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Approach to biliary access in patients with altered anatomy

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ABSTRACT

Alteration in the upper digestive tract or pancreaticobiliary anatomy poses a challenge for successful endoscopic retrograde cholangiopancreatography (ERCP). The alterations can arise either after surgery or because of tumor or diverticulum. In this scenario, the papilla may be unreachable or difficult to cannulate. The situation is further compounded by the lack of dedicated instruments for such procedures. Endoscopic ultrasound–guided biliary intervention and device-assisted enteroscopy are 2 techniques that have been found to be useful for ERCP in patients with altered anatomy. The ability of endoscopic ultrasound to visualize the biliary tree and enteroscope to reach deep into the small intestine has proven to be useful for ERCP in patients with altered anatomy. The technical and functional success rates of both approaches are relatively high. However, they have been associated with complications that are higher than that associated with standard ERCP. This finding is likely related to the learning curve of these advanced therapeutic interventions. With improvement in devices, technique, and accessories, both procedures are emerging as viable alternatives to standard ERCP in patients with altered anatomy.

1. Introduction

Endoscopic retrograde cholangiopancreatography (ERCP) is a standard technique to gain access to the biliary tree. The technical success rate for ERCP in patients with normal anatomy is more than 95%. However, infrequently endoscopists encounter an alteration in the anatomy because of a diverticulum, tumor, or surgery. Such an alteration poses a challenge for successful ERCP. ERCP for patients after a pancreaticoduodenectomy or Roux-en-Y gastric bypass is accorded the highest grade on the level of complexity of procedure by American Society for Gastrointestinal Endoscopy [1]. The challenges vary depending on the reason, type, or degree of anatomical alteration. Angulations, adhesions, length of intestine, orientation, and location of papilla determine the success rate of ERCP in a patient with an altered pancreaticobiliary anatomy. A number of different techniques (balloon-assisted enteroscopy and endoscopic ultrasound [EUS]-guided biliary or pancreatic access) have been used in patients with altered anatomy. The success rates of such techniques vary among different centers.

2. Reasons for failed standard ERCP

2.1. Failure to reach papilla

Failure to reach the papilla is probably the most common reason for failed ERCP [2]. Surgery of the upper digestive tract, biliary tree, or pancreas may alter the anatomy to such an extent that it precludes conventional ERCP. Roux-en-Y gastric bypass is a commonly performed surgery for obesity [3,4]. The surgery creates a small proximal pouch out of the stomach, which is then connected through a Roux limb distally to a biliopancreatic limb of the small intestine in a Y-shaped fashion. The biliopancreatic limb transports secretions from distal stomach, pancreas, and biliary tree. The length of the Roux limb varies among surgeons, with a greater length aimed at more weight loss [5]. The rapid weight loss that the surgery produces increases the risk of cholelithiasis [6]. A long Roux limb, as well as the angulation it produces, increases the difficulty for ERCP. In Billroth II gastric resection, performed for distal gastric cancer or peptic ulcer disease, the remnant proximal stomach is anastomosed with the Roux limb in an end-to-side fashion. The afferent limb is short in a retrocolic anastomosis and longer in an antecolic anastomosis. The afferent loop leads to the duodenal stump, whereas the efferent loop leads to the more distal small intestine. In a retrospective study of ERCP in patients with Billroth II gastric resection, the authors noted a high ERCP failure rate of 34%. The reasons for the

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failure included failure to enter the afferent loop (10%), failure to enter duodenum (12%), failure to cannulate (6%), and perforation (5%) [7]. The Whipple procedure and its modification, the pylorus-preserving pancreaticoduodenectomy, also alter the pancreaticobiliary anatomy. The surgery includes a gastrojejunostomy or duodenojejunostomy along with a pancreaticojejunostomy and a choledochojejunostomy. The pancreas and bile duct drain into the afferent limb. The Whipple procedure is performed for both malignant and benign indications [8]. The risk for development of biliary stricture increases with improved survival [8]. The incidence of biliary stricture after pancreaticoduodenectomy has been variably reported between 2.5% and 8% [8,9]. Afferent loop obstructions because of angulation or stricture can prevent access. Pannala et al [10] estimated that the prevalence of afferent loop syndrome is approximately 13% after a Whipple surgery. Hepaticojejunostomy and choledochojejunostomy are 2 other surgeries performed for both benign and malignant indications that alter the upper gastrointestinal tract anatomy and hinder conventional ERCP.

2.2. Failure to cannulate

Cannulation of the papilla is also another rate-limiting step in ERCP. Despite having reached the papillary orifice, inability to obtain proper orientation to the papilla may lead to the failure of ERCP. Duodenal diverticula are inconsequential except when they are near the ampulla of Vater (periampullary diverticulum [PAD]). There are 3 types of duodenal diverticula depending on the position of major papilla. Type I papilla is within the diverticulum, type II papilla is at the margin of the major papilla, and type III is when the papilla is near the diverticulum [11]. PAD may alter the axis and location of the papilla, making cannulation difficult. Controversy exists as to whether PAD interferes with successful cannulation. Rajnaova et al in a retrospective series have reported high rates of difficulty in cannulation (79.2%) in the presence of a PAD. However, other studies have not shown any difference in cannulation rates in the presence of PAD [12-14]. Despite conflicting evidence, many endoscopists exercise caution when perform ERCP in patients with PAD. A number of techniques have been described for cannulation in patients with PAD including entering the diverticular cavity with a forward-viewing or a side-viewing duodenoscope [15-17]. Another situation where cannulation may be difficult is in patients with malignant biliary obstruction. The situation is occasionally complicated by a deformed duodenum owing to malignant infiltration. Conventional ERCP may be difficult to perform in this group, and an alternate approach for biliary drainage (eg, EUS-guided biliary drainage [EUS-BD]) may be required in selected cases [18].

3. Assessment of the patient

A careful review of the surgical notes helps in planning the endoscopic approach for a patient who presents with biliary obstruction in the setting of surgically altered anatomy. Information regarding the type of surgery, type of anastomosis, and length of limbs are important determinants of approach to ERCP. Proper cross-sectional imaging, either magnetic resonance imaging or contrast-enhanced computed tomography, helps to fully delineate the postoperative anatomy. Magnetic resonance imaging has the added advantage of being able to completely delineate the biliary tree.

4. EUS-guided approach to the patient with altered biliary anatomy

EUS has a distinct advantage of being able to image the biliary tree throughout its length. In 1996, Wiersema et al [19] reported for the first time the feasibility of EUS-guided cholangiography. After this, in 2001, Giovannini et al [20] reported the success of EUS-guided choledochoduodenostomy. Since then, a number of studies have evaluated the success and complications of EUS-guided biliary intervention in patients with altered anatomy (Table 1). EUS-guided approaches to BD include EUS-guided transmural drainage (choledochoduodenostomy and hepaticogastrostomy [HG]), EUS-guided rendezvous, and EUS-guided antegrade drainage.

4.1. Transgastric-transhepatic biliary access

The transgastric-transhepatic route for drainage can be used for transmural BD, antegrade stenting, antegrade stone extraction, or rendezvous. The initial steps for biliary access are common to all of these approaches. A dilated intrahepatic bile duct is punctured with a 19-G needle under EUS guidance. Bile is then aspirated, and contrast is injected to confirm position. With the needle in position, a guidewire (0.025 in or 0.035 in) is inserted into the biliary tree. The tract is then dilated coaxially over the wire using a tapered-tip biliary cannula. If the dilatation is difficult, then a cystotome (6 Fr) or bougie dilator may be sequentially used [33]. The use of a needle knife for tract dilatation is associated with a higher risk of complications (odds ratio = 12.4, $P = 0.01$) and therefore is not an ideal option [31]. For transmural drainage, after the dilatation, a plastic or metal stent may be placed across the tract. If a metal stent placement is planned, then it is suggested to dilate the tract with a biliary dilating balloon. However, both stomach and liver are structures that move with respiration and are separated from one another. There exists a risk of stent migration with stent shortening, with fatal consequences [34]. Care must be taken to place a long stent with ample length within the stomach. Some centers clip the stent and or place a double pigtail stent through the metal stent to help prevent migration or use a wide flange coaxial system.

In patients with altered anatomy, the HG can be used to access the papilla or anastomotic area for therapy. Recently, Sanchez-Ocana et al described a technique of EUS-guided intervention in a patient with Roux-en-Y gastrectomy and esophagojejunostomy presenting with recurrent cholangitis after surgical sphincteroplasty. EUS-guided HG was performed, and a metal stent was placed across the HG. Through the metal stent, a transnasal endoscope was inserted in the bile duct, and needle knife papillotomy was performed in an antegrade manner. Following needle knife papillotomy, a guidewire was placed in the afferent loop and another covered metal stent was placed across the sphincter. Through both stents, a transnasal endoscope was used to reach the afferent loop and perform needle knife sphincterotomy in the retroflexed position [35]. Transhepatic antegrade stone removal is another novel technique for the removal of bile duct stones in patients with altered anatomy. In this technique, through the HG, balloon sphincteroplasty is perfomed, after which small stones can be pushed into the afferent loop. Itoi et al [36] described the use of an over-the-wire mechanical lithotripter through the HG for a large stone within the bile duct.

Finally, antegrade balloon dilatation and stenting of bilioenteric anastomotic strictures are difficult-to-manage clinical problems, which lead to EUS-guided approaches. Typically, these patients require serial dilatation or interval stenting with internal-external drains. Alternatively, labor-intensive iterative enteroscopy-assisted ERCP is an option. EUS-guided HG with a temporary covered metal stent can be used as an entry port for iterative treatment sessions, avoiding the need for external biliary drains. Although this approach is appealing for this particularly challenging patient subset (Figure 1), its viability remains to be studied.

The rendezvous technique is used if the papilla is accessible to the duodenoscope. A guidewire is manipulated across the stricture or