Basic and Advanced Biliary Cannulation: How Do I Do It?

Robert H. Hawes, MD[a,b,c,*]

KEYWORDS

• Cannulation • Sphincterotomy • Access sphincterotomy • Guidewire-assisted
• Advanced techniques • Pancreatic stent • Post-ERCP pancreatitis

KEY POINTS

- Successful biliary cannulation is more art than science and there is no substitution for experience and failure.
- Standard cannulation attempts fail up to 20% of the time even in experienced hands.
- Application of advanced techniques to failed cannulation should raise the overall cannulation rate to 90%–95%.
- With the advent of wire-guided cannulation, advanced cannulation techniques and pancreatic stenting, severe post-ERCP pancreatitis (PEP) should be rare.

INTRODUCTION

Selective cannulation during ERCP is an art guided by experience and science. It is interesting to note that the general technique of ERCP has not fundamentally changed over the last 50 years and deep cannulation of the desired duct is still the rate-limiting step that determines a successful or failed procedure. Becoming a good ERCP artist requires experience. Science can be applied to ERCP cannulation but an individual's experience strongly influences how the "science" is applied to one's individual practice. The first part of this article is heavy on experience and short on science. The nuances of cannulation and the myriad confirmations of the major papilla prevent the application of rigorous scientific research. The general principles of cannulation can be taught along with the advantages and disadvantages of various accessories but cannulation itself is a fluid process combining an almost infinite number of subtle maneuvers of the endoscope in concert with the accessories and this process cannot be rigorously evaluated in randomized trials.

There are also challenges to studying various "advanced techniques" applied to "difficult" cannulations. Even the definition of a "difficult" cannulation is not uniformly accepted. However, advanced techniques do lend themselves to more rigorous, albeit

[a] Orlando Health Digestive Health Institute, 1335 Sligh Boulevard, 3rd Floor, Orlando, FL 33806, USA; [b] Center for Advanced Endoscopy, Research and Education (CARE); [c] University of Central Florida College of Medicine
* Orlando Health Digestive Health Institute, 1335 Sligh Blvd, 3rd Floor, Orlando, FL 33806.
E-mail address: robert.hawesmd@gmail.com

Gastrointest Endoscopy Clin N Am 32 (2022) 385–395
https://doi.org/10.1016/j.giec.2022.01.002 giendo.theclinics.com
1052-5157/22/© 2022 Elsevier Inc. All rights reserved.

Descargado para Lucia Angulo (lu.maru26@gmail.com) en National Library of Health and Social Security de ClinicalKey.es por Elsevier en julio 20, 2022. Para uso personal exclusivamente. No se permiten otros usos sin autorización. Copyright ©2022. Elsevier Inc. Todos los derechos reservados.

imprecise, scientific study. The discussion on advanced cannulation techniques will present the science but ultimately the application of these advanced techniques will depend on the experience and bias of the individual endoscopist. Hopefully, this article will fully explain the art and science of cannulation in a clear and understandable way so that readers will be able to leverage this information to optimize their cannulation success and minimize complications.

BASIC CANNULATION TECHNIQUES

Despite improvements in endoscopes and accessories, deep cannulation of the desired duct in a native papilla remains the most challenging step to the successful completion of the procedure. No single technique is uniformly successful.

Important Components to Successful Cannulation Include

1. Taking the time to study the confirmation of the papilla.
2. Spending the necessary time to achieve proper positioning of the duodenoscope before touching the papilla.
3. Choosing your weapon.
4. When initiating cannulation, make sure that the leading edge of the accessory is perpendicular to the ampullary orifice
5. First obtaining a free "insinuation" of the ampullary orifice.
6. Use either the guidewire or a limited injection of contrast material (or both) as the first approach for deep cannulation
7. Never fight with the papilla.

Begin all ERCPs with a careful inspection of the papilla. What is the overall conformation of the major papilla including the intraduodenal length? Are there many surrounding folds and is the papilla semi-firm or very soft and mobile? In general, if the intraduodenal length is short, deep cannulation can be achieved by advancing the accessory in a single trajectory ("straight shot," no intrapapillary angles, single axis). Long intraduodenal segments, especially when associated with multiple folds and a soft texture will require careful, gentle, complex manipulation of the endoscope and accessory to negotiate and straighten angles.

An underappreciated aspect in achieving successful cannulation is the manipulation of the endoscope to obtain an optimal orientation to the papilla. We are taught to “shorten the scope” in the second portion of the duodenum and then begin cannulation. Although the “short scope” position provides the greatest maneuverability and keeps one close to the papilla, it is not a primary goal unto itself. The primary goal is to use whatever the confirmation of the scope is necessary to (1) allow the tip of the catheter to enter the papillary orifice at a perpendicular angle, (2) orient the papilla enface, (3) be acceptably close to the papilla, and (4) have the papilla in the center of the visual field (or slightly above). The radiographic scope position has no relevance to cannulation, but the fluoroscopic and endoscope positions must be coordinated to allow the radiographic observation of the shape of the distal, intrapapillary part of the duct. When this is suboptimal, consider repositioning the patient.

There are wide varieties of accessories available for initial cannulation. In the days of diagnostic ERCP, the procedure was often initiated with a standard catheter because many times the goal was to simply inject the appropriate duct (believe it or not, in the early days of ERCP, an accepted indication was to obtain a complete pancreatogram to determine if the patient had chronic pancreatitis using the Cambridge criteria.[1] At the NIH consensus conference on ERCP in 2002, it was concluded that diagnostic ERCP had been supplanted by CT, MRI and EUS.[2] There were no longer any indications

Descargado para Lucia Angulo (lu.maru26@gmail.com) en National Library of Health and Social Security de ClinicalKey.es por Elsevier en julio 20, 2022. Para uso personal exclusivamente. No se permiten otros usos sin autorización. Copyright ©2022. Elsevier Inc. Todos los derechos reservados.

for simply obtaining a cholangiogram or pancreatogram. Since the consensus conference, the goal for cholangiopancreatography is to direct therapy. As a result, cannulation usually begins with a soft-tipped guidewire and a papillotome. There are of course exceptions if the patient has had a prior sphincterotomy or pancreas divisum. There is no universal best or perfect accessory. One should be inquisitive and gain experience with a broad spectrum of available accessories to enable the selection of the appropriate ones for an individual case and to learn which ones you are most comfortable with.

The initial access for biliary cannulation is always cephalad (uphill). Whether using the wire or catheter tip at the initiation of cannulation, the tip should be perpendicular to the face of the papillary orifice with an uphill trajectory. Scope position and accessory orientation should be optimized before cannulation is initiated. Avoid forcefully engaging the papilla and then trying to reorient because this distorts the papilla and makes deep cannulation more difficult. Make every effort to stay reasonably close to the papilla. If the tip of the scope is too far from the papilla, the curvature of the catheter will inevitably cause the tip of the catheter to go into the roof of the papilla as it is advanced preventing deep cannulation. Operating far away from the papilla will also cause one to lose precision when making fine movements.

The first step to cannulation is to carefully and gently advance the tip of the accessory into the ampullary orifice; a maneuver that is termed "insinuation." The Miriam–Webster definition of insinuate is "to introduce something gradually or in a subtle, indirect or covert way." Insinuation describes the deep seating of the catheter into the ampullary orifice. It is a "feel" thing. It is important to achieve a comfortable “seeding” of the accessory into the ampullary orifice before progressing to maneuvers to achieve deep cannulation. You will know when you are "seeded" when the guidewire or the catheter tip is deeply engaged without distorting the papilla. Do not force the catheter tip into the ampullary segment. This causes distortion and compression of the papilla. When the catheter tip is forced into the papillary orifice, attempts to advance a wire will cause progressive edema, rendering further attempts more difficult, or cause the disruption of the mucosa, creating a false tract. If you try injecting contrast material, it will either reflux into the duodenum lumen or you will cause a submucosal injection; further distorting the ampullary anatomy. Nothing good comes from what is called the "cram and squirt” maneuver; trying to deeply cannulate without first achieving a free insinuation.

Insinuation of the ampullary orifice can occur either with the catheter tip or with a guidewire. Once one achieves optimal seating into the ampullary orifice, there are several options for the next maneuver:

1. Insinuation with catheter tip
   a. Inject a small amount of contrast followed by the advancement of the guidewire
   b. Advance the guidewire alone (wire-guided technique)
2. Insinuation with guidewire
   a. Advance catheter tip to end of guidewire and inject contrast
   b. Advance the guidewire while adjusting the angle with the catheter (wire-guided technique)

If one insinuates with the catheter tip, whether this is followed by contrast injection or advancement of the guidewire, always release the pressure on the catheter before proceeding; it will be less traumatic and more effective.

Much has been written about wire-guided cannulation: cannulation of the desired duct with a guidewire under fluoroscopic control without contrast injection. It was initially conceived as a technique to reduce post-ERCP pancreatitis (PEP) by avoiding the injection of contrast into the pancreatic duct.[3] Three meta-analyses concluded that

Descargado para Lucia Angulo (lu.maru26@gmail.com) en National Library of Health and Social Security de ClinicalKey.es por Elsevier en julio 20, 2022. Para uso personal exclusivamente. No se permiten otros usos sin autorización. Copyright ©2022. Elsevier Inc. Todos los derechos reservados.

the guidewire technique provided a significantly higher rate of biliary cannulation.[4–6] Four meta-analyses have compared wire-guided to contrast guided cannulation in terms of PEP and all 4 studies concluded that there is a lower risk of PEP associated with wire assisted biliary cannulation.[4–7] If a wire-guided technique is used, most endoscopists prefer a straight-tipped guidewire. Some believe that if wire-guided cannulation is failing with a straight-tipped guidewire, it is efficacious to switch to an angled-tipped guidewire. If using an angled-tipped guidewire, it is important that the guidewire is torque stable. In some circumstances, torquing and gently advancing an angled tip wire will successfully negotiate the papillary angles. The use of this technique should be a personal choice as randomized trials have not shown angle-tip guidewires to be superior to straight guidewires.[8]

Many experienced endoscopists feel there is too much emphasis placed on this approach. A gentle and limited injection of contrast material can provide a "roadmap" of the intra-ampullary segment, making it much easier to adjust the trajectory of the guidewire or catheter tip under fluoroscopic guidance to successfully negotiate tricky angles. The optimal approach is the careful use of either or both techniques depending on the circumstances. When there is an advanced pancreatic disease, there is no harm to limited pancreatic injections to achieve a radiographic roadmap. In these cases, ampullary distortion can be such that contrast guidance is indispensable in achieving a selective deep biliary cannulation. In the case of a normal pancreas, you may persist longer with a wire-guided method to avoid pancreatic injection (and the risk of pancreatitis). If an ampullary roadmap is desired, the injection should be slow, careful, under fluoroscopic guidance, and limited; the purpose is to understand the ampullary angles not to fill the biliopancreatic ducts.

No single technique is successful in all cases and it is important that one does not obstinately persist when a particular technique is not working. If you are trying to cannulate with the tip of the catheter, then switch to having a little guidewire protruding to more precisely engage at the 11 o'clock position. If you go into the pancreas, withdraw the catheter from the papilla and restart the cannulation from a slightly different angle. Do not forcefully engage the papilla and then try to redirect the catheter tip. If you are trying a wire-guided technique and it is not succeeding, inject a small amount of contrast material to obtain a roadmap.

One can examine the papilla and often predict what maneuvers will be required to cannulate. If the papilla faces downstream and there is a long intraduodenal segment, the scope tip will need to be positioned distal to the papilla so that the initial trajectory of the catheter/guidewire will be sufficiently "uphill." A distally oriented papilla may also require one to "hook" the papilla by engaging the elevator while pulling the scope shaft to straighten the ampulla and flatten the angle to facilitate deep cannulation. Remember that the tract to enter the bile duct is almost always some degree of an "S" shape; the acuteness of the angles is dependent on the individual anatomy and the pressure applied to the papilla by the accessory. The most common conformation of the papilla which can make cannulation difficult is what is called the "up and over" papilla (an accentuated "S" shape). On inspection, the papilla looks like a "camel's hump." It requires 3 distinct maneuvers to achieve deep cannulation. The first maneuver requires a cephalad trajectory, insinuation, and advancement to the apex of the hump. Then, one must direct the tip of the accessory downward and this requires: 1) turning left with the small dial of the scope and 2) pulling the shaft of the scope back. This will provide the downward trajectory needed to negotiate the angle at the top of the hump. This is also the time when your assistant can try to gently advance the guidewire. Once this is achieved, the scope shaft is pushed in (and the small dial gently turned back to the right) to re-achieve the cephalad trajectory needed to negotiate the second angle that is present at the ampullary duodenal junction. These angles

Descargado para Lucia Angulo (lu.maru26@gmail.com) en National Library of Health and Social Security de ClinicalKey.es por Elsevier en julio 20, 2022. Para uso personal exclusivamente. No se permiten otros usos sin autorización. Copyright ©2022. Elsevier Inc. Todos los derechos reservados.

are not only in the frontal but also in the anterior–posterior axis. Cannulation requires a 3–dimensional “vision” of what you are looking at.

A "shar-pei" papilla refers to one that has multiple redundant surrounding folds and no turgor (stiffness). This situation requires straightening the papilla by hooking it with the elevator and then turning left on a small dial while pulling back slightly on the scope shaft. With a shar-pei papilla, one will never achieve deep cannulation by simply pushing on the catheter or the guidewire.

ADVANCED TECHNIQUES

Despite the careful and persistent application of the cannulation principles outlined above, free cannulation may fail. Development of advanced techniques has been an important evolution in ERCP because data are now clear that prolonged papillary manipulation with repeated attempts to selectively cannulate the bile duct, particularly when inadvertent cannulation of the pancreas occurs, leads to an increased incidence of PEP.[9,10] In a study we published in 2016, we prospectively look at our cannulation rate of a native papilla using standard cannulation techniques. In a group of experienced pancreaticobiliary endoscopists, our cannulation rate was 87%.[11] However, we did not adhere to a uniform definition of “failure” using standard techniques. To understand and interpret the literature on difficult cannulation, one must understand the definition. The European Society of Gastrointestinal Endoscopy (ESGE)[12] defines "difficult biliary cannulation" by the presence of 1 or more of the following:

1. More than 5 contacts with the papilla while attempting to cannulate
2. More than 5 minutes spent attempting to cannulate the following visualization of the papilla
3. More than one unintended pancreatic duct cannulation or opacification

This definition is a consensus agreement with low-quality evidence to support it, but it provides readers some context to help understand when it may be appropriate to use "advanced techniques." It is a relatively conservative definition that was likely adopted to discourage prolonged manipulation of the papilla. In case of failed cannulation, the application of advanced cannulation techniques should be undertaken if the endoscopist has sufficient training and experience. In our study cited above, when we applied advanced techniques after failed standard techniques, our overall success rate for cannulation jumped to 98.3%.[11]

Advanced maneuvers have evolved to increase cannulation success when standard maneuvers fail. These can be organized into 2 categories:

1. Advanced cannulation techniques
2. Access sphincterotomy

ADVANCED CANNULATION TECHNIQUES

Advanced cannulation techniques primarily involve maneuvers to straighten the intra-ampullary angles. This is accomplished either by placing a guidewire into the pancreatic duct or by placing a small-caliber plastic stent. Placing a pancreatic guidewire is called "the double wire" technique. It involves achieving deep cannulation of the pancreatic duct with a soft-tipped guidewire, leaving the wire in place and then a cannula (usually a papillotome) loaded with a second guidewire is passed alongside the pancreatic wire and biliary cannulation is attempted. Theoretically, the guidewire "straightens" the ampullary segment providing more direct biliary access. Additionally, the endoscopist can now use fluoroscopy to adjust the trajectory angle of the catheter tip and/or

Descargado para Lucia Angulo (lu.maru26@gmail.com) en National Library of Health and Social Security de ClinicalKey.es por Elsevier en julio 20, 2022. Para uso personal exclusivamente. No se permiten otros usos sin autorización. Copyright ©2022. Elsevier Inc. Todos los derechos reservados.

guidewire toward the biliary direction. This technique is particularly popular in patients with a periampullary diverticulum which notoriously distorts and accentuates the angles of the distal bile duct and ampullary segment. Results from studies comparing the double wire technique to the persistence of standard cannulation techniques have been mixed. One study[13] showed no difference in successful cannulation and PEP, whereas another study showed a higher cannulation success rate but no difference in pancreatitis.[14] A Cochrane Systematic Review revealed that the sole use of the double wire technique was associated with an increased risk of PEP.[15] The review also concluded that the double guidewire technique was not superior to persistent attempts using standard cannulation techniques, precut sphincterotomy or a PD stent in achieving biliary cannulation. The ESGE clinical guidelines recommend that this should be the first maneuver attempted if standard cannulation techniques fail, especially if repeated unintentional pancreatic access has occurred.[12] If this maneuver is used, a prophylactic pancreatic stent should be placed before concluding the procedure.[12]

While the double wire technique is relatively straightforward conceptually, there are several cautionary points that are important. This maneuver is ideal if the course of the main pancreatic duct (MPD) is relatively straight because this makes the placement of the guidewire straightforward. However, if the MPD makes several acute turns within the head of the pancreas (sigmoid shaped) or the pancreatic duct makes a 360^0 curve (ansa pancreaticus), negotiating a guidewire around these angles to place the guidewire tip into the tail of the pancreas may be extremely difficult and may increase the risk of PEP. Another potential problem is that once a pancreatic guidewire is in place, the team must be diligent to monitor the tip of the guidewire. While concentrating on achieving biliary cannulation, the pancreatic guidewire can move. If the tip of the guidewire is forcefully passed into a side-branch of the pancreatic duct, it can cause perforation and subsequent acute pancreatitis.

If the double wire technique fails, one should place a small-caliber pancreatic stent and then try to cannulate alongside the stent. This can be cumbersome because many endoscopists will place a 5 French pancreatic stent. This caliber stent can completely fill the papillary orifice and make even guidewire cannulation alongside the stent quite difficult. Four French stents can be passed over an 0.025″ guidewire which may make this technique easier.

ACCESS SPHINCTEROTOMY

This section is termed "access sphincterotomy" because it is the best description of the maneuvers. Most readers are more familiar with the term "precut sphincterotomy." Historically, the term "precut" was coined by Kees Huibregtse to describe a technique that he conceived whereby a needle knife is used to initiate an incision at the ampullary orifice.[16] He used this technique to gain access to the biliary tree when standard cannulation attempts failed. Once access was achieved, the biliary orifice was often extended using a standard papillotome, hence the term “pre-cut.” There are now several techniques that are variations on Professor Huibregtse’s original description and all of them are used to gain access to the biliary tree after failed cannulation. The term “access sphincterotomy” is a better descriptor for this group of advanced sphincterotomy techniques used to gain access to the biliary tree because we often do not further extend the cut as originally described.

There are 4 techniques described in this section:

1. Free-hand sphincterotomy using a needle knife (Huibregtse technique)
2. Needle-knife sphincterotomy over a pancreatic stent
3. Fistulotomy

Descargado para Lucia Angulo (lu.maru26@gmail.com) en National Library of Health and Social Security de ClinicalKey.es por Elsevier en julio 20, 2022. Para uso personal exclusivamente. No se permiten otros usos sin autorización. Copyright ©2022. Elsevier Inc. Todos los derechos reservados.

4. Pancreatic sphincterotomy

Which technique is applied in what circumstance should be determined by the personal preference of the endoscopist and taking into account the overall health of the pancreas. Free-hand (precut sphincterotomy) and pancreatic sphincterotomy should be reserved primarily for those patients with advanced pancreatic disease; either advanced chronic pancreatitis or pancreatic cancer. These 2 techniques can adversely affect pancreatic drainage and patients with a normal pancreas are at high risk of PEP, to begin with. The other 2 techniques either protect pancreatic drainage with a stent or avoid the pancreatic duct altogether.

Free-hand access sphincterotomy using a needle knife was developed and championed by Kees Huibregtse at the Academic Medical Center (AMC) in Amsterdam (now the Amsterdam University Medical Center - AUMC).[16] It involves using a needle knife, beginning the incision at the ampullary orifice, and working cephalad in the 11:00 direction. Most people apply a "layering" cut for which the initial incision is superficial and then continued at deeper and deeper levels until the biliary orifice are identified. In the early days, this technique was criticized because of the potential for causing PEP. If this technique is applied primarily to patients with common bile duct stones, chronic pancreatitis, or pancreatic cancer, it is generally safe because these are patients at very low risk of PEP. However, when this technique is used in patients at higher risk of PEP (abdominal pain, recurrent acute pancreatitis, or a low probability of bile duct stones), early studies showed a high risk of PEP, particularly before the advent of pancreatic stenting. Early on, the free needle-knife precut sphincterotomy was often applied after prolonged attempts using standard techniques. Multiple meta-analyses have now suggested that the PEP rate may be related to timing; early application after failed cannulation seems to minimize the PEP rate.[17–20]

Access sphincterotomy performed with a needle-knife over a pancreatic stent has several advantages and therefore is the preferred technique by many endoscopists. The pancreatic stent is placed immediately after failed cannulation and thus assures pancreatic drainage early on during the procedure. After placement, the stent serves 2 main purposes. First, it provides a direction for the incision. This was initially described in 1994 and is a useful tip for biliary, pancreatic, and minor papilla sphincterotomy.[21] Second, it serves as a stable platform and prevents the endoscopist from extending the incision too deeply. Finally, if something happens during the course of the procedure that requires the procedure to be suspended, the stent is securely in place to prevent PEP. A prospective randomized trial was conducted comparing access sphincterotomy alone to the placement of a prophylactic pancreatic stent.[22] This study of 151 patients concluded that placing and maintaining a pancreatic stent for needle-knife precut sphincterotomy reduces the frequency and severity of PEP. In rare cases, there is a transposition of the ducts such that the pancreatic duct initially takes off in the 11 o'clock position while the bile duct takes off at 5:00 o'clock. With this technique, the ampullary segment is exposed with the stent clearly identifying the pancreatic duct and the aberrant orientation of the bile duct can be relatively easily detected. This technique (or fistulotomy – see later in discussion) are the techniques that the ESGE recommends in cases of a difficult cannulation associated with a peri-ampullary diverticulum.[12]

Although it is not popular or often used, this article would be incomplete without describing the placement of a 3 French pancreatic stent to facilitate access sphincterotomy. One must use a 0.018″ guidewire in conjunction with a tapered tip catheter to place a 3 French pancreatic stent. The floppy coiled tip and the nitinol body of the 0.018″ guidewire make it relatively easy to advance to the pancreatic tail. The 3 French

Descargado para Lucia Angulo (lu.maru26@gmail.com) en National Library of Health and Social Security de ClinicalKey.es por Elsevier en julio 20, 2022. Para uso personal exclusivamente. No se permiten otros usos sin autorización. Copyright ©2022. Elsevier Inc. Todos los derechos reservados.

stent (Cook Medical, Winston-Salem, NC) comes in a 12 cm length with a single full pigtail on the duodenal and but no side flap. The stent can be cut to an optimal length but the stent should be passed beyond the genu to ensure that it stays in place for at least 72 hours. The advantage of the small stent is that it almost always spontaneously passes on its own (prevents the need for a second procedure for stent removal) but is stable in the pancreas during the course of the sphincterotomy and whatever additional maneuvers are performed to complete the ERCP. It is soft and flexible and therefore does not cause damage to the MPD. Similar advantages can probably be obtained with a 4 French stent (Boston Scientific, Natick, MA) which can be passed over the more popular 0.025″ guidewire.

Fistulotomy refers to a technique that uses a needle knife to make an incision on the dome of the intraduodenal segment of the ampulla. This technique was developed because the incision does not extend to the ampullary orifice and thus should reduce the risk of PEP. This was tested in a randomized trial which showed needle-knife fistulotomy to be as effective as conventional needle-knife precut sphincterotomy but had a lower rate of PEP.[23] However, this technique depends on the conformation of the papilla and cannot be applied when there is no significant intraduodenal segment of the papilla.[24] A superficial incision is made and then slowly extended layer by layer until the bile duct is identified (usually by the visualization of bile). Sometimes bile is not seen if there is upstream obstruction and in which case one has to gently probe within the incision bed aiming in the 11:00 direction of the bile duct.

The technique of pancreatic sphincterotomy involves accessing the pancreatic duct and advancing a guidewire deeply enough into the pancreatic duct to stabilize the papillotome and then performing a sphincterotomy in the biliary direction. This technique can be very successful with one study accomplishing a 97% biliary cannulation rate in 255 cases of failed standard cannulation.[25] This technique is safe in patients with pancreatic cancer and advanced chronic pancreatitis but can carry a high risk of PEP if applied and the patient with normal pancreas, especially if a prophylactic pancreatic stent is not placed.[26] The advantage of this technique is that it uses a standard accessory (papillotome) and a familiar technique of standard sphincterotomy.

Ideally, all the advanced techniques described above should be in the armamentarium of the endoscopist. Which ones are used and the sequence of utilization is at the discretion of the endoscopist. An example of how these techniques can be used algorithmically was described by Lee and colleagues[27] In this study of 711 patients with a naïve papilla, 140 were determined to be "difficult cannulation" by their established criteria. If they failed cannulation but had no unintentional cannulations of the pancreatic duct, they applied the fistulotomy technique. If they had $\geq$3 unintentional pancreatic cannulations, then they first tried the double wire technique and if this failed, they performed an access sphincterotomy over a pancreatic stent. Using this algorithm, of the 140 patients with failed standard cannulation, they were able to achieve biliary cannulation and 90% (126/140).[27]

It is difficult to compare advanced cannulation techniques. Individual comparative studies will differ in a myriad of important parameters including the definition of “difficult cannulation,” variability in the patients studied, and variability in the skills of the endoscopist. Experienced endoscopists also develop personal bias with techniques and it is difficult to neutralize these biases in comparative studies. Nevertheless, a recent systematic review and network meta-analysis endeavored to evaluate the comparative efficacy of different methods for difficult biliary cannulation.[28] They compared advanced cannulation and access sphincterotomy techniques with their primary focus being: (1) success rate of biliary cannulation and (2) the incidence of PEP. The techniques studied included:

Descargado para Lucia Angulo (lu.maru26@gmail.com) en National Library of Health and Social Security de ClinicalKey.es por Elsevier en julio 20, 2022. Para uso personal exclusivamente. No se permiten otros usos sin autorización. Copyright ©2022. Elsevier Inc. Todos los derechos reservados.

1. Persistence with standard cannulation techniques
2. Pancreatic guidewire-assisted technique
3. Pancreatic stent-assisted technique
4. Early needle knife techniques
5. Late needle knife techniques
6. Transpancreatic sphincterotomy

In addition to the issues mentioned above, another weakness of this article is that they lump all needle knife techniques together (free-hand needle knife, needle knife over a pancreatic stent, and fistulotomy). The results showed that in terms of the success rate of biliary cannulation, transpancreatic sphincterotomy was the most successful followed by early needle-knife techniques. In terms of the rate of PEP, early needle-knife techniques were superior followed by transpancreatic sphincterotomy. The significant conclusions were that transpancreatic sphincterotomy increases the success rate of biliary cannulation as compared with persistence with standard cannulation techniques and early needle-knife techniques and transpancreatic sphincterotomy were superior to other interventions and decreasing rates of PEP.

SUMMARY

In this article, we have reviewed standard techniques for selective cannulation. With experience, these techniques should result in successful cannulation in 75% to 85% of cases. However, some notes of caution should be expressed. A good endoscopist will always be gentle with the papilla. If initial cannulation attempts fail, ultimate success is never accomplished by becoming angry with the patient, the scope, the papilla, or your coworkers. Careful, precise technique always produces better outcomes than force and frustration. However, even the very best endoscopists using the optimal technique will fail using standard techniques. We know now that prolonged persistence with standard cannulation techniques increases the risk of PEP. All endoscopists should have a reasonable threshold for abandoning standard cannulation techniques and adopting advanced techniques. In experienced hands, the application of advanced cannulation/sphincterotomy techniques should increase the overall cannulation rate to $\geq$ 95%. Experience is a key term because the techniques described above cannot be applied by simply reading about them or watching videos.

CLINICS CARE POINTS

- In most circumstances, the wire-guided technique should be the initial approach to selective cannulation.
- Standard cannulation should be limited by time and unintended pancreatic cannulation/injection to avoid an increased risk of PEP.
- Appropriate use of advanced cannulation and access sphincterotomy techniques will improve biliary cannulation success.

DISCLOSURE

Dr R.H. Hawes is a consultant for Olympus and Fuji and has stock in Apollo Endosurgery.

REFERENCES

1. Sarner M, Cotton PB. Classification of pancreatitis. Gut 1984;25:756–9.

Descargado para Lucia Angulo (lu.maru26@gmail.com) en National Library of Health and Social Security de ClinicalKey.es por Elsevier en julio 20, 2022. Para uso personal exclusivamente. No se permiten otros usos sin autorización. Copyright ©2022. Elsevier Inc. Todos los derechos reservados.

2. Cohen S, Bacon BR, Berlin JA, et al. National Institutes of Health State–of–the–Science Conference Statement: ERCP for diagnosis and therapy. Gastrointest Endosc 2002;56(6):803–9.
3. Lella F, Bagnolo F, Colombo E, et al. a simple way of avoiding post–ERCP pancreatitis. Gastrointest Endosc 2004;59:830–4.
4. Cheung J, Tsoi KK, Quan WL, et al. Guidewire versus conventional contrast cannulation of the common bile duct for the prevention of post ERCP pancreatitis: A systematic review and meta-analysis. Gastrointest Endosc 2009;70:1211–29.
5. Tse F, Yuan Y, Moayyedi P, et al. Guidewire–assisted cannulation for the prevention of post–ERCP pancreatitis: A systematic review and meta-analysis. Endoscopy 2013;45:605–18.
6. Shao LM, Chen QY, Chen MY, et al. Can wire–guided cannulation reduce the risk of post endoscopic retrograde cholangiopancreatography pancreatitis? Meta-analysis of randomized control trials. J Gastroenterol Hepatol 2009;24:1710–5.
7. Cennamo V, Fuccio L, Zagari RM, et al. Can a wire guided cannulation technique increase bile duct cannulation rate and prevent post- ERCP pancreatitis? A meta-analysis of randomized control trials. Am J Gastroenterol 2009;104:2343–50.
8. Tsuchiya T, Itoi T, Maetani I, et al. Effectiveness of the J–tip guidewire for selective biliary cannulation compared to conventional guidewires (the JANGLE study). Dig Dis Sci 2015;60(8):2502–8.
9. Freeman ML, DiSario JA, Nelson DB, et al. Risk factors for post-ERCP pancreatitis: a prospective multicenter study. Gastrointest Endosc 2001;54:425–34.
10. Wang P, Li ZS, Liu F, et al. Risk factors for ERCP-related complications: a prospective multicenter study. Am J Gastroenterol 2009;104:31–40.
11. Holt BA, Hawes R, Hasan M, et al. Biliary drainage: role of EUS guidance. Gastrointest Endosc 2016;83(1):160–5.
12. Testoni PA, Mariani A, Aabakken L, et al. Papillary cannulation and sphincterotomy techniques in ERCP: European Society of Gastrointestinal Endoscopy (ESGE) clinical guideline. Endoscopy 2016;48:657–83.
13. Herreros de Tejada A, Calleja JL, Diaz G, et al. Double-guidewire technique for difficult bile duct cannulation: A multicenter randomized, controlled trial. Gastrointest Endosc 2009;70:700–9.
14. Maeda S, Hayashi H, Hosokawa O, et al. Prospective randomized pilot trial of selective biliary cannulation using pancreatic guide-wire placement. Endoscopy 2003;35:721–4.
15. Tse F, Yuan Y, Bukhari M, et al. Pancreatic duct guidewire placement for biliary cannulation for the prevention of post–endoscopic retrograde cholangiopancreatography (ERCP) pancreatitis. Cochrane Database Syst Rev 2016;(5):CD010571.
16. Huibregtse K, Katon RM, Tytgat GN. Precut papillotomy via fine-needle knife papillotome: a safe and effective technique. Gastrointest Endosc 1986;32(6):403–5.
17. Cennamo V, Fuccio L, Zagari RM, et al. Can early precut implementation reduce endoscopic retrograde cholangiopancreatography related complication risk? Meta-analysis of randomized control trials. Endoscopy 2010;42(5):381–8.
18. Gong B, Hao L, Bie L, et al. Does precut technique improved selective bile duct cannulation or increase post ERCP pancreatitis rate? A meta-analysis of randomized control trials. Surg Endosc 2010;24(11):2670–80.
19. Navaneethan U, Konjeti R, Venkatesh PG, et al. Early precut sphincterotomy and the risk of endoscopic retrograde cholangiopancreatography related complications: An updated meta-analysis. World J Gastrointest Endosc 2014;6(5):200–8.
20. Sundaralingam P, Masson P, Bourke MJ. Early precut sphincterotomy does not increase risk during endoscopic retrograde cholangiopancreatography in

Descargado para Lucia Angulo (lu.maru26@gmail.com) en National Library of Health and Social Security de ClinicalKey.es por Elsevier en julio 20, 2022. Para uso personal exclusivamente. No se permiten otros usos sin autorización. Copyright ©2022. Elsevier Inc. Todos los derechos reservados.

patients with difficult biliary access: Meta-analysis of randomized control trials. Clin Gastroenterol Hepatol 2015;13(10):1722–9.
21. Siegel JH, Cohen SA, Kasmin FE, et al. Stent guided sphincterotomy. Gastrointest Endosc 1994;40(5):567–72.
22. Cha S-W, Leung WD, Lehman GL, et al. Does leaving a main pancreatic duct stent in place reduce the incidence of precut biliary sphincterotomy–associated pancreatitis? A randomized, prospective study. Gastrointest Endosc 2013;77(2):209–16.
23. Mavrogiannis C, Liatsos C, Romanos A, et al. needle-knife fistulotomy versus needle-knife precut papillotomy for the treatment of bile duct stones. Gastrointest Endosc 1999;50(3):334–92.
24. Zhang Q-S, Xu J-H, Dong Z-Q, et al. success and safety of needle-knife papillotomy and fistulotomy based on papillary anatomy: A prospective controlled trial. Dig Dis Sci 2021 [Online ahead of print].
25. Halttunen J, Keranen I, Udd M, et al. Pancreatic sphincterotomy versus a needle-knife precut and difficult biliary cannulation. Surg Endosc 2009;23(4):745–9.
26. Goff JS. Common bile duct pre-cut sphincterotomy: Transpancreatic sphincter approach. Gastrointest Endosc 1995;41(5):502–5.
27. Lee TH, Hwang SO, Choi HJ, et al. Sequential algorithm analysis to facilitate selective biliary access for difficult biliary cannulation in ERCP: A prospective clinical study. BMC Gastroenterol 2014;14:30.
28. Facciorusso A, Ramai D, Gkolfakis P, et al. Comparative efficacy of different methods for difficult biliary cannulation in ERCP: systematic review and network meta-analysis. Gastrointest Endosc 2022;95(1):60–71.

Descargado para Lucia Angulo (lu.maru26@gmail.com) en National Library of Health and Social Security de ClinicalKey.es por Elsevier en julio 20, 2022. Para uso personal exclusivamente. No se permiten otros usos sin autorización. Copyright ©2022. Elsevier Inc. Todos los derechos reservados.