OATS: A SELF-DESIGNED PLASTIC TAILED BILIARY STENT

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INTRODUCTION

Over the last two decades, endoscopic biliary stenting has become a procedure of choice for many biliary disorders.[1] A new era in therapeutic endoscopy began with the first endoscopic biliary stent placement of Soehendra in 1979.[2] Biliary stenting is widely used to palliate malignant obstruction or treat benign biliary diseases.[4] Today, the technique of biliary stenting has been standardized and the indications for biliary stenting have expanded. Currently, vast array of stents are now readily available in the market. Their uses and advantage varies and techniques for insertion are also different.

Although expandable metallic stents have become the standard in interventional radiology and cardiology, plastic stents continue to dominate in biliary endoscopy for two reasons: lower cost and the ease of stent exchange if clogging occurs. However, plastic stents continue to be limited by clogging and migration. Expandable metal stents are less prone to clogging, but stent-in growth and overgrowth limit patency. Migration of expandable stents is uncommon, but with the trade-off of permanency.[2]

Biliary stents however are not without complications. The complication rate ranges between 8% and 10% with a mortality rate below 1%. Complications specific to the stents include migration, occlusion and intestinal perforation. Migration of endoscopically placed biliary stents is a well-recognized complication of endoscopic retrograde cholangiopancreatography (ERCP). Serious complications can result from stent migration but fortunately less than 1% of migrated stents cause intestinal perforation.[10]

The new challenge in biliary stenting has already evolved but development of low cost plastic stents that would prevent most commonly encountered complications like proximal/distal migration and dreaded complication like perforation would still be the most popular options for various biliary conditions.

This report introduces an innovation in the era of plastic biliary stenting.

METHODOLOGY

Materials:

Generic Teflon plastic stent (7Fr or 10Fr; variable lengths)
Scalpel blade
Tape measure/Ruler
Pentel pen
Stiff metal rod which can fit into the lumen of the stent

Stent Assembly:

The Ong-Acuesta-Trecero Stent (OATS) is a self-designed generic plastic biliary stent designed to lessen the risk of stent migration, facilitate stent exchange, stent repositioning and prevent duodenal perforation in case of distal migration. It is molded to have a slightly tapered upper tip and a soft, bendable tail at the distal end with anchoring flaps positioned near both ends.

Stent Characteristics:

- Shape and material

  Generic teflon stents was modified by tapering the upper end with hot air. The metal rod is inserted into the lumen of the stent and a sharp thin lenghtwise cut was done over the lower end, to a length of approximately 2 cm. The other side of the flap is then cut off across the stent at its base. Flaps were then created near both ends of the stent.

- Diameter

  The diameter of plastic biliary stents is measured in French (Fr), a unit that corresponds to one third of a millimeter or 0.33 mm. As for OATS, the available diameters are 7Fr and 10Fr.

- Lengths

  Standard plastic stent models are available in lengths ranging between 5 and 18cm but custom-made stents (longer models) may be made if warranted. For our own consumption, the stated length indicates the upper tip to the lower tip of the stent, excluding the tail or flap.

DISCUSSION

Endoscopic biliary drainage using a tube stent is now a well-established therapy for biliary obstruction developing secondary to a malignant or benign disease.[6] Due to its convenience for use and cost effective features, plastic biliary stent is the most popular for various biliary conditions.[1]

Plastic stents come with many sizes, shapes and lengths. Straight and pigtail types are the most popular in the market. Other designs include angled stemts, Tannenbaum stents, duodenal angled stents, single pigtail stents among others. These stents are made of either polyethelene or teflon.[2]

Biliary stents are safe but nevertheless may cause serious complications. The most frequent complication associated with bile duct stents is early occlusion caused by clogging, with resultant cholangitis, or by tumor over-growth. Stent migration, although a rare complication associated with biliary stenting, is a late event following endoscopic stenting. It may involve proximal or distal migration, with an overall incidence of up to 6%. [8]

The main benefit of pigtail stent over the straight system is the lower risk for migration because it provides superior anchorage and rarely causes tissue injuries during migration. Therefore, pigtail stent is indicated in the situation with higher risk for stent migration such as large common bile duct, post biliary sphincterotomy and gallbladder stentings.[1]However, these stents, the standard in other disciplines where plastic stents are used (e.g. urology and interventional radiology), fell out of favor after studies showed higher rates of clogging compared with straight stents.[2]

There are several options for dealing with migrated stents. One option is to attempt endoscopic retrieval before any surgical intervention. A recent review showed that it might be difficult for proximally migrated stents (with a 71% success) but was more successful for distally migrated stents (with 100% success).[5]

Endoscopic retrieval of proximally migrated biliary plastic stents may be technically challenging and sometimes unsuccessful. Because no endoscopic view is available, therefore only fluoroscopic monitoring can b used.[1] Despite the widespread use of standard stents, there are few reports on the technique for retrieval of migrated stents. It may usually be achieved endoscopically using Dormia basket, balloon, balloon and basket, basket and ball tip catheter, forceps, and Soehendra stent retriever. The choice of a retrieval technique, however, is dependent on several factors including biliary ductal dilatation, depth of stent migration, distal stent impaction and biliary stricture distal to the migrated stent. The placement of an additional stent alongside an irretrievable stent is a satisfactory alternative to retrieval. Figure 1 shows some of the different techniques commonly used to remove proximally migrated plastic stents.

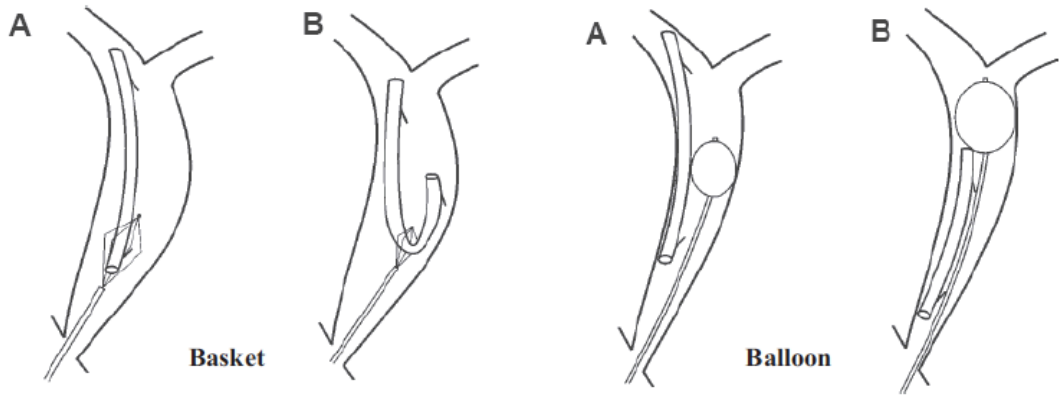
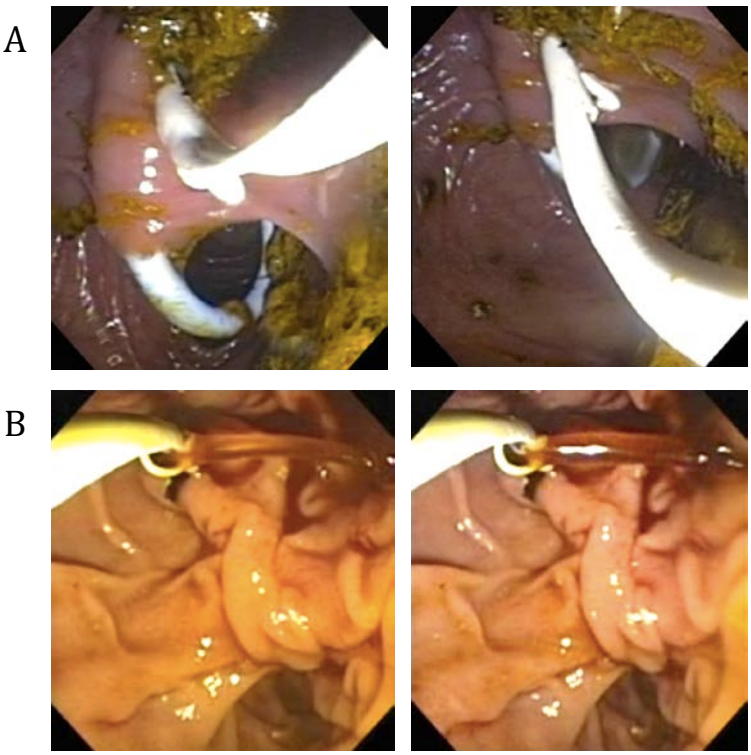


Figure 1: Different techniques to remove proximally-migrated plastic stents

Retrieving a proximally migrated OAT stent would be much easier as long as a portion of the tail would be still be visible in the duodenum. This can be simply pulled out directly and repositioned using any of the grasping forceps available. In case the whole stent including the tail entered the bile duct, it would be easier to get hold of the flap compared to the whole diameter of the stent's lower end using any of the usual maneuvers.

On the other hand, distal stent migration has been observed in up to 6% of inserted biliary endoprostheses. As reported by Johansen et al., the only identified risk factor for migration of stents out of the common bile duct is papillary stenosis. Intestinal perforation is a rare but serious late complication of distal migration of a biliary stents. Most reported cases of intestinal perforation are from migrating biliary stents that cause duodenal perforation, likely because the duodenum is fixed.[9]A straight biliary stent may migrate since there is nothing to hold it in place, eventhough there are side flaps. Inappropriately long stent may also exert pressure on the duodenal wall causing fatal complications like tissue necrosis and perforation.[10] In OATS, potential life-threatening sequalae of distal stent migration would somehow be avoided. Its long-tailed distal end would not give contact pressure on the duodenal wall as it migrates distally because it would be flexible enough to accommodate the contour the duodenum as shown in Figure 2. The tail also serves as a cushion to prevent direct contact pressure of the stent end on the duodenal wall, either by inward or outward curling of the flap.

Figure 2: Deployment of OATS during Endoscopic Retrograde Pancreatography (ERCP)



Plastic stents (OATS) were inserted into the (A) choledochoduodenal fistula and (B) native papilla with subsequent good bile flow for both patients in cholangitis

Double plastic stenting entails inserting one stent after the other. The second stent may pull the first stent inwards if the angle of insertion is incorrect, or simply push the first one in if there is much friction between the 2 stents. For ampullary and bleeding lesions, it is advisable to use OATS as the first stent so that in case of inward migration, one can still salvage the procedure by simply pulling out the first stent after the second one is in position.

OATS also offers the added advantage of cutting procedure time during stent exchange. While 7 French stents are routinely pulled out of the working channel during stent exchange, retrieval of a 10 French requires removing the duodenoscope and inserting it again to put in a new one. The thin and long tail of the OATS can easily be grasped with a basket or any retrieval accessory and pulled out from the working channel. This is possible also in 10 French stents because the grasping forceps does not take space along side of the stent as it is pulled out. Of course one has to make sure that the lower tip of the old stent is aligned with the scope channel. This lessens procedure time and possible trauma related to reinsertion of the scope.

CONCLUSION

Biliary stent design largely affects the risk for migration. The stent shape, diameter and length all play an important role in the early and late complications of biliary stenting. Appropriate selection of commercially available stents for different situations is imperative for the satisfied outcome. With the advancements and innovations done in OATS, these aforementioned impediments would be lessened.

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