Published in final edited form as:

Dig Dis Sci. 2018 September ; 63(9): 2202–2205. doi:10.1007/s10620-017-4837-y.

Cut and paste: Endoscopic management of a perforating biliary stent utilizing scissors and clips

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Keywords

Stent; ERCP; Migration; Perforation; Endoscopic Scissors; Endoclips

Case presentation and evolution

A 57-year-old man presented with fevers and chills associated with abnormal liver tests. He had a history of primary sclerosing cholangitis with a dominant left main hepatic duct stricture that had been managed by ERCP with placement of two 8.5 Fr $\times$ 15 cm straight plastic stents two months previously. His vital signs were, heart rate of 91 /min, temperature of 36.9 °C, blood pressure of 122/84 mm Hg and respiratory rate of 11/min. Physical examination was unremarkable. Recent laboratory studies were not available.

ERCP was performed under moderate sedation. Initial endoscopic views of the duodenum revealed distal migration of one of the two previously-placed plastic biliary stents, with the distal tip of the stent penetrating the duodenal wall opposite the ampulla (Figure 1). Attempts to gently retract the stent from the duodenal wall using a rat tooth forceps were unsuccessful, indicating that the stent was embedded within or was perforating through the duodenal wall (Figure 1). The procedure was terminated due to patient combativeness and oxygen desaturation. A decision was made to repeat the procedure under anesthesia and to obtain cross sectional imaging prior to re-attempting extraction of the perforating/embedded stent.

Computed tomography (CT) imaging of the abdomen revealed that the migrated biliary stent projected approximately 1.5 cm beyond the intraluminal portion of the duodenum, suggesting penetration through the duodenal wall. There was no evidence of free fluid or air adjacent to the tip of the stent indicating a contained perforation (Figure 2).

The following day, upper endoscopy and ERCP were performed under general anesthesia. As the migrated stent was embedded in the duodenal wall, its distal tip could not be accessed for retrieval with a snare. As the stent was impacted proximally at the bile duct stricture and distally in the duodenal wall, there was concern regarding the potential for extending the size of the mural defect with use of a rat tooth forceps for retrieval, due to the necessary

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tangential directionality of the pulling force. To facilitate rapid stent capture, extraction, and closure of the duodenal wall defect, a 2-channel therapeutic gastroscope was then utilized. Prototype flexible endoscopic scissors (Apollo Endosurgery, Austin, Texas, USA) were used to transect the stent above the site of duodenal wall penetration (Figure 3) to allow the stent to be grasped close to the mural wall. An endoclip (Boston Scientific, Marlborough, Massachusetts, USA) was advanced through the second channel of the therapeutic gastroscope to facilitate rapid deployment. Next, the distal end of the stent, which remained embedded in the duodenal wall, was removed using a rat tooth forceps applying an axial pulling force along the long axis of the remaining stent (Figure 3). Minimal self-limited oozing was noted from the site of impaction/penetration. Four endoclips were then rapidly placed to close the duodenal wall defect (Figure 3). ERCP was then performed, the straight plastic stents were removed and were replaced with pigtail biliary stents, as these carry a low risk of duodenal perforation.

The patient remained stable post-procedure. He was discharged home the following day with a 7-day course of oral antibiotics. A repeat ERCP performed 2-months after stent removal revealed complete healing of the stent penetration site and the previously-placed endoclips were no longer present.

Discussion

Biliary stents are placed at ERCP for the management of benign or malignant biliary strictures, bile leaks and occasionally for complex biliary stone disease when all stones have not been successfully extracted. Proximal or distal stent migration has been reported to occur in up to 10% of patients undergoing stent placement.¹ Stents may be passed spontaneously before migration is detected. When migration is detected prior to stent passage, one management option is a conservative 'watch and wait' approach with radiological surveillance to monitor stent transit and to confirm expulsion. This approach is typically chosen when the stent is determined to have migrated beyond the easy reach of standard upper endoscopy or push enteroscopy. Serial X-rays indicating non-advancement of the stent may imply stent impaction which increases the risk of perforation and should prompt colonoscopy, and if necessary balloon enteroscopy for stent retrieval, particularly in patients with known small bowel or colonic diverticula.^{2,3} At endoscopy, capture of the most accessible end of the migrated stent is most easily accomplished using a rat tooth forceps although polypectomy snares and biliary stone extraction baskets have also been employed.

Intestinal wall penetration or transmural perforation due to stent migration is a rare event, with an incidence of less than 1%.⁴ Our own unpublished Stanford data indicates that this phenomenon may be exceedingly rare, with an incidence of <0.001%. Case reports document right colonic perforation or perforation of a small bowel or colonic diverticula as a consequence of migrated stents.^{4,5} However, intestinal perforation as a result of stent migration occurs most commonly at the duodenum, either due to stent perforation through a diverticula, or as a consequence of the stent impacting on the duodenal wall opposite the ampulla, resulting in a slow ischemic perforation from contact/pressure necrosis. Concurrent ongoing tissue remodeling during slow ischemic perforation usually results in a small mural

defect and in a contained perforation. The gradual ischemic perforation process is akin to that noted with intraluminal erosion of gastric bands in the bariatric population.⁶

Migrated stents may result in free intraperitoneal or in contained retroperitoneal perforations. Intra-peritoneal perforations present early and patients are typically extremely ill, with severe abdominal pain, fevers, chills and sepsis.³ Retroperitoneal perforations may be asymptomatic, or associated with persistent abdominal or flank discomfort and fever.⁵ CT imaging has the highest sensitivity and specificity for detecting stent migration-associated perforation;⁵ however other imaging modalities may also be useful. Abdominal radiographs may demonstrate a change in stent position, coupled with air under the diaphragm or gastric pneumatosis⁷ and ultrasound may demonstrate obscuration of the right kidney due to retroperitoneal gas, known as the “Veiled Kidney Sign.”⁸

Stent retrieval and repair of the associated mural defect required surgical intervention in the past,⁹ but advances in therapeutic endoscopy now allow the minimally invasive option of endoscopic management, which can be easily accomplished in stable patients.^{5,4,9} Closure of the usually small stent-associated mural defects can be readily undertaken using through the scope endoscopic clips particularly for contained perforations. In the unlikely event of a larger or indurated mural defect an over-the-scope clip can be considered. In our patient, endoscopic scissors were necessary to transect the stent for easier and safer retrieval as the stent was impacted in the bile duct proximally and in the duodenal wall distally. Previously available endoscopic scissors were fragile and only allowed cutting of suture material.¹⁰ The prototype robust scissors we used in this patient are now commercially marketed by a new company (Ensizor™ Endoscopic Scissors, Slater Endoscopy LLC, Miami Lakes, Florida) and have expanded the therapeutic endoscopy toolkit. To our knowledge, this represents the first report of purely endoscopic retrieval of a perforating biliary stent facilitated by endoscopic scissors.

This case highlights the efficacy of therapeutic endoscopy techniques in accomplishing stent retrieval and closure of associated mural defects and provides another example of the transition in management of gastrointestinal conditions from invasive surgical intervention to rapid, safe and effective endotherapy. Surgery for biliary stent associated perforations should today be largely reserved for patients who present with an acute free perforation which may require intraperitoneal washout or in patients with hemodynamic instability.

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Key Points

- Plastic biliary stents are the mainstay of endotherapy for biliary strictures but stent migration occurs in up to 10% of patients following stent placement
- Distal stent migration may result in recurrent biliary obstruction or rarely in stent-associated intestinal penetration or free perforation
- Advances in therapeutic endoscopy enable endoscopic approaches for the retrieval of migrated stents and for the management of stent-associated intestinal perforations

Figure 1. Endoscopic (A) and fluoroscopic (B) images of biliary stent penetrating the duodenal wall opposite the ampulla. Rat tooth forceps failed to easily dislodge stent, suggesting deeply embedded or perforating stent.

Figure 2.
CT scan of the abdomen (coronal view) demonstrating the distally migrated biliary stent projecting approximately 1.5 cm beyond the intraluminal portion of the duodenum, suggesting contained perforation of the duodenal wall.

Figure 3. Endoscopic images sequentially depicting endoscopic scissors transecting the perforating biliary stent, rat tooth forceps retrieving the residual penetrating stent and endoscopic clip closure of the small duodenal wall defect.