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SpyCatcher: Use of a Novel Cholangioscopic Snare for Capture and Retrieval of a Proximally Migrated Biliary Stent

Monique T. Barakat¹, Subhas Banerjee¹

¹Division of Gastroenterology and Hepatology, Stanford University School of Medicine, 300 Pasteur Drive, MC:5244, Stanford, CA 94305, USA

Case Presentation and Evolution

A 60-year-old woman was evaluated in our institution with abnormal liver function tests 1 month following orthotopic liver transplantation for alcoholic cirrhosis. Vital signs were notable for a heart rate of 76 beats/min, temperature of 36.3 °C, blood pressure of 101/64 mm of Hg, and respiratory rate of 10/min. Physical examination revealed healed abdominal incisions consistent with her surgical history and no abdominal tenderness. Endoscopic retrograde cholangiopancreatography (ERCP) revealed an anastomotic biliary stricture, which was treated with ampullary sphincterotomy and placement of an 8.5 French × 7 cm straight plastic stent. Seven weeks later, she returned for repeat ERCP for incremental dilation and stent exchange as part of the management of her post-liver transplantation anastomotic biliary stricture. Her laboratory studies, including liver function tests, were normal.

At ERCP, the initial fluoroscopy scout image localized the stent in the right upper quadrant, consistent with a biliary location. Nevertheless, the distal end of the stent was not visualized at the ampulla, indicating proximal migration of the stent into the bile duct (Fig. 1). The ampulla was located somewhat distally in the second part of the duodenum. The bile duct was cannulated using a sphincterotome; injection of contrast confirmed that the stent was within the bile duct and across the anastomotic stricture. An extension biliary sphincterotomy was performed followed by standard techniques typically used for retrieval of proximally migrated stents, including attempted stent capture with a rat-tooth forceps and polypectomy snare were sequentially employed, but were all unsuccessful due to difficulty in aligning the devices with the ampulla and bile duct.

A SpyGlass™ cholangioscope (Boston Scientific, Marlborough, MA, USA) was then advanced into the distal bile duct, facilitating visualization of the distal end of the migrated stent, located approximately 3–4 cm proximal to the ampulla (Fig. 2). The SpyGlass™ Retrieval Snare was then advanced through the working channel of the cholangioscope (Fig. 3). The mini-snare was opened within the bile duct and manipulated to encircle the migrated stent proximal to the stent's distal flange. The mini-snare was then closed to grasp the stent

Subhas Banerjee, sbanerje@stanford.edu; Monique T. Barakat, mbarakat@stanford.edu.

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within the distal flange at the level of the distal side hole. The cholangioscope and mini-snare were then withdrawn together from the bile duct into the duodenum, under direct cholangioscopic visualization (Fig. 2). The mini-snare was then disengaged from the stent and the cholangioscope removed. The stent was then removed using a standard polypectomy snare. Two new plastic biliary stents were subsequently placed across the anastomotic biliary stricture under endoscopic and fluoroscopic guidance. The patient tolerated the procedure well and was released from the hospital.

Discussion

Plastic biliary stents are widely utilized for the management of benign and malignant biliary obstruction. Proximal or distal migration of plastic biliary stents has been reported in 5–10% of patients [1]. Distal biliary stent migration may result in recurrent biliary obstruction, cholangitis, or bowel perforation [2–4]. Proximal biliary stent migration may result in pain/biliary colic, bile duct wall injury with resultant stricture formation, or deposition of stone debris around the stent [2, 3]. Retrieval of proximally migrated biliary stents may require protracted, technically challenging procedures. Stent retrieval may nevertheless fail, requiring additional ERCPs for success. Common reasons for failure may include inability to align and advance stiff, non-dedicated retrieval devices into the ampulla and bile duct, embedment of the stent into the bile duct wall and/or stent migration proximal to a biliary stricture. Another factor may relate to endoscopist volume and experience. A volume–outcomes relationship exists in therapeutic endoscopy [5, 6], and lower-volume endoscopists will inevitably be inexperienced in the retrieval of proximally migrated stents, and may therefore have a lower success rate.

Traditional stent retrieval methods have relied heavily on fluoroscopic guidance for stent capture. Although the initial approach for many endoscopists is to attempt to retrieve the stent using a rat-tooth forceps, a snare, or a stone retrieval basket facilitated by fluoroscopy, these approaches are reportedly successful in only approximately one-third of patients [3, 7]. When direct grasping techniques fail, guidewire-facilitated stent retrieval techniques such as the Soehendra™ stent extraction device [3] or intra-stent balloon extraction have been used, although these guidewire-facilitated stent retrieval approaches require successful advancement of a guidewire into the lumen of the migrated stent in order to enable subsequent stent capture with the stent extractor or dilation balloon. Successful guidewire advancement into the stent lumen may be difficult since the fluoroscopic image represents only a two-dimensional projection of the ductal anatomy. Moreover, fluoroscopy-facilitated approaches are usually lengthy, often requiring high-magnification fluoroscopy and prolonged fluoroscopy time, with significant radiation exposure to both patients and endoscopists.

Cholangioscopy offers the advantages of rapid and predictable stent capture and retrieval under direct endoscopic guidance, without the need for fluoroscopy. Although dedicated devices that can be utilized through the narrow 1.2 mm lumen of the SpyGlass™ cholangioscope have previously been limited, we and others have demonstrated the utility of cholangioscopy-facilitated stent cannulation and retrieval [8–10]. Cholangioscopy offers an additional familiar visual dimension which supports easy and precise alignment with the

stent, enabling successful guidewire advancement into the stent lumen for subsequent capture with a dilation balloon. We have also captured proximally migrated stents cholangioscopically, at their tip or by their flange, using dedicated SpyBite™ mini-forceps.

The novel SpyGlass™ Retrieval Snare used in this patient that has just been commercially released facilitates direct cholangioscopic stent capture. The shaft of the snare is 286 cm long and ~ 1 mm in diameter, enabling advancement through the 1.2 mm working channel of the Spyglass™ cholangioscope. The snare opens to a diameter of 9 mm. This initial experience with the snare was notable for overall good functionality of the device, with successful stent retrieval achieved rapidly on our first attempt using the device. As described with other SpyGlass™ devices, we experienced some difficulty advancing the snare through the distal part of the cholangioscope where it bends over the duodenoscope elevator. This issue was easily addressed by withdrawing the cholangioscope into the duodenum, easing off on the elevator and advancing the snare to the tip of the cholangioscope, prior to re-advancing the cholangioscope into the bile duct. Simple capture anywhere along the distal end of the stent is readily accomplished and suffices for stent retrieval in most patients with proximally migrated stents. Where the proximally migrated stent still traverses a tight biliary stricture as in our patient, more secure capture is advantageous; we recommend engaging and closing the snare at the level of the distal side hole—the flap of the distal flange will anchor the snare and prevent it from sliding off the stent. The fluoroscopic burden for this procedure was several-fold lower than that for typical stent retrieval procedures (fluoroscopy time = 0.8 min) which reflects fluoroscopy-facilitated stent retrieval efforts that preceded cholangioscopy. Similarly, the procedure duration (39 min) was shorter than that for typical stent retrieval procedures. Again, the proportion of time utilized for purely cholangioscopic stent retrieval was under 5 min.

In conclusion, we have demonstrated the utility of a novel SpyGlass™ Retrieval Snare for capture and retrieval of a proximally migrated biliary stent. Advantages of the direct cholangioscopic approach include rapid and predictable success, along with avoidance of the need for fluoroscopy. The main disadvantage is the cost of the cholangioscope and associated devices. A rational strategy could be devised based on available clinical information such as history of prior failed attempts at fluoroscopy-facilitated stent retrieval, stent type, biliary anatomy, prior endoscopist experience, and other factors that would dictate whether to use cholangioscopic retrieval as the primary approach or as the secondary approach after initial fluoroscopy-based efforts have failed. Such a strategy is likely to be cost-effective as it would obviate the need for a repeat ERCP.

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Key Messages

- Plastic biliary stent migration occurs in up to 10% of patients.
- Although fluoroscopy-facilitated approaches utilizing non-dedicated devices are commonly employed for stent retrieval, these approaches often require lengthy procedures with high fluoroscopy utilization.
- Cholangioscopy, with use of the SpyGlass™ Retrieval Snare, offers the advantages of rapid and predictable stent capture and retrieval under direct endoscopic guidance, without the need for fluoroscopy.

Fig. 1.
a Biliary stent was evident in the right upper quadrant on initial fluoroscopy scout films, although **b** the stent not evident on endoscopic ampullary views

Fig. 2.
Flow diagram depicting steps in cholangioscopic stent capture and retrieval utilizing the new SpyGlass™ Retrieval Snare

Fig. 3.
Images of the SpyGlass™ Retrieval Snare