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TOPIC HIGHLIGHT

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Pancreatic sphincterotomy: Technique, indications, and complications

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Abstract

Pancreatic sphincterotomy serves as the cornerstone of endoscopic therapy of the pancreas. Historically, its indications have been less well-defined than those of endoscopic biliary sphincterotomy, yet it plays a definite and useful role in diseases such as chronic pancreatitis and pancreatic-type sphincter of Oddi dysfunction. In the appropriate setting, it may be used as a single therapeutic maneuver, or in conjunction with other endoscopic techniques such as pancreatic stone extraction or stent placement. The current standard of practice utilizes two different methods of performing pancreatic sphincterotomy: a pull-type sphincterotome technique without prior stent placement, and a needle-knife sphincterotome technique over an existing stent. The complications associated with pancreatic sphincterotomy are many, although acute pancreatitis appears to be the most common and the most serious of the early complications. As such, it continues to be reserved for those endoscopists who perform a relatively high-volume of therapeutic pancreaticobiliary endoscopic retrograde cholangio-pancreatography.

Key words: Pancreas; Sphincterotomy; Endoscopic; Technique; Indications; Complications

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INTRODUCTION

Since its initial application in 1974, endoscopic biliary sphincterotomy has revolutionized the approach to patients with biliary tract diseases[1]. Utilizing biliary sphincterotomy in conjunction with stone extraction, stent placement, or stricture dilatation has become the standard of care for problems that were once only remedied by surgical procedures. Endoscopic therapy for pancreatic disorders has not advanced quite so rapidly, however[2]. Pancreatitis and its associated complications have prevented some endoscopists in the past from attempting to apply similar therapeutic techniques as those used in treating biliary tract disorders. In addition, clear-cut indications for endoscopic therapy of the pancreas have been much more difficult to define due to a paucity of well-designed clinical trials justifying its use. Most of the techniques that have been used in previous studies were performed on small numbers of patients, and in expert centers only. The majority of studies have been retrospective in nature, lacking randomization with a prospective design[2].

It is on this background in which the topic of endoscopic pancreatic sphincterotomy (EPS) is reviewed. EPS is the cornerstone of endoscopic therapy[3] of the pancreas, and once access is obtained, EPS may be used as a single therapeutic maneuver (e.g. to treat pancreatic-type sphincter of Oddi dysfunction), or in series with other endoscopic therapeutic techniques such as stone extraction or stent placement[1,4]. The following review will attempt to provide an evidence-based summary of the technique, the indications, and the complications associated with endoscopic pancreatic sphincterotomy.

THE ENDOSCOPIC TECHNIQUE

The main principles involved in EPS are very much like those of biliary sphincterotomy. They involve wire-guided cannulation of the duct prior to cutting, and they utilize a slow and stepwise approach that relies on accurate identification of anatomical landmarks. There are essentially two different types of techniques that are used by most expert endoscopists when performing this procedure. The first approach, and the more widely utilized, is performed while using a standard pull-type sphincterotome. The second approach uses an endoscopic needle-knife to cut the sphincter muscle after placement of a pancreatic duct stent. Both techniques have their advantages and disadvantages, and the details surrounding each approach are discussed here. In addition, pre-cut or 'access' pancreatic sphincterotomy in those instances when the endoscopist is faced with a difficult pancreatic

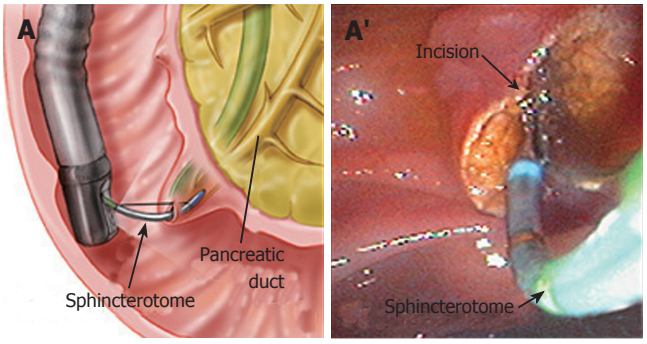

Figure 1 EPS performed using a pull-type sphincterotome without prior pancreatic stent placement.

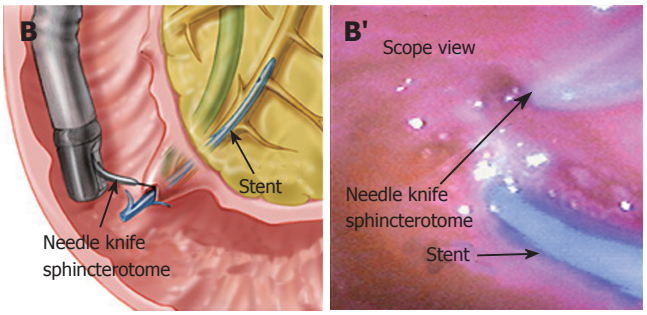

Figure 2 EPS performed with a needle-knife sphincterotome over a pancreatic stent.

annulation will be discussed. Finally, sphincterotomy of the minor papilla will be briefly mentioned as well.

PULL-TYPE SPHINCTEROTOMY

Once successful cannulation of the pancreatic duct orifice is achieved, the guidewire is advanced into the main pancreatic duct and confirmation of position is usually obtained with a contrast pancreatogram. Assuming a clear indication for sphincterotomy has been established, this part of the procedure is most often performed with a pull-type sphincterotome. Like biliary sphincterotomy, the incision should be 'hot and slow'[5]. It should be directed towards the 1 to 2 o'clock position with the very distal part of the cutting wire[6-8]. In other words, most of the cutting wire should be visible outside the papillary orifice. Note that the direction of the cut is very different from that of a biliary sphincterotomy. In biliary sphincterotomy, the cutting direction is in the 11 o'clock to 1 o'clock position (preferably the 12 o'clock position). The sphincterotome is slightly bowed while the cutting wire is 'walked up' the *roof* of the papilla in a stepwise fashion[6]. In pancreatic sphincterotomy, the same principles apply, but the direction is more towards the right, guiding the cutting wire along the floor of the papillary orifice (Figure 1).

The actual incision should be performed using the pure cutting current with the electrosurgical generator[7]. This prevents further damage to the pancreas and limits the possible future development of fibrosis and papillary stenosis[8-10]. The length of the cut is generally between 5mm and 10 mm. Larger diameter ducts require longer cuts in order to achieve the largest possible access. Once the sphincterotomy has been completed, a temporary pancreatic stent is usually left in place for a short period of time in order to help facilitate adequate drainage from the duct. The edema that ensues following a pancreatic sphincterotomy can cause ductal obstruction and eventual pancreatitis[11]. This policy of placing a pancreatic stent after every pancreatic sphincterotomy, however, is not universal. Some expert endoscopists do not feel the need to perform this step. Moreover, the types of stents that are chosen and the desired duration of use are also debated[12].

Early in the era of pancreatic sphincterotomy, many endoscopists advocated always performing EPS in concert with a prior biliary sphincterotomy. Biliary sphincterotomy done immediately before pancreatic sphincterotomy is felt by some to allow for easier identification of clear anatomical landmarks, thus making it a safer and more effective procedure. It may provide better exposure of the pancreaticobiliary septum, and therefore allow improved access to the desired pancreatic tissue[13]. Also, this method of choice prevents the rare possibility of biliary complications following a primary pancreatic cut[1]. This includes inadvertent damage to the distal bile duct, as well as possible biliary obstruction due to edema adjacent to the biliary duct orifice. Many recommend a biliary sphincterotomy before a pancreatic sphincterotomy in cases of cholangitis or obstructive jaundice, a common bile duct diameter > 12 mm, or an alkaline phosphatase level > twice normal[8]. It may also be performed when there is a need to obtain improved access to the main pancreatic duct[14].

NEEDLE-KNIFE SPHINCTEROTOMY

An alternative method to pancreatic sphincterotomy utilizes an endoscopic needle-knife instead of a standard pull-type sphincterotome. Cutting with the needle-knife is done only after placement of a pancreatic duct stent. The tip of the needle-knife is placed at the most proximal portion of pancreatic sphincter tissue that is overlying the stent. While using the stent as a guide to direct the cut along the plane of the pancreatic duct, the needle-knife tip is advanced over the top of the stent and down its longitudinal axis thereby 'unroofing' the intraduodenal portion of the major papilla (Figure 2). Incision length is similar to that of sphincterotomy with a pull-type sphincterotome; that is, the length is generally between 5 mm and 10 mm. Many experts believe that a prior biliary sphincterotomy is especially helpful before utilizing needle-knife technique[13]. Good exposure of the pancreaticobiliary septum allows for better tissue access and more effective 'septotomy'.

There are a few limitations to this technique, however. The absolute prerequisite of pancreatic stent insertion makes it a technique that may not always be feasible if a stent cannot be placed. For example, in chronic pancreatitis, it may be very difficult to insert a stent without first removing ductal calculi[8]. Also, many endoscopists find it easier to perform the sphincterotomy without having to first exchange the sphincterotome, place the stent, and then insert the needle-knife in order to

perform the cut. Finally, most biliary sphincterotomies are performed with a standard pull-type sphincterotome, and so many are accustomed to performing EPS in a similar fashion. Furthermore, many experts may argue that EPS could be done in a more controlled fashion using this technique

Despite the fact that pancreatic sphincterotomy is performed by only two different techniques, survey questionnaires show that there is a lack of expert consensus in terms of which is the better approach. A recent survey of 14 expert endoscopists in nine US centers showed that six of the 14 gastroenterologists either 'always' or 'often' use the pull-type sphincterotome technique, while seven out of 14 'always' or 'often' use the needle-knife technique[12]. Eight physicians 'always' perform a biliary sphincterotomy prior to pancreatic sphincterotomy, and only two of 14 use pure cutting current during the procedure. Almost all endoscopists insert a pancreatic stent after sphincterotomy, as it lowers the likelihood of post-ERCP pancreatitis[11]. However, which types of stents to be used and how long to leave them in place for is quite variable among those who perform EPS on a regular basis[12].

PRE-CUT PANCREATIC SPHINCTEROTOMY

The pre-cut pancreatic sphincterotomy refers to an endoscopic technique that allows access to the pancreatic duct without performing prior deep cannulation. It is usually done when access to the duct is blocked in some manner (e.g. an impacted stone)[9,15]. Once the pancreatic duct is accessed, conventional pancreatic sphincterotomy is performed. Generally, this technique is not utilized as often as the pre-cut biliary sphincterotomy since a difficult pancreatic duct cannulation is encountered far less often than a difficult biliary cannulation. The pancreatic pre-cut is done in a manner that is very similar to the biliary pre-cut sphincterotomy. Most endoscopists will use a free-hand needle-knife to perform the pre-cut, although there are several options for this technique[15]. In the case of a stone that is obstructing the pancreatic orifice, for example, a needle-knife can be used to cut the papillary mucosa lying directly over the stone. Once the stone is released and the obstruction is relieved, the pancreatic duct can be cannulated in the usual manner to prepare for a conventional pancreatic sphincterotomy.

MINOR PAPILLA SPHINCTEROTOMY

Minor papilla sphincterotomy is actually a misnomer since the cutting that is performed during this technique is more of a 'papillotomy', rather than a true muscle 'sphincterotomy', per se. Hence, the term is more appropriately phrased as 'minor papillotomy'. It was first described by Cotton in 1978 as a means to treat recurrent dorsal pancreatitis[16]. Since then, it has successfully emerged as a recognized and effective treatment for patients with pancreas divisum who require ductal decompression. Like sphincterotomy of the major papilla, minor papillotomy can be performed using two different techniques: standard pull-type technique and needle-knife technique. The pull-type technique involves wire-guided cannulation of the dorsal duct with a regular size papillotome. Although some advocate the use of an ultra-tapered tip papillotome in this setting (e.g. 3-F), we find a regular papillotome to be softer on the papilla and allow for easier cannulation. In addition, a soft-tipped, hydrophilic, 0.035-inch guidewire is generally used during cannulation. Once deep cannulation is achieved, the papillotome may be slightly bowed while the cutting wire is directed along the course of the dorsal duct (usually in the 11 o'clock position) so as to completely ablate the mucosal mound of minor papilla. Either pure cutting current or blended current on the electrosurgical generator may be used.

The needle-knife technique is similar to that of EPS of the major papilla. Following wire-guided cannulation, a small diameter 3-F or 5-F pancreatic stent is first placed over the wire and through the minor papillary orifice into the proximal dorsal duct. Once the stent is in position and the guidewire is removed, a needle-knife is used to cut the portion of the minor papillary mound above the stent. The needle-knife cutting wire is generally directed in the 11 o'clock position along the course of the dorsal duct as the minor papilla is 'unroofed'. Again, either blended current or pure cutting current may be used.

INDICATIONS FOR EPS

Unlike endoscopic biliary sphincterotomy, literature that describes and validates the indications for pancreatic sphincterotomy is sparse. There are several reasons for this disparity. First, EPS appears to be mainly performed at specialized referral centers. Physicians performing this procedure usually have years of experience in therapeutic biliary and pancreatic endoscopy. In order to perform EPS with adequate proficiency, the endoscopist must typically practice in an environment that yields a relatively high volume of ERCP. The centers that perform EPS should be capable of handling all the possible complications associated with this procedure. Furthermore, it is the relatively high likelihood of complications seen with EPS that contributes to the reluctance among physicians to perform this technique. As a result, there have been fewer published studies over the years that outline the indications, outcomes, and safety of pancreatic sphincterotomy.

EPS may be indicated for a variety of diseases and disease-related manifestations that involve the pancreas. In general, it is easier to consider the indications for EPS in terms of primary or secondary therapy (Table 1). In other words, this technique may be performed by itself as the primary treatment modality (i.e. for the treatment of pancreatic-type sphincter of Oddi dysfunction); or it may be utilized as a secondary treatment modality in facilitating a further intervention (i.e. better access to the main pancreatic duct before dilating a downstream dominant stricture. Overall, there is far more data available regarding the use of EPS in conjunction with an additional intervention (secondary therapy) than for using this technique alone (primary therapy)[4].

EPS AS PRIMARY THERAPY

Most of the literature describing pancreatic sphincterotomy as the primary endoscopic therapy of choice is concentrated

Table 1 Indications for endoscopic pancreatic sphincterotomy (EPS)

EPS as primary therapy
Sphincter of Oddi dysfunction (SOD)
-Pancreatic SOD
-Biliary SOD unresponsive to biliary sphincterotomy
Chronic pancreatitis with papillary stenosis/stricture
Pancreas divisum (EPS of the minor papilla)
EPS to facilitate a further intervention
Chronic pancreatitis treated with pancreatic stent and/or stone removal
Pancreatic pseudocyst treated with transpapillary drainage
Resection of an ampullary adenoma
Pancreatic fistula treated with stent placement
Pancreatic disease due to malignancy
-Primary pancreatic cancer causing strictures, stones, pseudocysts
-Metastatic disease to the pancreas causing strictures, stones,

on the area of pancreas divisum and minor papillotomy. This is a separate topic and should be reserved for a separate review. However, EPS has been shown to provide primary therapeutic benefit in patients with at least two separate and distinct disorders: pancreatic-type sphincter of Oddi dysfunction (SOD) and chronic pancreatitis.

SOD is a benign obstruction to the flow of bile or pancreatic juice at the level of the pancreaticobiliary junction[16-20]. It is due to functional dyskinesia or hypertension of the biliary and/or pancreatic portion of the sphincter[21-25]. It results in transient noncalculous obstruction, causing abdominal pain or pancreatitis[26-30]. Isolated pancreatic-type SOD may be seen in 15% to 20% of all patients with acute recurrent pancreatitis of unknown etiology. It has been estimated to occur in 25% of all patients undergoing manometry for suspected SOD[31-35]. Type 1 pancreatic SOD is characterized by the triad of pancreatic-type abdominal pain, elevated amylase and lipase levels, and a dilated main pancreatic duct[36,37]. Type 2 pancreatic SOD has pancreatic-type abdominal pain associated with either elevated enzyme levels or a dilated duct[16].

The overall clinical response rate of endoscopic sphincterotomy for SOD (biliary and pancreatic) ranges between 55% and 95%. Patients with Type 1 pancreatic SOD are most likely to benefit from EPS. Several studies have shown that these patients may experience a significant reduction in pain and clinical episodes of pancreatitis. Type 2 pancreatic SOD may also achieve benefit from EPS, but some prefer to document abnormal pancreatic manometry before undergoing sphincterotomy. In addition, more recent studies have suggested a clinical benefit from EPS in those patients who have persistent pain despite prior biliary sphincterotomy[38].

A pancreatic sphincterotomy alone is frequently used as the primary treatment modality in moderate to severe chronic pancreatitis. The rationale for treating chronic pancreatitis with endoscopic therapy is based on the principle of decreasing pancreatic intraductal pressure. In moderate to severe disease, the development of ductal stones, protein plugs, and ductal strictures may occur. Each of these can cause partial or complete obstruction to the flow of pancreatic juice out into the duodenum, resulting in permanent alterations to the duct morphology. Ductal obstruction leads to tissue hypertension, and thus tissue ischemia. Karanjia *et al*[39] demonstrated a reduction of pancreatic blood flow after ligation of the main pancreatic duct (therefore producing intraductal hypertension) in a feline model of pancreatitis. The reduction of blood flow was partially reversed after relief of the main duct obstruction. It is believed that the symptom of pain in chronic pancreatitis is directly due to this parenchymal ischemia[1].

Another consequence of obstruction to the main pancreatic duct is secondary obstruction to the smaller side branch ducts. This ultimately causes parenchymal atrophy. As the tissue begins to atrophy, the pancreas loses its ability to perform both its endocrine and exocrine functions. A therapeutic intervention that could minimize intraductal pressure might help to prevent this dangerous cascade of events, thus diminishing pain and preserving function. This is the basis, although controversial, behind EPS in chronic pancreatitis.

Few studies have specifically examined the role of EPS as the sole endoscopic therapy in chronic pancreatitis. Most studies that have investigated this topic have done so in the context of additional endoscopic interventions. Studies like this need to be examined closely in order to separate those patients who received EPS alone versus those who received EPS in concert with an additional endoscopic technique. This is often difficult, especially if the authors have not clearly distinguished between the two groups. Nonetheless, several studies have attempted to evaluate the safety and long-term results of pancreatic sphincterotomy in chronic pancreatitis.

Ell *et al*[40] described pancreatic sphincterotomy in 118 patients with chronic pancreatitis. Eighty percent of the patients underwent a standard pull-type sphincterotomy, while 20% underwent a needle-knife technique. Overall, 98% of the sphincterotomies performed were successful, and the complication rate was only 4.2%, including four cases of moderate pancreatitis and one case of severe bleeding. The results in terms of pain relief were not examined in this study, however.

Okolo *et al*[41] retrospectively analyzed 55 patients who had a pancreatic sphincterotomy. Forty patients (73%) underwent the procedure for the indication of symptomatic chronic pancreatitis. The goal of the study was to assess the long-term efficacy of sphincterotomy with pain relief being the primary endpoint. After a median follow-up of 16 mo, 60% of all patients reported a significant improvement in their pain scores.

Papillary stenosis appears to be a clear-cut indication EPS in those patients with symptomatic chronic pancreatitis. Without significant ductal abnormalities distal to the papilla, pancreatic sphincterotomy by itself can be confidently utilized as the primary endoscopic therapy of choice in these patients. Similarly, mucinous ductal ectasia involving the proximal main pancreatic duct is also a proven indication for EPS in those patients with recurrent pancreatitis[4].

EPS AS SECONDARY THERAPY

Pancreatic sphincterotomy is commonly performed in concert with other endoscopic techniques such as stent placement or balloon dilatation of the pancreatic duct.

Table 2 Complications of endoscopic pancreatic sphincterotomy (EPS)

Early Complications (< 3 mo, typically < 72 h)
Pancreatitis
Severe bleeding
Perforation
Pancreatic and/or biliary sepsis
Late Complications (> 3 mo)
Papillary stenosis
Proximal pancreatic duct strictures
Stent-related Complications (variable timing)
Ductal and parenchymal changes
Stone formation
Infection
Ductal perforation
Stent migration
Stent occlusion
Duodenal erosion

In this setting, the purpose of the sphincterotomy is to help facilitate the primary therapy (i.e. removal of stones from the duct or dilatation of a ductal stricture). There are several diseases and conditions in which EPS is used in this manner (Table 1). The decision to cut the sphincter in these situations is based on sound clinical judgment by the endoscopist, and whether or not he or she feels that the risk of EPS is outweighed by the potential benefit gained in aiding the primary therapy.

In moderate to severe chronic pancreatitis, ductal strictures and stones are frequently encountered. If their location within the main duct is very distal to the papilla, EPS alone may not be sufficient. Stone removal or stricture dilatation is often times the main goal of ERCP for certain patients. Pancreatic sphincterotomy may be needed before the procedure for better access to the duct (precut), or it can be used simply to help reduce intraductal hypertension and allow for easier flow of juice and calculous debris out into the duodenum. This also holds true, for example, when treating pancreatic pseudocysts by means of a transpapillary approach. For those pseudocysts that communicate with the main pancreatic duct, a stent is placed within the duct in order to bridge the fistulous connection[42]. EPS in this setting also helps to reduce intraductal pressures and facilitate flow out towards the papilla.

Other clinical scenarios for which sphincterotomy is indicated as secondary therapy include stent placement prior to surgery for mucinous ductal ectasia, as well as stent placement in the treatment of a pancreatic fistula[4]. EPS may also be used in concert with a pancreatic stent following the resection of an ampullary adenoma. Here, the purpose of the sphincterotomy (and the stent) is to reduce the risk of post-procedural pancreatitis due to peri-ampullary edema. Finally, sphincterotomy is often indicated for the palliative treatment of strictures, stones, and pseudocysts in malignant obstruction of the pancreas.

COMPLICATIONS OF EPS

In general, there are essentially three different types of complications associated with pancreatic sphincterotomy: early, late, and stent-related complications (Table 2)[43]. Early complications are usually recognized within the first 72 h after the procedure, but often times within the first few hours. They include pancreatitis, severe bleeding, perforation, and pancreatic or biliary sepsis. Late complications are encountered at least 3 mo after the procedure, and this category mainly consists of papillary stenosis and proximal ductal strictures. Stent-related complications include pancreatic ductal and parenchymal changes, stone formation, infection, ductal perforation, stent migration, stent occlusion (causing pain and/or pancreatitis), and duodenal erosion.

Within the last 13 years, there have been four major studies that have examined the rates of complication associated with pancreatic sphincterotomy of the major papilla[14,44-46]. In a study by Kozarek *et al*[13], 56 patients underwent EPS. Fifty-four (96%) patients had chronic pancreatitis and two patients had acute recurrent pancreatitis. The indications for the sphincterotomy were as follows: obstructing ductal calculi (26), ductal disruption and leak (12), sphincter stenosis (10), and dominant stricture (8)[14]. Forty-seven patients had a pull-type sphincterotomy, and 33 of these patients also had a pancreatic stent placed after the sphincterotomy. Nine patients had a needle-knife sphincterotomy over an existing pancreatic stent. Early complications occurred in 10.7% of the patients, and they included pancreatitis (4 patients, 7.1%) and cholangitis (2 patients, 3.6%). Late complications, however, occurred in 30% of the patients: 14% with papillary stenosis, and 16% with asymptomatic ductal changes (thought to be due to the stent placement).

Esber *et al*[44] reported the complications of EPS in 236 consecutive patients. A pull-type sphincterotomy was performed in 123, and 87 patients in this group also had a stent placed following the sphincterotomy. Needle-knife sphincterotomy over a pancreatic stent was performed in 113 patients. Seventy-four percent of the patients had a sphincterotomy for the purposes of treating pancreatic-type SOD, while 26% had chronic pancreatitis and the procedure was performed to facilitate an additional endoscopic maneuver such as removal of stones, stricture biopsy, *etc*. Overall, post-ERCP pancreatitis occurred in 14% (mild in 76%, moderate in 21%, and severe in 3%). Other various complications occurred in only 1.7% of the cases. The rate of pancreatitis was 15.5% in the patients with pancreatic-type SOD. It was only 9.7% in the patients with chronic pancreatitis. It has been suggested that the reason for this lower rate of post-ERCP pancreatitis is due to the periductal fibrosis and scarring seen in those patients with underlying chronic pancreatitis. In other words, the limited amount of nearby healthy pancreatic parenchyma offers some protection against the injury that occurs after a pancreatic sphincterotomy[14,43].

Parsons *et al*[45] evaluated the complication rate of performing a stentless pancreatic sphincterotomy. In 31 patients, EPS was done with a pull-type sphincterotome followed by the placement of a nasopancreatic tube. All the tubes were removed within 24 h of placement. Post-ERCP pancreatitis was observed in one patient (3.2%), and there were no other complications seen such as perforation, bleeding, or sepsis.

More recently, Varadarajulu *et al*[46] performed a randomized, prospective trial comparing pull-type and

needle-knife EPS in pancreatic-type SOD patients[47]. The aim of the study was to assess the relative safety of each method of sphincterotomy. Consecutive patients who were diagnosed with pancreatic SOD by manometry were randomized to receive EPS by pull-type or needle-knife sphincterotome. The primary outcome was the rate of post-ERCP pancreatitis, and secondary outcomes included the rate of endoscopic re-intervention and the response to therapy. A total of 48 patients were enrolled, with 24 in each group. Seven patients (29%) in the pull-type EPS group developed pancreatitis, as compared to none in the needle-knife group ($P = 0.01$). Three patients (12.5%) in the pull-type group required a re-intervention of some kind, versus two (8.3%) in the needle-knife group. Response to endoscopic therapy was the same in each group. The authors concluded that EPS in high-risk patients such as those with SOD is safer if performed with a needle-knife over a pancreatic stent.

Attwell recently compared the complication rates of minor papillotomy using either pull-type or needle-knife technique in 184 patients with pancreas divisum[48]. In this single-center study, there was no significant difference in the rates of post-ERCP pancreatitis or post-papillotomy bleeding. The overall complication rates in each group were 8.3% (needle-knife group) versus 7.8% (pull-type group). However, the authors did conclude that younger age (< 40 years old) was independently associated with higher rates of restenosis and endoscopic reintervention.

Overall, the rate of pancreatitis following a pancreatic sphincterotomy appears to be approximately 10%-12%[47-51], with a total early complication rate between 10%-15%[52-56]. Pancreatitis occurs more frequently in those patients with pancreatic-type SOD, rather than those who have it performed for problems associated with chronic pancreatitis[57-61]. Thorough data concerning the use of pancreatic stents in the prevention pancreatitis following a pull-type sphincterotomy is somewhat lacking[62-66]. Sherman *et al*[67] showed that a pancreatic stent used with needle-knife sphincterotomy may limit the frequency of post-procedural pancreatitis in SOD patients. The problem, however, is that if the stent is left in place for too long, it may begin to induce unwanted ductal and parenchymal changes itself. Also, depending on the type of stent used, patients may need to undergo an additional procedure to have this endoprosthesis removed.

Pancreatitis is the most concerning potential complication for those endoscopists who perform EPS. This is mainly because it appears to be the complication over which we have the least amount of control, and also because its effect may be very severe and sometimes lethal[68]. The decision to place a stent following any sphincterotomy is made on a case-by-case basis. Factors weighed in the decision include the perceived risk of early pancreatitis versus the potential for late complications and the need for an additional procedure.

CONCLUSION

Pancreatic sphincterotomy is an endoscopic technique used for various pancreas and pancreas-related diseases. The current standard of practice utilizes two different techniques for performing EPS: a pull-type sphincterotome without prior stent placement, and a needle-knife sphincterotome over a stent. Historically, the indications for EPS have been less well-defined than those of endoscopic biliary sphincterotomy. Nonetheless, there are at least a few conditions such as chronic pancreatitis and pancreatic SOD in which pancreatic sphincterotomy plays a definite role. The complications associated with EPS are many, although acute pancreatitis appears to be the most common and the most serious of the early complications. Papillary stenosis is a significant late complication of this procedure as well. The technique of pancreatic sphincterotomy continues to be reserved for those endoscopists who perform a relatively high-volume of therapeutic pancreaticobiliary ERCP.

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