



The Art of Selective Cannulation at ERCP

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Abstract

Purpose of Review ERCP is undergoing its 50th anniversary with a steady conversion from a diagnostic procedure to a therapeutic procedure. This paper shows a reflection of my 42 years of experience in the accession of biliary and pancreatic ducts and how the techniques have evolved to achieve a high rate of primary duct cannulation.

Recent Findings There has been an increase in the primary approach to cannulation involving different cannulation catheters and guidewires, and we will review some of those available, realizing that the selection may vary depending on operator preference and team approach. Different views and experiences with these techniques will be presented.

Summary ERCP has evolved from a diagnostic to primarily a therapeutic procedure. This has resulted in the development of a variety of devices and techniques to access the ducts of interest. I have presented several of the techniques and my team approach that has evolved over a number of years. A more prospective evaluation of devices and wires is needed to see if one is superior to the other.

Keywords Endoscopic retrograde cholangiopancreatography · ERCP · Billroth II · Duodenal diverticulum · Major ampulla · Minor ampulla

Introduction

The first ERCP was reported by McCune in 1968 [1] using a duodenoscope with a catheter taped to the side of the instrument, and successful duodenal intubation in 50% and pancreatography in 25% of the attempts. There was more luck than art in this novel undertaking and there has been considerable refinement in the endoscopes, accessory equipment, and patient management over the next 50 years to improve or ability to achieve selective cannulation safely [2].

Endoscopic Team

Our team consists of a CRNA, and GI RN and a GI technician. I prefer a nurse anesthetist using either propofol alone or

general anesthesia while monitoring the patient as most of our procedures are therapeutic, many are complicated, and this allows the endoscopist to concentrate on the procedure. A well-trained GI technician or RN assisting with the guidewire and having a good understanding of the instruments and the communication between the team members goes a long way toward a successful outcome.

Endoscope Placement

The traditional teaching is to insert the duodenoscope through the pylorus to the distal bulb, turn the left-right control clockwise and pull the scope back to the flat scope position which brings the major papilla oriented into the 12 o'clock position to provide a good orientation for cannulation (Fig. 1), the traditional “flat scope” position [3•]. The field of view should be sufficiently wide that the endoscopist visualizes not only in the left and right visual plane but also in the depth of field as well. This allows for refinement of control of the scope itself and the instruments to be used in cannulation. However, there are occasions where the endoscope is positioned very closely to the papilla or is angulated and space for achieving the ideal cannulation position is compromised. One must remember that we are working in a three dimensional space but observing on a two dimensional screen. The

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Fig. 1 Fluoroscopic standard flat endoscope position

axis of the common bile duct (CBD) and pancreatic duct (PD) in the anterior/posterior axis is equally important. If this awkward position is encountered then I go to the “long scope” position. This is done by releasing the left-right control to the neutral position, then advancing the endoscope and simultaneously adding counterclockwise rotation on the endoscope. Once past the papilla, the endoscope is rotated clockwise back to a neutral position (Fig. 2). The major issue with physicians new to this technique is that they stop too soon and if they would gently insert the endoscope a little further, they would obtain a good final position for cannulation. This technique is also useful during positioning prior to biliary sphincterotomy as it may give a good 11 to 12 o'clock axis.

An exception to the typical endoscope position is found when the papilla is oriented on either the left (9 o'clock) or the right edge (3 o'clock) edge of a diverticulum. The goal is to get the axis of the papilla as close as possible to the 12 o'clock position. For the 9 o'clock position, the best orientation is obtained by turning the left/right control fully clockwise, rotating the endoscope counterclockwise, and pulling back to a very flat endoscope position (Fig. 3). The 3 o'clock position requires just the opposite maneuver, insert the scope to the deeply apply clockwise rotation on the endoscope and turn the left/right knob fully clockwise as well (Fig. 4).

The minor papilla is located more proximal and to the right of the major papilla and I have seen two methods to start cannulation. The first is an extreme flat scope position; once the major papilla is visualized, the up/down is relaxed and the scope is pulled back and rotated clockwise. I find the position attained from this technique approximates the minor papilla too close to the endoscope providing limited space for cannulation and very limited space for therapy. I prefer the “semi-long” position. Pull the endoscope back into the bulb or stomach and re-insert as if going for the major papilla but once the endoscope is inserted into the distal duodenal bulb, fully turn the left/right control clockwise; the minor may appear high in superior aspect of the field of view, and if the scope is gently inserted further and the minor comes more central in the field of view (Fig. 5).

Cannulation Equipment

With the advent of magnetic resonance imaging cholangiopancreatography, and the use of endoscopic ultrasound to exclude the presence of CBD stones, ERCP has become primarily a therapeutic procedure. Classic cannulation teaching was to start with a diagnostic cannula, with either injection of radiopaque contrast and/or guidewire insertion. The more common current practice is to start with a sphincterotome (one with a rotatable tip may be an asset for fine tuning the left/right axis) and a guidewire. There is a wide variety of tomes and guidewires available. A lot of the selection is based to physician preference and the expertise of their assistants. Devices are designed to have the catheter and guidewire be fully controlled by the endoscopist, and the device stripped away from the wire after cannulation or therapy. Many high-volume centers have the wire controlled by a well-trained assistant. An advantage to the team approach is that there can be simultaneous adjustments to the cannula/tome and wire to facilitate cannulation, where the single operator must do one at a time. A recent publication of a randomized controlled trial comparing endoscopist-controlled vs.



Fig. 2 **a** Papilla view from standard flat endoscope position. **b** Fluoroscopic view of in the long endoscopic position. **c** Papilla position from long endoscope position, better axis for CBD cannulation



Fig. 3 **a** Papilla arising from left rim of diverticulum standard endoscope position. **b** Endoscope pulled back and rotated for better axis. **c** Papilla viewed from new endoscope position

assistant-controlled wire-guided cannulation using standard guidewires, found similar cannulations rates, but a significant increase in pancreatitis in the assistant-controlled group, 2.8% vs. 9.3%, resulting in the trial being stopped after the interim analysis [4].

There is a plethora of guidewires, straight or curved tip, caliber varying from 0.018" to 0.035", and all types of coatings including hydrophilic tips or wires that are fully hydrophilic coated, the first to address wire caliber. The most commonly used wires are 0.025" or 0.035". There is little data on the advantage of one over the other. A recent trial comparing conventional 0.025" vs. 0.035" showed no significant in 710 patients [5]. A smaller recent study compared a standard, curved tip 0.035" vs. a "novel highly flexible-tip" 0.025" wire [6]. They demonstrated fewer attempts to successful cannulation and a higher overall success with the new wire, 96% vs. 86%. I prefer to work with a standard papillotome and assistant-controlled cannulation, and have a much lower rate of post cannulation pancreatitis which is in the range of that with the endoscopist-controlled group in the study. We use a short, straight tipped, fully hydrophilic-coated guidewire because there is no resistance encountered from friction within the papillotome and allows the operating team to feel the resistance of the guidewire within the papilla. In essence, you

can palpate with the wire and this gives a feel for what the wire is doing within the papilla. The guidewire operator needs to keep the wire moist with a saline gauze during manipulation to prevent drying the hydrophilic coating. If resistance during wire exchange within the tome/catheter place a 3-cc syringe and flush saline through the guidewire port.

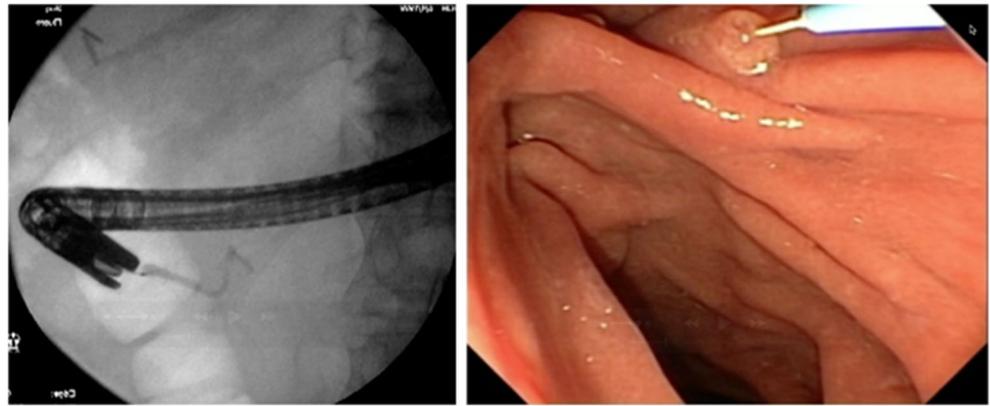
CBD Cannulation

There are two schools of thought on wire insertion, advancing the tip of the cannula a couple of millimeters within the papilla and then gentle insertion of a curved tip wire with a spinning action [3••], or straight wire about 1 cm out of the papillotome and then advance in an 11 or 12 o'clock direction relative to the papilla. The second axis is parallel to the long axis of the ampulla in the anterior/posterior plane. If resistance is encountered then try to bow the tome toward the scope and try again, adjusting the left-right movement a little. If the wire goes in a short distant (1 cm or less) then the endoscopist can insert the tome deeper as the technician slowly withdraws the wire, then check the position fluoroscopically and inject a small amount of contrast with gentle pressure. If in the CBD or common channel again try to advance the wire looking for little or no



Fig. 4 **a** Papilla arising from right rim of diverticulum. **b** Fluoroscopic position for right sided cannulation. **c** Endoscopic view after endoscope repositioning

Fig. 5 **a** Fluoroscopic view of endoscope in minor papilla cannulation position. **b** Minor papilla in good cannulation position



resistance. This is the point to avoid forceful wire insertion as it can produce a wire perforation in the intra-duodenal portion of the papilla. Sometimes when in the intrapapillary CBD, the wire will not advance further because of sharp medial angulation of the upper portion of the intra-duodenal CBD, and after a short medial segment it then turns superiorly again. Switching to a curved hydrophilic wire may allow you negotiate these turns. An alternative technique is to insert the catheter tip over the wire up to the first angulation and then gently pull back and ease off on the up/down of the endoscope. Then release any bowing of the papillotome, and some of the flexion on the elevator as well. This technique may allow the tome to flatten the first angulation of the CBD and advance to tome to the second angulation. Then again advance the curved wire with gentle forward motion and rotation and this may provide deep cannulation of the CBD (Fig. 6). If this fails then bow the papillotome and the tip may slide up into the CBD.

If repeated attempts with the guidewire result in PD insertion then we will leave a wire in the PD and try the double wire cannulation (DGC) technique for CBD access. The key is to orient the tome tip or guidewire just to the luminal side of the PD wire and gently advance the wire, you can detect minimal PD entry and pull the wire back and reposition the tome tip and try to reinsert the guidewire (Fig. 7). The technique has some controversial literature, a recent study showed an 18%

incidence of post ERCP pancreatitis vs. 4% for standard cannulation. This was a retrospective study and only 21% of the DGC patients had pancreatic stents inserted [7]. A second study using DGC and papillary septotomy for difficult cannulation found no increase in complication over standard techniques [8•]. Our center has a low rate of precutting and we consistently place a short 4 French pancreatic stents with no antimigration flap if double to wiring was done [9].

Multiple publications have discussed the concept of “pre-cut sphincterotomy,” with the two major types being needle-knife pancreatic pre-cut (NPK), or transpancreatic sphincterotomy (TPS). A meta-analysis concluded that TPS had a higher cannulation success with no difference in complication rates [10]. You cannot discern what role, if any, that a pancreatic stent would have an effect or change the approach in this scenario. A word of caution is that these studies are coming from expert centers with experienced endoscopists and are not recommended for the routine use.

Cannulation in Billroth II patients can be done with either an end-viewing or side-viewing endoscope. However, the success of cannulation is slightly higher with side-viewing endoscope 92%, with less pancreatitis and bleeding but the rate of perforation was higher [11].

One modification that I use for Billroth II patients is to modify a standard double lumen diagnostic catheter to direct

Fig. 6 **a** Sigmoid distal CBD, wire in. **b** Sphincterotomy over the wire to first bend. **c** Flatten endoscope and advance to second bend



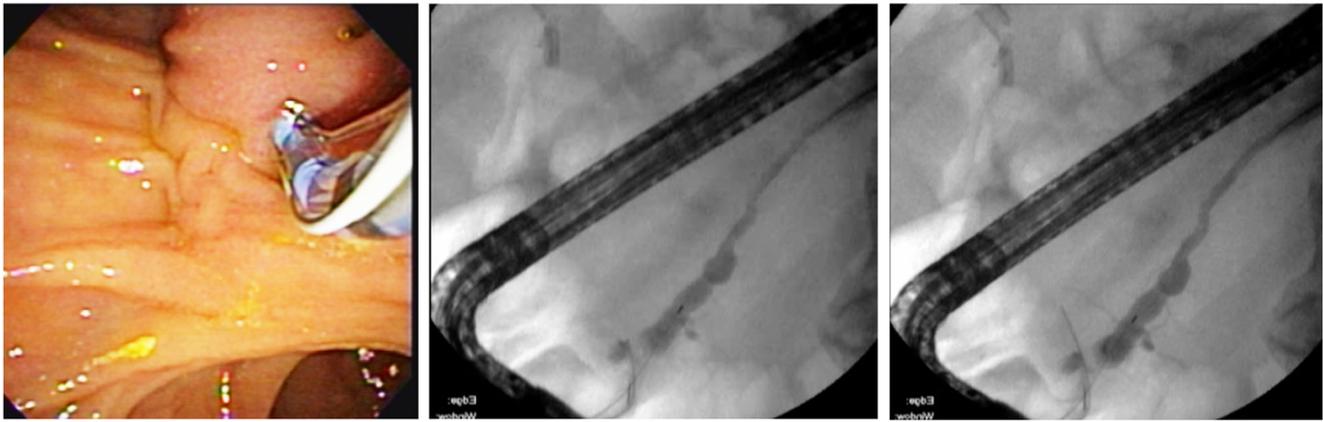


Fig. 7 a Endoscopic view with Sphincterotome flexed for CBD cannulation. b Fluoroscopic image of sphincterotome flexed for CBD cannulation. c Guidewire deep into CBD

the tip toward the biliary side of the ampulla (Fig. 7). This is done by removing the wire mandrel of a papillotome insert it in to the diagnostic cannula and bend the tip 45° opposite of the natural curvature. This requires the application of heat on the tip under a flame or heat of similar intensity. The wire mandrel is left in place and the catheter is res-sterilized for later use. The advantage of this modification is that it redirects the catheter and guidewire to a more favorable biliary cannulation position. Once the tip is inserted into the papilla gently dropping, the elevator may give a move favorable biliary cannulation axis. Occasionally, the catheter has a tendency to meet resistance at the elevator due to the curvature, if the guidewire is advanced first then the catheter passes easily (Fig. 8).

Cannulation PD

Main PD cannulation is achieved by angling the tome/guidewire to the 1 to 2 o'clock position and with less elevation, being careful to advance the guidewire slowly with fluoroscopic

control and avoid impacting it in a side branch. Switching to a curved wire is easier with a spinning motion if it is necessary to advance above the genu. It is also helpful to flip the flexible tip of the wire into a “j” or alpha loop where the leading edge is in a full curve and it will follow the main duct rather than entering a side branch. If there is already a biliary sphincterotomy in place and PD cannulation is needed, I always do a wire first cannulation. Many times, the PD orifice is not apparent, so I start at the inferior margin of the sphincterotomy and slide the wire up the deepest part of the groove in the incision.

Cannulation of the minor papilla for proven or suspect pancreas divisum can be a bit more challenging as many times the orifice is not obvious. If the divisum status is unknown, it must be remembered that the minor papilla is not patent in about 50% or less of individuals. In past times, my preferred cannulation was a tapered tip cannula with a straight 0.018 hydrophilic wire, but it is no longer available. New 0.018” wires may resolve this problem. Currently, I modify a 5,4,3 tapered cannula to accept a 0.025” wire or a tapered tip sphincterotome, with the same wire. Once the minor papilla is visualized, advance at least 10 mm of the wire and cannulate

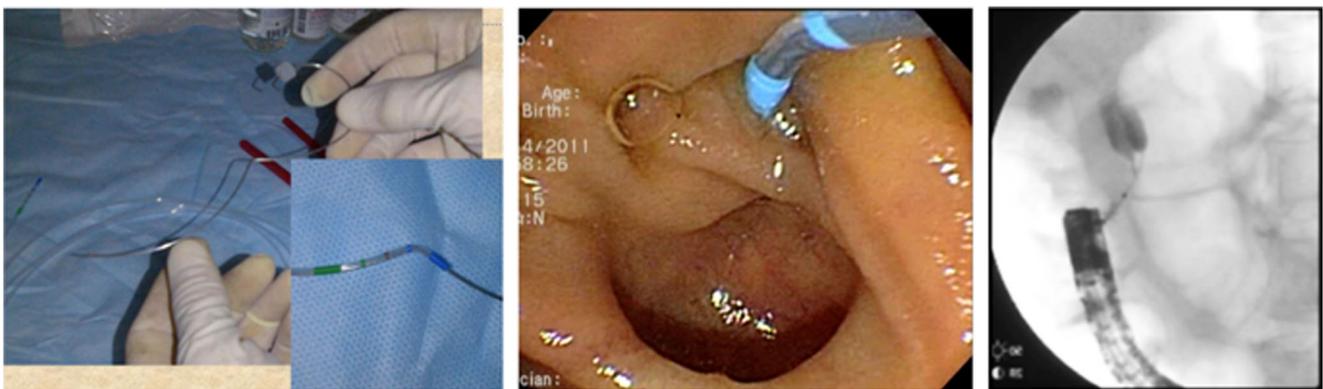


Fig. 8 a Modification of a diagnostic catheter for BII cannulation. b BII cannulation in a duodenal diverticulum. c Deep cannulation with catheter and guidewire

wire first. If I do not see a possible orifice, I do not try to probe the minor with the wire because it will create artifact that looks like a possible orifice. Next, I administer a standard dose of secretin and usually within 5 min pancreatic juice will be seen coming from the minor and now you know where a wire can be inserted. Once the wire enters smoothly, with no resistance a couple of centimeters, it impact the catheter on the minor and under fluoroscopic guidance; inject a small amount of contrast to visualize the course of the dorsal duct. This is important as there may be a tendency for the wire to enter a side branch, if that is occurring then advance the catheter/tome through the minor and once in the duct for a centimeter or more, switch to a curved guidewire for deep insertion with a spinning motion.

Summary

Selective cannulation of the biliary and pancreatic tree can be accomplished by first having a thorough familiarity and comfort with the equipment being used and a team that can accomplish a high cannulation percentage. It requires a significant understanding to what each tool can provide and a careful and cautious approach to cannulation. There is a lot of data on guidewire, guidewire caliber and shape, time to cannulation, and with what device, but it does not fully translate to the individual endoscopist. Attaining a good endoscopic view of the major or minor papilla in a position allows for placement of the cannulation equipment in an axis that allows for selective cannulation. Good communication between the physician and their assistants if the teamwork approach is being used is essential.

Compliance with Ethical Standards

Conflict of Interest The author declares that there is no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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