

# Optimal endoscopic techniques to reduce the risk of post-endoscopic retrograde cholangiopancreatography pancreatitis



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## ABSTRACT

Post-endoscopic retrograde cholangiopancreatography pancreatitis (PEP) is the most common and feared complication of endoscopic retrograde cholangiopancreatography. Patient selection is an important variable that is important when determining the risk of PEP. The factors that may increase the risk of PEP include papillary trauma, papillary edema, and pancreatic ductal injury (mechanical or hydrostatic). Proven methods to decrease the risk of PEP include wire-guided cannulation, prophylactic short-term pancreatic duct (PD) stenting, and avoiding frequent PD cannulation, injection, or overinjection. Additional measures that might decrease the risk of PEP by decreasing cannulation time include a double guidewire technique, and early precut sphincterotomy. Certain techniques are known to have an increased risk of pancreatitis and should be implemented only when necessary. When performing measures such as large-balloon papillary dilation or pancreatic sphincterotomy, the rates of pancreatitis may be decreased with small alterations in the technique. A short biliary sphincterotomy when performed with papillary large-balloon dilation and needle-knife pancreatic sphincterotomy over a PD stent have both been shown to decrease the risk of pancreatitis.

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## 1. Introduction

Post-endoscopic retrograde cholangiopancreatography (ERCP) pancreatitis (PEP) is the most common and most feared complication of ERCP. Fortunately, severe or life-threatening pancreatitis after ERCP is rare [1]. Nevertheless, it should be the goal of the therapeutic endoscopist to decrease the rate of severe pancreatitis to as close to zero as possible and to reduce the overall rate of pancreatitis after ERCP. The risk of PEP varies, based on indication, patient-related factors, and intended therapy. As discussed previously, patient selection becomes the most important method that the endoscopist can employ to decrease ERCP-related pancreatitis, though it is not a “technique”-related factor [2,3].

With the widespread availability of magnetic resonance cholangiopancreatography and endoscopic ultrasound, ERCP has primarily become a therapeutic endeavor, as diagnostic ERCP is rarely indicated [4,5]. There are a variety of techniques that are associated with an increased risk of PEP, and it is important to use them only when necessary (Table). By knowing which techniques decrease the risk of pancreatitis and employing them, one can increase the overall safety of the procedure for the patient. The proposed mechanisms that cause PEP include mechanical injury from

pancreatic duct (PD) or ampullary instrumentation, thermal injury causing ampullary or pancreatic orifice edema, side branch injury or acinarization with pancreatography, chemical or allergic injury of the contrast dye, cytokine and enzymatic activation by intraluminal contents, and possibly bacterial injury [3,6]. We discuss techniques that intend to mitigate some of those presumed risk factors for PEP.

## 2. Cannulation

Mechanical injury begins at the level of the papilla, and there is a relationship between ampullary injury and risk for pancreatitis. It is during the process of cannulation that we often cause most of papillary injury, edema, and possibly pancreatic outflow obstruction; thus, much of the potential risk of pancreatitis begins with cannulation. Prolonged or difficult cannulation can increase the risk of PEP. Therefore, techniques that improve cannulation success or reduce cannulation time, or both, may also improve the rate of PEP [6,7]. Regardless of which technique is initially employed, when failing cannulation the endoscopist should move to an alternative approach with relative rapidity.

### 2.1. Wire-guided cannulation

Wire-guided cannulation is one of the most studied techniques regarding its relationship to ERCP-related pancreatitis and access

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**Table**

Risk factors for post-ERCP pancreatitis on multivariate analysis.

Definite <sup>*</sup>	Maybe <sup>†</sup>	No <sup>‡</sup>
Suspected SOD	Acinarization	Small CBD diameter
Young age	Female gender	SO manometry
Normal bilirubin	Absence of CBD stone	Biliary sphincterotomy
History of post-ERCP pancreatitis	Lower ERCP case volume	
Difficult or failed cannulation	Trainee involvement	
Pancreatic duct injection		
Pancreatic guidewire placement		
Pancreatic tissue sampling by any method		
Pancreatic sphincterotomy (minor papilla)		
Balloon dilation of biliary sphincter		
Precut sphincterotomy		

Abbreviations: CBD, common bile duct; SO, sphincter of Oddi, SOD, sphincter of Oddi dysfunction.

\* Significant by multivariate analysis in most studies.

† Significant by univariate analysis only in most studies.

‡ Not significant by multivariate analysis in any study.

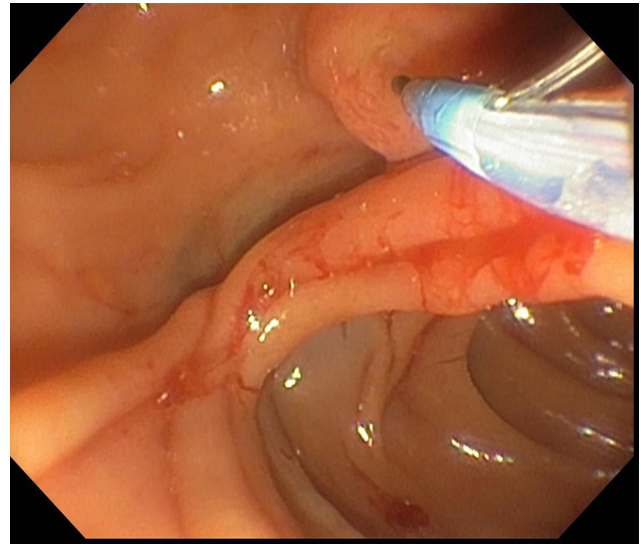
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success. In this technique, a guidewire delivered via a catheter is used to probe the papilla to access the bile duct. This is in contrast to the traditional technique where a catheter is placed in the papilla and used to freely cannulate the bile duct or is used to inject contrast material to delineate the bile duct and possibly facilitate access by opening up the entry into the duct. Theoretically, a guidewire should cause less trauma and edema at the papilla than a cannula and should more easily enter the bile duct. Further, without contrast injection, there is a lower risk of submucosal injection and no risk of PD injection. A large retrospective study of 822 patients showed a high rate of technical success in achieving deep biliary cannulation with the wire-guided technique, as well as a low rate of PEP (1.3%) [8]. However, smaller prospective comparative studies show variability in the rate of PEP [9,10]. A recent Cochrane review of 12 studies comparing catheter-based dye-assisted vs wire-guided cannulation showed a significant decrease in PEP from 6.7%–3.5%. Furthermore, there was a significantly greater primary cannulation success rate of 83.6% vs 77.3% (risk ratio = 1.07) [11]. The risks attributed to the wire-guided approach include creation of a false passage, perforation, and PD injury; however, the rate of these complications is low and even if wire perforation occurs it can usually be managed conservatively [6,8].

The use of “free wire,” “pure wire,” or “wire only” cannulation where the tip of the delivery device never touches or engages the papilla might further decrease the risk of pancreatitis (Figure 1). The wire is passed freely into the papilla and directed into the bile duct with manipulation of the endoscope and catheter. In theory, there should be less papillary trauma and resulting edema with this method of cannulation. This appears to be a promising technique, although cannulation rates may vary widely. Currently, there are no published studies looking at this approach and the patient's anatomy may be prohibitive in some cases. In our experience, this technique works best in patients without a long intraduodenal segment or rolling (ie, floppy) papilla.

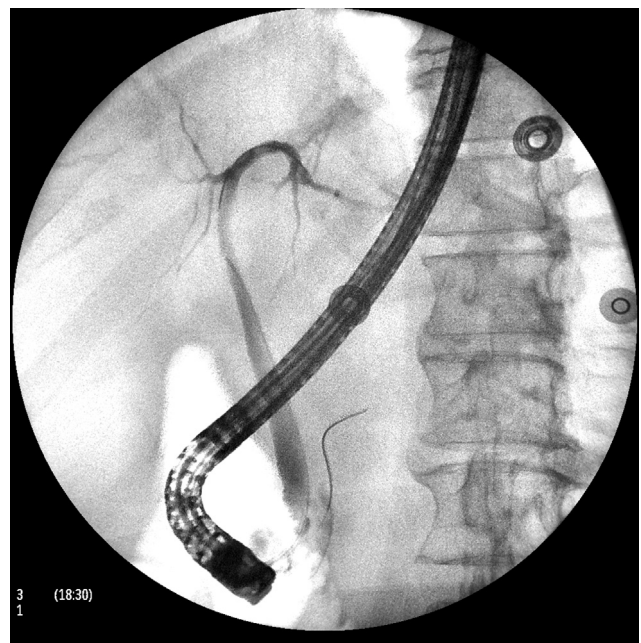
## 2.2. Double guidewire technique

First described in 1998, the double guidewire (DGW) method begins with a wire-guided cannulation technique. If biliary



**Fig. 1.** “Pure wire” cannulation where the tome does not engage for wire cannulation of the duct. (Color version of figure is available online.)

cannulation is difficult and the PD is inadvertently accessed, the wire is then placed deep enough into the PD so as to not fall out. A second wire is loaded onto the delivery catheter to then selectively cannulate the bile duct alongside the pancreatic wire [12]. In theory, the wire in the pancreatic duct straightens the papilla and possibly pulls down the septum between the PD and bile duct while protecting the pancreatic orifice, thus allowing the second wire to more easily enter the bile duct. This technique may also facilitate visualization of the direction of the PD and bile duct to help direct the second wire (Figure 2). Early accounts of this technique described it as a promising method for gaining selective biliary access in cases with difficult cannulation [13]. Multiple prior studies have shown that repeated PD injection and papillary trauma, often due to difficult cannulation, increases the rates of PEP [6,14]. It would stand to reason that with the DGW technique fewer episodes of pancreatic injection would occur along with fewer attempts at precut sphincterotomy and thus may decrease



**Fig. 2.** Fluoroscopic image showing double guidewire technique.

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