obstruction due to irremovable colon cancer. *Ann R Coll Surg Engl*. 2004;86(2):99–103.