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Endoscopic Retrograde Cholangiopancreatography Difficulties and Techniques

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Abstract: Background: Since endoscopic retrograde cholangiopancreatography (ERCP) introduction in 1968, it has been an essential endoscopic technique for the diagnosis and treatment of pancreato-biliary diseases. ERCP is an advanced endoscopic technique that is challenging for trainees for several reasons such as the use of side view endoscope, procedural complexity, and risk of complications. As a result, proficiency in using an upper gastrointestinal endoscope is imperative and a precise understanding of the pancreato-biliary anatomy and physiology is essential. When selective biliary cannulation (SBC) using the techniques described is not easily achieved, it is considered a difficult cannulation. Over the years, there have been several attempts to objectively define difficult cannulation. Most definitions use a combination of a minimum number of cannulation attempts, typically 5 to 15, and a minimum time spent on standard cannulation techniques, typically greater than 5 to 20 min. The concept of difficult biliary cannulation (DBC) has changed over time (3-5). Recently, the European Society of Gastrointestinal Endoscopy (ESGE) redefined DBC as more than five contacts with the papilla, unsuccessful cannulation longer than 5 minutes, or more than one unintentional cannulation or opacification of the pancreatic duct (PD).

Keywords: *Endoscopic Retrograde CholangioPancreatography, difficulties, techniques*

Introduction

Since endoscopic retrograde cholangiopancreatography (ERCP) introduction in 1968, it has been an essential endoscopic technique for the diagnosis and treatment of pancreato-biliary diseases [1]. ERCP is an advanced endoscopic technique that is challenging for trainees for several reasons such as the use of side view endoscope, procedural complexity, and risk of complications. As a result, proficiency in using an upper gastrointestinal endoscope is imperative and a precise understanding of the pancreato-biliary anatomy and physiology is essential [2].

Indications For ERCP

Because ERCP procedures are difficult and can cause serious complications, it is necessary to clearly understand their purpose and indications. Although it is difficult to definitively specify the indications for ERCP procedures, endoscopists who practice ERCP must objectively assess its purpose and indications. Therefore, ERCP should be performed only for appropriate indications and should not be routinely used before cholecystectomy. It should also not be performed in cases of abdominal pain without evidence of pancreatic duct closure or to provide routine decompression of malignant biliary obstructions preoperatively [3].

ERCP is generally indicated in [4]:

A. The jaundiced patient suspected of having biliary obstruction (appropriate therapeutic maneuvers should be performed during the procedure). B. The patient without jaundice whose clinical and biochemical or imaging data suggest pancreatic duct or biliary tract disease. C. Evaluation of signs or symptoms suggesting pancreatic malignancy when results of direct imaging (eg, EUS,US, computed tomography [CT], magnetic resonance imaging [MRI]) are equivocal or normal D. Evaluation of pancreatitis of unknown etiology. E. Preoperative evaluation of the patient with chronic

pancreatitis and pseudocyst. F. Evaluation of the sphincter of Oddi by manometry. Empirical biliary sphincterotomy without sphincter of Oddi manometry is not recommended in patients with suspected type III sphincter of Oddi dysfunction. G. Endoscopic sphincterotomy: Choledocholithiasis. Papillary stenosis or sphincter of Oddi dysfunction. To facilitate placement of biliary stents or dilation of biliary strictures. Sump syndrome. Choledochocele involving the major papilla. Ampullary carcinoma in patients who are not candidates for surgery. Facilitate access to the pancreatic duct. H. Stent placement across benign or malignant strictures,fistulae, post-operative bile leak, or in high risk patients with large unremovable common duct stones. I. Dilation of ductal strictures. J. Balloon dilation of the papilla. K. Naso-biliary drain placement. L. Pancreatic pseudocyst drainage in appropriate cases. M. Tissue sampling from pancreatic or bile ducts. N. Ampullectomy of adenomatous neoplasms of the major papilla. O. Therapy of disorders of the biliary and pancreatic ducts. P. Faciliation of cholangioscopy and pancreatoscopy.

ERCP is generally not indicated in [4]:

A. Evaluation of abdominal pain of obscure origin in the

absence of objective findings that suggest biliary or

pancreatic disease. Magnetic resonance cholangiopancreatography and EUS are safe diagnostic procedures that can obviate the need for ERCP.

B. Evaluation of suspected gallbladder disease without

evidence of bile duct disease.

C. As further evaluation of proven pancreatic malignancy

unless management will be altered.

Successful biliary cannulation was first achieved by the obstetrician William McCune and the surgical team at George Washington University, using an Eder fiberoptic duodenoscope equipped with a forward and side lens [1]. At that time, McCune recorded a 50% success rate, and wrote, “Anyone who looks through one of these instruments has to have 2 personality characteristics. First, he has to be honest, and second, must have an undying, blind, day and night, uncompromising persistence.” Rapid improvement in success rates came one year later in Japan, when Oi [5] developed a side-viewing fiberoptic duodenoscope with the ability to manipulate the cannula. The investigators reported a 77% success rate, without significant morbidity [5].

Meanwhile, Kawai [6] developed a technique similar to modern-day needle knife sphincterotomy. These early breakthroughs were inspired by many sources, including the already ubiquitous use of baskets, stents, catheters and guidewires in the fields of cardiology, urology, and interventional radiology, and have undoubtedly laid the foundation for modern day ERCP [6].

Despite technological advances in endoscopic retrograde cholangiopancreatography (ERCP), the technique continues to be difficult and requires a high level of experience from the endoscopist. In reference centers, as

many as 35% of biliary cannulations are unsuccessful. General complications in biliary cannulation patients are about 2% in centers with expertise in this population, compared to 7% in centers with low volume [7].

Even in patients with normal anatomy and easily visible papilla, multiple cannulation attempts can cause mechanical trauma to the papilla and make subsequent attempts more difficult [8].

The resulting edema may obstruct the pancreatic duct (PD). Also, chemical injury from the inadvertent injection of contrast media in the PD increases the risk of post-ERCP pancreatitis (PEP) [9].

Several factors have been associated with difficult biliary cannulation (DBC), including the experience level of the endoscopist and the patient's anatomy (type of papilla, altered anatomy, or anatomical variant) [8].

DIFFICULT CANNULATION

Even in the hands of experienced endoscopists, SBC can fail in up to 20% of cases [10].

Defining difficult biliary cannulation

When selective biliary cannulation (SBC) using the techniques described is not easily achieved, it is considered a difficult cannulation. Over the years, there have been several attempts to objectively define difficult cannulation. Most definitions use a combination of a minimum number of cannulation attempts, typically 5 to 15, and a minimum time spent on standard cannulation techniques, typically greater than 5 to 20 min [11].

The concept of difficult biliary cannulation (DBC) has changed over time [12]. Recently, the European Society of Gastrointestinal Endoscopy (ESGE) redefined DBC as more than five contacts with the papilla, unsuccessful cannulation longer than 5 minutes, or more than one unintentional cannulation or opacification of the pancreatic duct (PD) [13].

The number of inadvertent mean pancreatic duct injections or cannulations may also be considered part of the definition of difficult cannulation, with some studies suggesting > 4 MPD cannulations as the limit [14].

Recently, the European Society of Gastrointestinal Endoscopy (ESGE) guidelines defined difficult biliary cannulation in an intact papilla as any procedure in which the duration of cannulation attempt exceeded 5 min or 5 attempts, or a procedure with more than one unintentional MPD cannulation or opacification [13].

However, there is no uniform definition of what comprises a cannulation attempt. Friedland et al.,2002 defined a cannulation attempt as any repositioning or wedging of the cannulation device while attempt selective biliary cannulation (SBC), while Bailey et al.,2010 defined an attempt as sustained contact between the cannulation device and the papilla for five seconds or more [15].

Multiple attempts at SBC increases the time patients spend on anesthesia, increase the risk of post-ERCP pancreatitis (PEP), and delay therapeutic options [16].

When difficult SBC is encountered, the endoscopist must decide to either persist with standard cannulation techniques, switch to more advanced techniques such as pancreatic guidewire or precut techniques, or abort the procedure. The safety of the patient, urgency of the procedure, time spent on cannulation, and cost of the tools are all important factors in this decision [8].

Studies have shown that increased time spent on cannulation and a greater number of attempts can leads to increased rates of Post-ERCP pancreatitis (PEP) and using advanced instruments such as various needle knife tools and additional guidewires can incur greater cost to both the patient and endoscopist. PEP is the most common and serious complication of ERCP [17].

In the quest to improve cannulation rates, many techniques and tools were designed to not only facilitate biliary cannulation but also to reduce the risk of PEP. Factors that make SBC difficult ERCP is an advanced technique that not all endoscopists perform routinely [2].

Regardless of which definition is used, it is generally accepted that once difficult cannulation is encountered, the risk of PEP or complete failure of the procedure is dramatically increased [8].

It is important to note that when the purpose of SBC is for pancreatic intervention only, cannulation of the minor papilla can be pursued as an alternative to the methods discussed below. Although SBC of the major papilla the most common and effective method used for management of pancreatic diseases, when access to

the major papilla is difficult or impossible due to severe duct distortion or obstructive mass, cannulation of the minor papilla may be easier and safer than persistent attempts at major duct cannulation [8].

The minor papilla is the papilla of the accessory pancreatic duct, or sometimes, a variant duct anatomy in pancreas divisum [18].

Access to the minor papilla enables therapeutic options for pancreatic diseases such as chronic or recurrent acute pancreatitis and pseudocysts, but not for biliary disease as the minor papilla does not connect to the CBD [18].

Factors that make SBC difficult

• Endoscopist Factors

As one may expect, increased experience with ERCP is associated with higher cannulation success rates. A success rate of 80% has been suggested as the goal during ERCP training. This success rate appears to require a minimum of 200 ERCP examinations [19].

Routine performance of ERCP also appears to be required to maintain ERCP proficiency, as lower provider volume has been associated with a higher failure rate and a greater need for post-procedure hospitalisation [20].

Besides endoscopist practice and expertise, a multitude of additional factors can make biliary cannulation difficult, even for the practiced endoscopist. Correct duodenal positioning, and adequate visualization of the papilla are vital for success, however, size of the papilla, and variant patient anatomy can also affect the degree of difficult in cannulation [8].

Even in patients with normal anatomy and easily visualized papilla, multiple attempts of SBC can traumatize the papilla and extensively opacify the pancreas, these factors in themselves can distort visualization of the papilla and can make further attempts even more difficult [8].

Gastroscopes are now less commonly used, predominantly only in older patients, without entero-enteric anastomosis. However, they are still used for initial inspection and for primary visualization of anastomose-type. Patient anatomy with long afferent loops or post Roux-en-Y anastomosis who require subsequent ERCP, may require an enteroscope longer than 170 cm for forward viewing endoscopic techniques [21].

• Patient Factors

In normal anatomy, the papilla is on the inside (medial aspect) of the mid-second portion of the duodenum; however, it is occasionally found more proximally (near the superior duodenal angle) or more distally (bordering the third portion of the duodenum). In these cases, as well as others of altered papillary location or morphology, locating the frenulum of the longitudinal duodenal fold or the papillary “beard” can help localize the major papilla, and a catheter or ST can lift duodenal folds to permit better visualization [21].

The size of the papilla is another important factor [22]. A small papilla can be difficult to identify, especially when there are excessive mucosal folds or other architectural distortions, and the tip of the ST may be larger than the papilla itself. A small papilla is also associated with initial contact of the ST with the septum instead of smooth insertion into the bile duct. If a wire lead cannulation technique is used, a small papilla makes it more difficult to redirect the ST without losing contact with the papilla. An extra-large papilla can also be problematic, as it can be more relaxed and unstable, making initial ST entry more troublesome. Also, the larger the papilla the more difficult further cannulation is, even with successful initial ST-papilla contact [22].

Although the hepatopancreatic (also termed biliopancreatic) ampulla usually enters the duodenum in the second portion, it is sometimes further distal in the third portion, making it more difficult to reach [22].

A periampullary diverticulum (PAD), alternatively termed juxta papillary diverticulum, can also make SBC difficult. For example, PAD can obscure the papilla or distort its orientation. In cases of PAD, the biliary direction is not angulated superiorly, but instead runs horizontally, therefore there is no need to angulate the ST upward. If using an ST is unsuccessful, a standard catheter may be more beneficial for cannulation [22].

Once periampullary diverticulum (PAD) is suspected, it can be exposed by using the ERCP catheter to move the duodenal mucosa from the outer rim of the diverticular ring, exposing the papilla. Another method includes injecting the inferior section of the diverticulum to move the papillary tip into view. However, this technique is associated with higher risks of needle perforation, retroperitoneal leaks, and causing papillary edema with subsequent obscuration of the papillary orifice [21].
Precut techniques and pancreatic duct stent placement are recommended to better expose the papilla for cannulation [13].
Once the papilla is identified, selective biliary cannulation (SBC) is usually achieved easily. Notably, and as alluded to above, anatomic distortion from PAD can cause deviation in the location of the orifice of the CBD and MPD from their most common positions at 11 and 2 o'clock, respectively [22].

Patients with a Billroth II gastrectomy or Roux-en-Y surgery are considered to have complex post-surgical anatomy and selective biliary cannulation (SBC) should be attempted at referral centers by endoscopists who have experience with such anatomy. Patients with these surgeries typically have the papilla in a portion of the duodenum retrograde from the gastrojejunostomy site. Because of this increased distance, push or balloon enteroscopy retrograde from the jejunum to the duodenum is frequently needed to reach the papilla [23].
Besides papilla size, location, duodenal positioning, periampullary diverticulum (PAD), and iatrogenic patient varied anatomy, other factors that lead to swelling of the papilla also contribute to difficult cannulation such as, biliary malignancies, tumor infiltration of the papilla or duodenum can make the papilla difficult to find. Also, malignancy makes the cystic tracts and vasculature more friable; this leads to more papillary edema, trauma and bleeding, with fewer cannulation attempts [8].

STANDARD METHODS FOR SELECTIVE BILIARY CANNULATION
Since the advent of ERCP, selective biliary cannulation (SBC) has remained not only the first and rate-limiting step of the procedure, but also one of the most technically challenging portions. The incidence of complications while trying to achieve SBC ranges from 4%-30% depending on various research studies [16].
Failed biliary cannulation occurs in up to 20% of cases and itself is associated with a higher risk of complications including post-ERCP pancreatitis (PEP), bleeding, delayed therapy, and others [16].
The standard endoscopic approach to uncomplicated SBC can be conceptualized chronologically as presented below;
Papillary assessment and positioning
Good visualization of the major duodenal papilla for biliary cannulation is achieved by placing the duodenoscope below the papilla. Shifting the patient into a left lateral decubitus or supine position can help improve the orientation of the scope and prevent it from falling back into the stomach. If a long scope position is required, the scope tip should be placed below the level of the papilla while applying gentle (counterclockwise) torque, thus allowing for appropriate infra papillary orientation while maintaining visualization [22].
Technique:
• contrast cannulation vs wire guided cannulation
Standard methods of biliary cannulation include contrast-assisted cannulation and guide-wire assisted cannulation. In these methods, the majority of endoscopists use a sphincterotome (ST) since it can be adjusted into the direction of the biliary duct by pulling or relaxing the cutting wire and allows for sphincterotomy if necessary. Triple-lumen STs are especially used to cannulate never previously proceduralized papilla [24].
The ST is inserted past the papilla, into the bile duct, with focus on minimizing papilla trauma and MPD cannulation or opacification. PD opacification (i.e., injection with contrast) is directly related to increased risk of PEP. Cannulation technique varies by hospital, physician comfort and available devices, we will review

herein the most widely used techniques, in particular contrast vs wire guided cannulation. Contrast cannulation was first demonstrated with the Deming-Classen probe but is associated with a higher rate of PEP as compared with wire-guided cannulation (WGC), a technique first described by Bassi et alin 1987 [25].

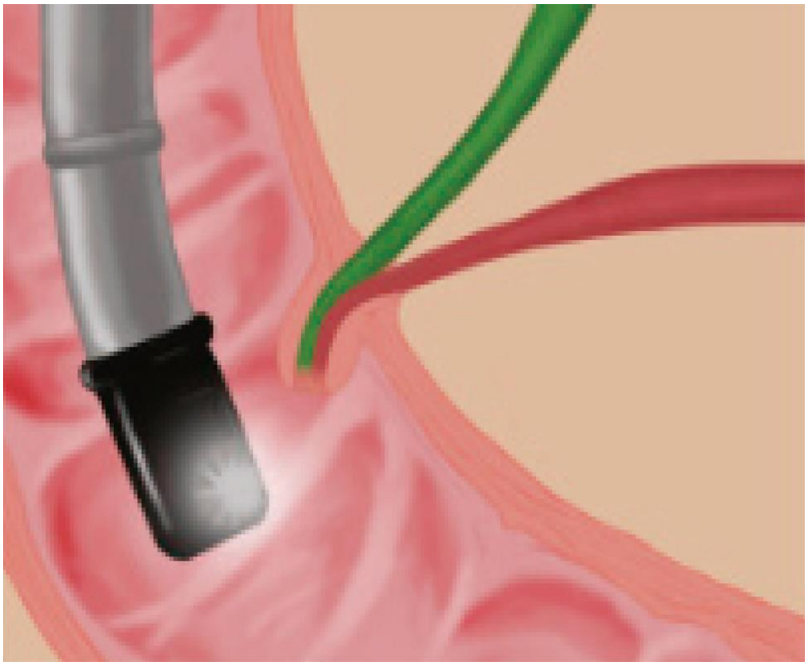

Figure 1 Correct positioning of duodenoscope for bilary cannulation. Visualize the papilla by placing the duodenoscope inferior to the papilla [25].

In contrast-assisted cannulation, the tip of the ST or other cannula is inserted into the papillary orifice followed by injection of contrast under fluoroscopy to visualize the ampulla and distal common bile duct and subsequent advancement of the catheter into the bile duct. This technique often requires repetitive probing and multiple attempts of injecting contrast; factors that contribute to its association with high rates of PEP. In WGC, a soft, hydrophilic guidewire serves as a tract that achieves desired duct selection without injection of contrast [10].

The most common guidewire used is a 0.035-inch diameter hydrophilic tip guidewire [13].

Hydrophilic tip guidewires are commonly used because of their reduced friction and ease of pushing. Guidewires with angled tips have been shown to lead to shorter cannulation times, likely because the angled tips are better able to follow the "S" shape of the intraduodenal segment of the bile duct and/or turn cephalad into the biliary system [26].

Once an endoscopist has decided on WGC, the next step is deciding between the touch technique and the no-touch technique. In the former, the catheter is inserted into papillary orifice and then a guidewire is advanced under fluoroscopic guidance into the common bile duct (CBD). In the latter, the guidewire is advanced just beyond the tip of the catheter, and then the catheter with guidewire tip protruding is advanced directly into the papillary orifice under fluoroscopy and onward into the bile duct [8].

Variations of WGC and the touch vs no-touch technique are commonly seen. The most common variations include: initial bile duct access with ST, followed by wire advancement (touch) vs ST advancement to the level of the papilla, after which the wire is used to achieve SBC (no-touch) or initial wire advancement past the tip of the ST, followed by "wire ST complex" advancement into the papilla (no-touch) [8].

These techniques are used respectively: in papilla of normal size, position and SBC challenge vs with floppy or mobile papilla vs in scenarios where the papilla is small (if the ST tip is larger than the papillary opening). Besides these techniques, the endoscopist can also decide between assistant-controlled wire-guided, using the

wire to access the duct, the endoscopist to control the ST and the assistant to control the wire vs physician-controlled wire-guided cannulation, in which, the physician controls both the ST and the wire. During particularly challenging ERCPs with variant patient anatomy, contrast can opacify the intraduodenal portion of the CBD to better determine the direction of catheter advancement [11].

Every time the ST comes in contact with the ampulla, contrast is injected, therefore, every cannulation attempt is also associated with risk of injecting contrast into the MPD and risk of PEP. Therefore, despite its procedural flexibility, WGC still carries a risk of PEP, intramural dissection, perforation of MPD side branches and creation of false passages [25].

FOR SELECTIVE ADVANCED ERCP TECHNIQUES BILIARY CANNULATION

• Pancreatic guidewire/double guidewire technique ;

Using a pancreatic guidewire or pancreatic duct stent may be helpful in various scenarios to achieve SBC. The pancreatic guidewire technique (PGT) involves the placement of a guidewire into the MPD and then attempting to cannulate the biliary duct. A guidewire in the MPD helps straighten the intramural segment of the bile duct and direct the ST or other catheter into the bile duct and thus reduces the chance of accidental cannulation of the MPD. When the pancreatic guidewire method is combined with WGC, it is known as the double guidewire technique (DGT) [27].

Another technique is to place a temporary pancreatic stent and then perform WGC above the stent, called wire-guided cannulation over a pancreatic stent (WGC-PS) technique. A short 5-Fr pancreatic stent between 2 cm to 5 cm can be used, with the proximal tip not past genu to prevent duct injury. After placement of the pancreatic stent, the papilla is then cannulated using the WGC technique above the stent. The pancreatic stent all but ensures that no further accidental cannulation of the MPD can occur [8].

An abdominal x-ray should be performed 2 wk after the procedure to confirm spontaneous passage; if the stent has not passed, a stent removal procedure may be needed [27].

The advantages of the WGC-PS technique is that a pancreatic stent is easy to insert, especially if a pancreatic guidewire is already in place, and has been shown to lead to a significant lower rate of PEP, with various studies showing rates reduced from as high as 23% to less than 3% after placement of a PD stent [27].

The WGC-PS technique is also more cost effective, most likely due to the lower rates of PEP, and can be combined with other ancillary methods of cannulation such as needle-knife sphincterotomy [28].

Due to lower rates of PEP seen with pancreatic duct stenting, the ESGE suggests a placement of a pancreatic duct stent both prior to both wire-based cannulation methods as well as and precut techniques [13].

• Precut techniques ;

When biliary cannulation using the techniques mentioned above fails, many endoscopists opt to create a papillotomy to access the hepatopancreatic ampulla; this may involve the sphincter of Oddi, thereby performing a sphincterotomy, or be performed staying above the sphincter, i.e., a fistulotomy. These techniques are collectively procedure. The most common tool employed in precut techniques is the needle-knife, a small precision cutting tool that cuts when current is applied [29].known as precut techniques to facilitate access to the biliary tree and require an intimate understanding of papillary anatomy to ensure a safe and effective

The tip should not be extended beyond the catheter further than 2 to 3 mm as the tip of the needle knife cuts easily and rapidly; over-extension of the needle knife increases the risk of perforating the back wall or causing a retro duodenal perforation. Newer “hybrid-tomes” integrate the needle-knife directly into the ST and may be easier to handle than regular needle knives [29].

If possible, a pancreatic duct stent should be placed before hand to protect the pancreatic orifice, straighten the intramural segment of the bile duct, and position the biliary duct for easier access with the ST after the cut is complete. There is currently no standard for the naming of the various precut techniques. For this review, the naming system described by Davee et al.,2012 will be used [30].

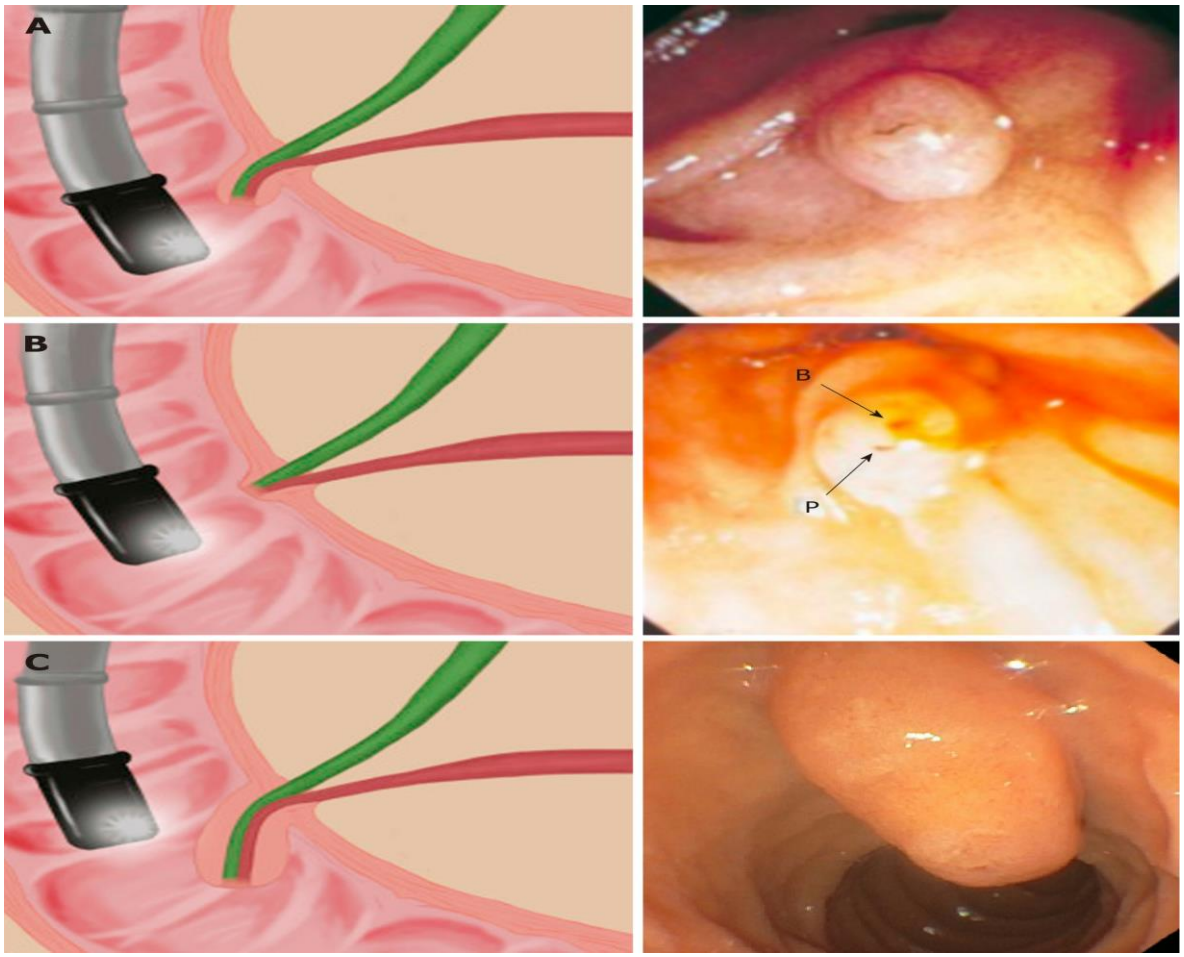

Figure 2 Drawing and corresponding endoscopic view of anatomic variants seen during endoscopic retrograde cholangiopancreatography of the ampulla and major duodenal papilla. A: Normal ampulla and pancreato-biliary junction; B: No common channel; endoscopically, two separate openings (P: Pancreatic duct; and B: Bile duct) may be seen at the papillary tip; C: Large, protuberant, and/or redundant papilla [29].

• Precut papillotomy:

In precut papillotomy (PP), the needle knife is used to dissect the major duodenal papilla to visualize and cannulate the CBD. Typically, needle-knife is placed at the 11-12 o'clock position of the papillary orifice and cut upward along the midline of the intraduodenal segment of the bile duct to expose the CBD. The biliary sphincter muscle can be recognized by its whitish onion-skin appearance. Once this muscle is exposed, the papilla can often be seen as a red dot or nipple-like structure. If examined carefully, bile may be seen flowing from the papilla. The papilla can then be cannulated or the biliary sphincter can be transected further and then cannulation afterwards can be performed [22].

• Precut fistulotomy:

In a precut fistulotomy, an incision is made using a needle knife in an area of the papilla, above the papillary orifice, that covers the intraduodenal segment of the distal CBD (or the hepatopancreatic ampulla) to create a

fistula between the duodenal lumen and the CBD lumen. The incision can be extended downward towards the papillary orifice or upward, depending on the initial incision site [8].

The precut fistulotomy technique leaves the sphincter and papillary orifice intact (though the fistulotomy may be extended downward across the sphincter, if necessary) and creates a fistula that allows the endoscopist to directly cannulate the CBD [31].

At least in theory and based on anecdotal evidence, this method reduces the risk of thermal injury to the pancreatic orifice and therefore the risk of PEP. A variation of this technique, the supra-papillary puncture, creates direct duodeno-choledochal access using a catheter fitting with a needle to directly puncture the biliary duct under fluoroscopic guidance without cautery. When combined with EUS, this method has been shown to reduce the rate of PEP while having seemingly acceptable perforation rates [31].

• Trans pancreatic precut sphincterotomy:

Achieving an adequate precut papillotomy or fistulomy using a needle knife may be difficult in patients with small or difficult to locate papilla. For such patients, the trans pancreatic precut sphincterotomy (TPS) may be a viable alternative method. First reported in 1995 by Goff, the TPS method uses a standard ST oriented toward the CBD at approximately 11 o'clock that is inserted superficially in the ampulla or major pancreatic duct [8].

The ST itself is then used to incise upward to perform a papillotomy. The advantages of TPS include not needing to exchange the ST for a needle-knife device and better control of the depth of incision compared to needle knife device [32].

Although TPS alone carries a risk PEP of 9%, likely due to irritation and edema involving the MPD, placement of a PD stent after TPS has been shown to reduce the incidence of PEP to 4% [33].

• RENDEZVOUS TECHNIQUES:

A- EUS-guided rendezvous

EUS-guided rendezvous (EUS-RV) is a well-known salvage technique where the biliary ducts are punctured under real-time EUS guidance directly from the gastric or duodenal lumen. A wire is then passed through the needle anterograde into the duct and out the papilla. SBC can then then be achieved by directing the ST over the guidewire or in parallel to the wire [8].

Multiple authors have pointed out however, that this improvement potentially comes at the cost of increased procedure, time, equipment, and training required to perform EUS-RV [34].

B- Hybrid rendezvous

EUS-RV failure is most frequently due to the inability to pass a guidewire through the papilla anterograde due to strictures, masses, or edema. The technique also carries a risk of biliary peritonitis and perforation [35].

C- Salvage techniques

when EUS-RV failure occurs include direct puncture of the ampulla under EUS guidance, re-attempting rendezvous following EUS-cholangiography, and using a dilator to enlarge the needle-tract when manipulating the wire, a technique called hybrid rendezvous [35].

D- Percutaneous rendezvous technique

Another type of rendezvous' technique is the percutaneous rendezvous technique (Perc-RV), in which access to the bile duct is achieved percutaneously (by Interventional Radiology), after which a guidewire is threaded anterograde through the needle into the bile duct and out through papilla [8].

This technique has been used in cases of difficult anatomy, e.g., patients with large, infiltrative tumors involving the papilla or cases of post-operative anatomy, such as Roux-en-Y anastomosis, Billroth II gastrectomy, where the location of the papilla may be difficult to access conventionally or via EUS [8].

Perc-RV involves increased technical difficulty and training required to obtain percutaneous access to the biliary ducts, however, it allows a percutaneous transhepatic biliary drain to be inserted to alleviate biliary obstruction if other methods of obtaining biliary access fails [8].

E- Other methods

There are other methods of performing rendezvous-based SBC such as enteroscopy assisted EUS or Perc-RV techniques for Roux-en-Y or Billroth II anatomy or intraoperative rendezvous technique where a guidewire is surgically inserted into the biliary ducts [8].

Surgically Altered Anatomy:

Patients with surgically altered anatomy such as post Billroth II gastrectomy or post-Roux-en-Y gastric bypass present with a unique set of challenges and ERCP in these patients is generally performed at referral centres by endoscopists who have experience with these types of anatomical alterations [36].

In patients who are post Billroth II, a standard duodenoscope can be used because of the short distance to the papilla through the afferent loop. However, determining the afferent from the efferent limb can be challenging, and approaching the papilla from the opposite direction can be disorienting [37].

On the other hand, ERCP in patients who have had a Roux-en-Y requires the use of a longer length endoscope (or a direct trans gastric approach) because of the need to transverse a large length of small bowel prior to reaching the descending duodenum. This requires the use of a colonoscope or enteroscope, both of which are forward-viewing instruments that are not designed for ERCP. Similar to Billroth II cases, recognising the proper intestinal lumen and selective cannulation from the opposite direction can be challenging [37].

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