Palliative Nonvascular Interventions

Kent T. Sato, M.D.,¹ and Christopher Takehana, B.S.¹

ABSTRACT

Interventional radiologists are often called on to help with quality of life issues in end-stage cancer patients. Many times, the discomfort can be directly associated to the tumor mass itself, but in other instances, tumors can cause secondary obstruction of normal structures that can lead to patient distress. As with most palliative care patients, their medical conditions are not conducive to major surgery; therefore minimally invasive techniques are ideal for the treatment of these conditions. The following discussion addresses the various nonvascular interventions available to these patients, including the indications and limitations of these procedures.

KEYWORDS: Biliary obstruction, hydronephrosis/hydroureter, gastric outlet obstruction

Objectives: Upon completion of this article, the reader should understand the various treatment options for the palliation of symptomatic biliary obstruction, gastrointestinal obstruction, and urinary obstruction.

Accreditation: Tufts University School of Medicine (TUSM) is accredited by the Accreditation Council for Continuing Medical Education to provide continuing medical education for physicians.

Credit: TUSM designates this educational activity for a maximum of 1 *AMA PRA Category 1 Credit*TM. Physicians should only claim credit commensurate with the extent of their participation in the activity.

BILIARY OBSTRUCTION

Obstruction of the normal flow of bile can occur at many levels within the biliary tree. Symptoms of biliary obstruction include jaundice, pruritus, cholangitis, and hepatic dysfunction. Patients with biliary obstruction improve clinically with the placement of biliary stents to bypass the occlusion.^{1,2} Traditionally, the method of relieving this obstruction depends on the location of the occlusion, the patient's prior surgical history, and the patient's life expectancy. In an otherwise healthy patient, endoscopic retrograde cholangiopancreatography with stent placement has been the first-line therapy for patients with symptomatic obstruction from unresectable common bile duct tumors. Endoscopic therapy for treatment of patients with pancreatic-biliary malignancy is effective in the relief of biliary obstruction.³

However, many patients are not eligible for endoscopic intervention. Some patients are too ill to undergo

endoscopy. Others who have had prior biliary-enteric anastomoses are not ideal candidates for endoscopic management due to the difficult anatomical position of the Roux limb. In these instances, less invasive percutaneous methods are available to achieve the same goals. Percutaneous biliary drainage has been used to relieve biliary obstruction, regardless of the location. The percutaneous approach can be used in situations where the bile ducts are inaccessible endoscopically.

Regardless of the approach, once the lesion has been crossed, there are two ways to proceed. Some stent the lesion primarily, whereas others elect to relieve the obstruction first with an internal-external biliary drainage catheter and then stent at a later date. If there is any question of an underlying cholangitis, drains should be placed first to decompress the biliary system and allow the infection to clear. Only after the infection has been cleared should consideration be given to stenting.

¹Department of Radiology, Feinberg School of Medicine, Northwestern University, Chicago, Illinois.

Address for correspondence and reprint requests: Kent T. Sato, M.D., Assistant Professor, Department of Radiology, Northwestern University Medical School, 251 E Huron Street, Room 4-710R Feinberg, Chicago, IL 60611 (e-mail: k-sato@northwestern.edu).

Palliative Interventions in Interventional Radiology; Guest Editor, Kent T. Sato, M.D.

Semin Intervent Radiol 2007;24:391-397. Copyright © 2007 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA. Tel: +1(212) 584-4662.

DOI 10.1055/s-2007-992327. ISSN 0739-9529.

Biliary stents improve the quality of life in patients with malignant biliary obstruction.^{4,5} Depending on the type of stent used, the duration of patency and symptom relief vary.⁶ Endoscopically placed polyethylene stents are the most commonly placed type of biliary stent. The endoscopic route is associated with a lower complication rate than percutaneous or open surgical techniques.⁷ The stents do occlude more frequently due to their smaller luminal diameter, but they can be exchanged as needed endoscopically. Metallic stents are currently used to treat unresectable biliary occlusions (Fig. 1). Their luminal diameter is greater than plastic stents and their patency interval is greater. Unlike plastic stents, however, metallic stents are permanent and cannot be exchanged when they occlude. Their patency interval is about 6 months; therefore if a patient's life expectancy is greater than that, plastic stents should be used.

Metallic stents can be placed either endoscopically or percutaneously. Common self-expanding stents include the Wallstent (Boston Scientific, Natick, MA), Smart stent (Cordis, Miami, FL), and the Gianturco Z stent (Cook, Bloomington, IN). These stents all have open interstices, so covering the cystic duct rarely results in obstruction of this duct. When tumors involve the common bile duct, or ampulla, a single stent is all that is required, but when the lesion is at the hilum (e.g., Klatskin tumor), a bilateral approach may be necessary to drain both bile ducts. However, bilateral drainage is not always necessary. If one of the halves of the liver has a relatively small volume compared with the other, unilateral drainage can be performed. The unilateral approach is effective in palliating obstructive symptoms in most patients.⁵

Covered metallic stents have been used for biliary stenting as well. Theoretical advantages include limiting

Figure 1 (A) Percutaneous transhepatic cholangiogram shows occlusion of the common bile duct (arrow) that has been crossed with a guidewire. (B) Metallic stent (arrow) has been deployed across the lesion. (C) Completion cholangiogram shows the newly placed stent to be widely patent.

the rate of tumor ingrowth because of the covering material. But covered stents are prone to migration; patency rates for covered stents have not been shown to be superior to uncovered stents.⁸⁻¹⁰ These stents can also cover the cystic duct as well and are associated with a higher rate of cholecystitis.⁸

Many patients have had prior biliary surgery. Patients with biliary-enteric anastomoses are difficult to access endoscopically and must be approached from a percutaneous transhepatic route. Other times, patients are not candidates for metallic stenting. If the lesions are so extensive that a single stent cannot adequately reestablish a lumen without covering side branches, placement of percutaneous biliary drains is the best method for relieving symptomatic biliary obstructions.^{11,12} Although effective, patients need to have these catheters in place for the remainder of their lives. These biliary catheters also tend to occlude and need to be exchanged over guidewires periodically. However, because internal stenting is not an option in these patients, biliary catheters remain the best option for relief of these obstructions.

GASTRIC OBSTRUCTION

Severe malignant gastric obstruction can negatively affect a patient's quality of life by causing nausea, vomiting, dysphagia, and nutritional deficiency. Surgical palliation through a gastric bypass can be performed but is also associated with significant rates of morbidity and mortality.¹³⁻¹⁵ Percutaneous gastrostomy offers a safe and effective method of palliating gastric obstruction.^{16,17} The procedure involves moderate sedation, placement of a small-bore nasogastric tube for gastric insufflation, and percutaneous puncture of the distended stomach. Endoscopic gastrostomy tube placement is also a minimally invasive technique, although patients with

significant gastric tumors may be anatomically challenging for the endoscopist. For patients with dysphagia but not gastric obstruction, gastrostomy tubes allow for a simple, safe method for providing enteral support. Although the quality of life of these patients can be improved through better nutrition,¹³ the main disadvantage is the inability to resume oral intake.

Placement of self-expanding metallic stents from either an endoscopic or percutaneous route can be used for the rapid palliative treatment of obstructive gastric tumors.¹⁸⁻²¹ In many instances, gastric stenting allows the patient to resume eating solid food or, at the very least, a soft diet.²² Stents can be introduced peroral or percutaneously through a gastrostomy tube tract. Endoscopic placement with fluoroscopic guidance is the most common method of placing gastroduodenal stents (Fig. 2). The use of fluoroscopy and iodinated contrast facilitates accurate placement of the device. The technique for primary percutaneous placement without the use of endoscopy has also been described.²³

The procedure has a technical success rate described between 92 and 100%.^{18-20,24} There are no absolute contraindications to gastric stenting; however, patients with distal intestinal obstruction probably would not benefit greatly from the procedure. Overall complication rates are low and most commonly include stent obstructions, stent migration, and duodenal perforation. Patients who require gastric stenting have a mean survival of 7 to 14 weeks following the procedure;^{18,22,25} thus occlusion by tumor overgrowth does not become an issue unless the patients' survival is longer than expected.

Large-diameter self-expanding stents are most commonly used for gastric obstruction. The Wallstent is probably the most common stent used for this procedure, although the use of nitinol stents has been described.²⁶ Restenosis by tumor ingrowth is one problem with traditional uncovered stents, so covered stents have

Figure 2 (A) Upper gastrointestinal study shows the constricting lesion at the gastric antrum (arrows). (B) Follow-up study 1 year after Wallstent placement shows some ingrowth of tumor through the stent, but there is still flow through the lumen.

been used in an attempt to minimize this problem.²⁷ However, covered stents are associated with an increased incidence of stent migration (21 to 26%) compared with uncovered stents (0 to 3%).^{28,29} This has subsequently led to the investigation of dual-lined and coaxial stents to minimize migration of these stents.^{30,31}

Gastric outlet obstruction can be a difficult problem to manage. It is frequently seen in the end stages of advanced gastric, duodenal, and biliary malignancies. Many of these patients are not candidates for palliative surgical therapies; therefore, less invasive procedures are needed to improve these patients' symptoms. Simple decompressive procedures like nasogastric tube placement and gastrostomy tube placement can provide temporary relief of a patient's symptoms. For a longer lasting solution, gastroduodenal stenting provides relief of the obstruction while allowing the patient to continue with oral intake. This improves overall quality of life while only subjecting the patient to minimal risk.

COLONIC OBSTRUCTION

Advanced colonic malignancies can present with obstruction of the colon in 15 to 20% of patients,³² which if left untreated can result in perforation and life-threatening peritonitis. Traditional surgical intervention involves a staged procedure with resection of the obstruction and creation of a colostomy and subsequent reversal of the colostomy at a later date. However, surgical intervention carries a certain amount of morbidity and mortality.³³ In addition, many patients are not good surgical candidates. As with gastric obstructions, self-expanding metallic stents offer a method of palliation of these obstructive symptoms with minimal risk.

Colonic stents can be used to decompress the colon temporally before a definitive surgery, thereby increasing the chance that a primary anastomosis can be performed.³⁴ Relieving the obstruction with a stent converts an emergent surgery to an elective one, which is associated with fewer complications and a shorter hospital stay. Primary colonic stenting can be used successfully to palliate colonic obstruction as well. The procedure has a high success rate (80 to 100%),³⁵⁻³⁷ and distal lesions are more easily treated than proximal ones. Complications include transient anorectal pain, tenesmus, rectal bleeding, perforation, and, most commonly, stent migration. The use of larger diameter stents, however, has decreased the incidence.³⁸ Large-diameter uncovered self-expanding stents such as the Wallstent are commonly used due to the low-profile delivery system and reconstrainability. Covered stents have also been used to help decrease the incidence of tumor ingrowth, but they are associated with a higher incidence of migration.^{39,40} Although the most common technique for insertion of these metallic stents is with endos-

copy with fluoroscopic guidance, distal lesions in the descending colon and rectosigmoid area can easily be accessed transanally with fluoroscopic guidance only.³⁸ Colonic stenting is a safe and effective method for the palliation of symptomatic colonic obstruction that avoids the risks of surgery while improving the quality of life for these patients.

URETERAL OBSTRUCTION

Malignant ureteric obstruction can be seen in advanced cases of many pelvic malignancies of both genitourinary (GU) and non-GU related tumors. The sequelae of prolonged urinary obstruction is uremia and renal failure; both if left untreated are terminal conditions. Relief of the obstruction can be performed in two different ways: urinary diversion through percutaneous nephrostomies and ureteral stent placement.

Percutaneous nephrostomy is a safe, cost-effective procedure for urinary diversion in patients with malignant ureteral obstruction. The procedure is well tolerated, and in many patients who have a short life expectancy it allows for palliation of their symptoms with minimal discomfort.^{41,42} Alternatively, the placement of a double-J ureteral stent allows for the relief of urinary obstruction while sparing the patient the potential discomfort of a percutaneous catheter protruding from the back (Fig. 3). Overall, ureteral stents are successful in alleviating obstructive symptoms, but when tumors progress to involve the bladder outflow, patients may need a percutaneous nephrostomy.⁴³

The overall quality of life with either percutaneous nephrostomy or ureteral stents does not differ significantly. Patients with nephrostomies require more extensive daily care of the catheter and drainage bag, whereas patients with ureteral stents experience more irritative symptoms and local discomfort. However, when looking at overall quality of life and morbidity associated with both procedures, there was no significant difference between them.^{44,45} Patients with ureteral stents should be routinely monitored for secondary obstruction that may require a nephrostomy tube placement.

As an alternative to double-J ureteral stents, self-expanding metallic stents have been used to relieve malignant ureteral obstructions. These stents were placed in an antegrade fashion through a percutaneous nephrostomy approach with fluoroscopic guidance. The procedure was technically successful in all cases described. The mean duration of stent patency was 9 months.^{46,47} These stents are presumably less irritating to the bladder because they do not extend very far beyond the ureterovesicular junction. Covered metallic stents have also been used, although the follow-up data are too early to determine if they have any added benefit over uncovered metallic stents.⁴⁸ The use of metallic stents for the palliation of malignant ureteral obstruction is a safe and

Figure 3 (A) Coronal T2-weighted magnetic resonance imaging image shows occlusion and dilation of the distal ureter by a cervical mass. (B) Ureterogram shows a similar appearance of the occluded distal ureter. (C) Distal end of the double-J ureteral stent across the lesion into the bladder.

effective alternative to traditional ureteral stents of nephrostomy catheters.

CONCLUSION

Malignant obstruction of any organ can be a serious, life-threatening event for patients with end-stage malignancies. As with any palliative intervention, patient comfort and the quality of life must be considered before proceeding with any intervention. Many of these procedures do not necessarily extend the life expectancies of these patients; therefore it is important to consider how these procedures affect their overall comfort. The primary goal of interventional radiologists should be to offer services

to the patient that will improve the overall quality of life while presenting the least risk.

REFERENCES

1. McDougall EM, Bennett HF, Monk TG, et al. Functional MR imaging of the porcine kidney: physiologic changes of prolonged pneumoperitoneum. *JSL* 1997;1:29–35
2. Ballinger AB, McHugh M, Catnach SM, et al. Symptom relief and quality of life after stenting for malignant bile duct obstruction. *Gut* 1994;35:467–470
3. Razavi R, Hill DL, Keevil SF, et al. Cardiac catheterisation guided by MRI in children and adults with congenital heart disease. *Lancet* 2003;362:1877–1882

4. Zhai R, Qian X, Dai D, et al. Malignant biliary obstruction: treatment with interventional radiology. *Chin Med J (Engl)* 2003;116:888-892
5. Brountzos EN, Ptochis N, Panagiotou I, et al. A survival analysis of patients with malignant biliary strictures treated by percutaneous metallic stenting. *Cardiovasc Intervent Radiol* 2007;30:66-73
6. Nakamura T, Hirai R, Kitagawa M, et al. Treatment of common bile duct obstruction by pancreatic cancer using various stents: single-center experience. *Cardiovasc Intervent Radiol* 2002;25:373-380
7. Prat F, Chapat O, Ducot B, et al. Predictive factors for survival of patients with inoperable malignant distal biliary strictures: a practical management guideline. *Gut* 1998;42:76-80
8. Park do H, Kim MH, Choi JS, et al. Covered versus uncovered Wallstent for malignant extrahepatic biliary obstruction: a cohort comparative analysis. *Clin Gastroenterol Hepatol* 2006;4:790-796
9. Soderlund C, Linder S. Covered metal versus plastic stents for malignant common bile duct stenosis: a prospective, randomized, controlled trial. *Gastrointest Endosc* 2006;63:986-995
10. Yoon WJ, Lee JK, Lee KH, et al. A comparison of covered and uncovered Wallstents for the management of distal malignant biliary obstruction. *Gastrointest Endosc* 2006;63:996-1000
11. Baijal SS, Dhiman RK, Gupta S, et al. Percutaneous transhepatic biliary drainage in the management of obstructive jaundice. *Trop Gastroenterol* 1997;18:167-171
12. Born P, Rosch T, Triptrap A, et al. Long-term results of percutaneous transhepatic biliary drainage for benign and malignant bile duct strictures. *Scand J Gastroenterol* 1998;33:544-549
13. Cozzi G, Gavazzi C, Civelli E, et al. Percutaneous gastrostomy in oncologic patients: analysis of results and expansion of the indications. *Abdom Imaging* 2000;25:239-242
14. Buckley DL, Drew PJ, Mussurakis S, et al. Microvessel density of invasive breast cancer assessed by dynamic Gd-DTPA enhanced MRI. *J Magn Reson Imaging* 1997;7:461-464
15. Smith JW, Brennan MF. Surgical treatment of gastric cancer: proximal, mid, and distal stomach. *Surg Clin North Am* 1992;72:381-399
16. Lorentzen T, Nolsoe CP, Adamsen S. Percutaneous radiologic gastrostomy with a simplified gastropexy technique under ultrasonographic and fluoroscopic guidance: experience in 154 patients. *Acta Radiol* 2007;48:13-19
17. de Baere T, Zhang X, Aubert B, et al. Quantification of tumor uptake of iodized oils and emulsions of iodized oils: experimental study. *Radiology* 1996;201:731-735
18. Nassif T, Prat F, Meduri B, et al. Endoscopic palliation of malignant gastric outlet obstruction using self-expandable metallic stents: results of a multicenter study. *Endoscopy* 2003;35:483-489
19. Mosler P, Mergener KD, Brandabur JJ, et al. Palliation of gastric outlet obstruction and proximal small bowel obstruction with self-expandable metal stents: a single center series. *J Clin Gastroenterol* 2005;39:124-128
20. Adler DG, Baron TH. Endoscopic palliation of malignant gastric outlet obstruction using self-expanding metal stents: experience in 36 patients. *Am J Gastroenterol* 2002;97:72-78
21. Kim TO, Kang DH, Kim GH, et al. Self-expandable metallic stents for palliation of patients with malignant gastric outlet obstruction caused by stomach cancer. *World J Gastroenterol* 2007;13:916-920
22. Lindsay JO, Andreyev HJ, Vlavianos P, et al. Self-expanding metal stents for the palliation of malignant gastroduodenal obstruction in patients unsuitable for surgical bypass. *Aliment Pharmacol Ther* 2004;19:901-905
23. Lopera JE, Brazzini A, Gonzales A, et al. Gastroduodenal stent placement: current status. *Radiographics* 2004;24:1561-1573
24. Bessoud B, de Baere T, Denys A, et al. Malignant gastroduodenal obstruction: palliation with self-expanding metallic stents. *J Vasc Interv Radiol* 2005;16:247-253
25. Kaw M, Singh S, Gagneja H, Azad P. Role of self-expandable metal stents in the palliation of malignant duodenal obstruction. *Surg Endosc* 2003;17:646-650
26. Yoon CJ, Song HY, Shin JH, et al. Malignant duodenal obstructions: palliative treatment using self-expandable nitinol stents. *J Vasc Interv Radiol* 2006;17:319-326
27. Jeong JY, Kim YJ, Han JK, et al. Palliation of anastomotic obstructions in recurrent gastric carcinoma with the use of covered metallic stents: clinical results in 25 patients. *Surgery* 2004;135:171-177
28. Jung GS, Song HY, Kang SG, et al. Malignant gastroduodenal obstructions: treatment by means of a covered expandable metallic stent—initial experience. *Radiology* 2000;216:758-763
29. 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
30. Jung GS, Song HY, Seo TS, et al. Malignant gastric outlet obstructions: treatment by means of coaxial placement of uncovered and covered expandable nitinol stents. *J Vasc Interv Radiol* 2002;13:275-283
31. Song TJ, Ip EW, Fong Y. Hepatocellular carcinoma: current surgical management. *Gastroenterology* 2004;127(suppl 1):S248-S260
32. Law WL, Choi HK, Chu KW. Comparison of stenting with emergency surgery as palliative treatment for obstructing primary left-sided colorectal cancer. *Br J Surg* 2003;90:1429-1433
33. Buechter KJ, Boustany C, Caillouette R, Cohn I. Surgical management of the acutely obstructed colon: a review of 127 cases. *Am J Surg* 1988;156:163-168
34. Martinez-Santos C, Lobato RF, Fradejas JM, et al. 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
35. Repici A, Pagano N, Hervoso CM, et al. Metal stents for malignant colorectal obstruction. *Minim Invasive Ther Allied Technol* 2006;15:331-338
36. 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;47:39-43
37. Maetani I, Tada T, Ukita T, et al. Self-expandable metallic stent placement as palliative treatment of obstructed colorectal carcinoma. *J Gastroenterol* 2004;39:334-338

38. Aviv RI, Shyamalan G, Watkinson A, et al. Radiological palliation of malignant colonic obstruction. *Clin Radiol* 2002;57:347–351
39. Repici A, Reggio D, De Angelis C, et al. Covered metal stents for management of inoperable malignant colorectal strictures. *Gastrointest Endosc* 2000;52:735–740
40. Zollikofer CL, Jost R, Schoch E, Decurtins M. Gastrointestinal stenting. *Eur Radiol* 2000;10:329–341
41. Radecka E, Magnusson M, Magnusson A. Survival time and period of catheterization in patients treated with percutaneous nephrostomy for urinary obstruction due to malignancy. *Acta Radiol* 2006;47:328–331
42. Wilson JR, Urwin GH, Stower MJ. The role of percutaneous nephrostomy in malignant ureteric obstruction. *Ann R Coll Surg Engl* 2005;87:21–24
43. Ganatra AM, Loughlin KR. The management of malignant ureteral obstruction treated with ureteral stents. *J Urol* 2005;174:2125–2128
44. Joshi HB, Adams S, Obadeyi OO, Rao N. Nephrostomy tube or “JJ” ureteric stent in ureteric obstruction: assessment of patient perspectives using quality-of-life survey and utility analysis. *Eur Urol* 2001;39:695–701
45. Ku JH, Lee SW, Jeon HG, et al. Percutaneous nephrostomy versus indwelling ureteral stents in the management of extrinsic ureteral obstruction in advanced malignancies: are there differences?. *Urology* 2004;64:895–899
46. Pandian SS, Hussey JK, McClinton S. Metallic ureteric stents: early experience. *Br J Urol* 1998;82:791–797
47. Wakui M, Takeuchi S, Isioka J, et al. Metallic stents for malignant and benign ureteric obstruction. *BJU Int* 2000;85:227–232
48. Tekin MI, Aytekin C, Aygun C, et al. Covered metallic ureteral stent in the management of malignant ureteral obstruction: preliminary results. *Urology* 2001;58:919–923