Post-endoscopic retrograde cholangiopancreatography (ERCP) pancreatitis

AUTHORS: Andrea Tringali, MD, PhD, Silvano Loperfido, MD, Guido Costamagna, MD, FACG
SECTION EDITOR: Douglas G Adler, MD, FACG, AGAF, FASGE
DEPUTY EDITOR: Kristen M Robson, MD, MBA, FACG

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INTRODUCTION

Endoscopic retrograde cholangiopancreatography (ERCP) is a specialized endoscopic procedure for managing pancreaticobiliary disorders (eg, removal of bile duct stones, relief of biliary obstruction). The most frequent adverse event associated with ERCP is acute pancreatitis. Post-ERCP pancreatitis can lead to severe complications, including pancreatic necrosis and organ failure, and it is a common basis for ERCP-related malpractice claims [1,2]. Strategies involving procedural techniques and pharmacologic prophylaxis can lower the risk of post-ERCP pancreatitis.

This topic will discuss risk factors for and strategies to prevent post-ERCP pancreatitis.

The diagnosis and management of acute pancreatitis from other causes are discussed separately:

- (See "Clinical manifestations and diagnosis of acute pancreatitis".)
- (See "Management of acute pancreatitis".)
- (See "Predicting the severity of acute pancreatitis".)

Other aspects of ERCP, including patient selection and preparation, are discussed separately. (See "Overview of endoscopic retrograde cholangiopancreatography (ERCP) in adults".)

PATHOGENESIS

Several events related to ERCP may contribute to the risk of acute pancreatitis [3,4]:

- **Mechanical and/or thermal injury** – Mechanical and/or thermal injury may cause edema of the pancreatic orifice that can obstruct the outflow of pancreatic secretions. Sources of mechanical injury include prolonged manipulation of the pancreatic orifice and repeated instrumentation of the pancreatic duct. These maneuvers often occur when selective bile duct cannulation is challenging. Thermal injury is typically related to use of an electrocautery device during biliary sphincterotomy [5].

- **Injury related to injection** – Hydrostatic injury results from excessive injection of any fluid (eg, contrast material, saline) into the pancreatic duct. In addition, exposing the pancreatic duct to contrast or other fluid may result in activation of proteolytic enzymes and subsequent enzymatic injury [6]. However, the available data suggest that the risk of post-ERCP pancreatitis does not correlate with the type of contrast material (eg, iso-, low-, or high-osmolality agent) [7,8]. (See "Patient evaluation prior to oral or iodinated intravenous contrast for computed tomography", section on 'Types of contrast material'.)

  Training for the endoscopy staff on injection and fluoroscopy techniques may help to minimize risk associated with excessive contrast injection (eg, acinarization of the pancreatic gland). (See 'Preventive endoscopic techniques' below.)

The pathogenesis of acute pancreatitis is discussed in more detail separately. (See "Pathogenesis of acute pancreatitis".)

DEFINITION AND EPIDEMIOLOGY

The definition of post-ERCP pancreatitis has varied among studies and consensus statements [9-12]. We agree with society guidelines that use criteria that account for pre-existing abdominal pain in patients with a history of pancreatitis and that define post-ERCP pancreatitis as follows [11]:

- New or worsened abdominal pain combined with >3 times the normal value of amylase or lipase more than 24 hours after ERCP and requirement of hospital admission or prolongation of a planned admission.

The overall incidence of post-ERCP pancreatitis across studies has ranged from 3.5 to 9.7 percent [13,14]. Most cases of post-ERCP pancreatitis are mild, and rates of severe pancreatitis

have been low and range from 0.3 to 0.8 percent [13-16].

Mortality rates related to post-ERCP pancreatitis have also been low and range from 0.1 to 0.7 percent [13,14].

RISK FACTORS

The development of post-ERCP pancreatitis is likely related to increased pressure within the main pancreatic duct that results from periampullary inflammation caused by instrumentation during ERCP [17]. Thus, some risk factors are related to increased inflammation in the region of the ampulla and pancreatic head (table 1). Injury to the pancreatic acinar cells leads to a proinflammatory cascade followed by release of activated pancreatic enzymes and cytokines [17]. (See "Pathogenesis of acute pancreatitis".)

Most risk factors for post-ERCP pancreatitis can be classified as follows [3,11,18-20]:

- Procedure-related factors (see 'Preventive endoscopic techniques' below)
  - Difficult cannulation of the bile duct
  - Repeated guidewire cannulation into the main pancreatic duct
  - Multiple injections of contrast material or other fluid into the main pancreatic duct
  - Balloon dilation of an intact biliary sphincter
  - Pancreatic sphincterotomy
  - Endoscopic snare papillectomy

Precut (access) sphincterotomy has been associated with increased risk for pancreatitis when it is performed after repeated cannulation attempts using other methods [21]. (See "Precut (access) papillotomy".)

- Patient-related factors
  - Younger age (<55 years) [22,23]
  - Female sex
  - History of pancreatitis related to ERCP or another etiology [24,25]
  - Suspected type I or II sphincter of Oddi dysfunction [26-28]

Risk factors for post-ERCP pancreatitis are additive; thus, patients with more than one risk factor have a higher risk than patients with only one risk factor [13,24,29].

PREVENTIVE STRATEGIES

General principles — For patients undergoing ERCP, the goal of a preventive strategy is to reduce the risk of post-ERCP pancreatitis and its associated adverse events (eg, organ failure).

Preventive strategies for patients undergoing ERCP typically include a combination of general measures, pharmacologic prophylaxis, and endoscopic techniques. For some higher-risk patients, additional interventions such as pancreatic duct stenting may be used. (See "Prophylactic pancreatic stents to prevent ERCP-induced pancreatitis: When do you use them?".)

General measures include [4,30,31]:

- **Patient selection** – An important aspect of preventing ERCP-related complications is confirming that the indications for ERCP are appropriate. The role of ERCP in managing pancreaticobiliary disorders is mostly a therapeutic one because other methods of diagnostic testing (eg, magnetic resonance cholangiopancreatography [MRCP] or endoscopic ultrasound) provide high diagnostic accuracy without the risks associated with ERCP [32]. Indications for ERCP-guided interventions are discussed separately. (See "Overview of endoscopic retrograde cholangiopancreatography (ERCP) in adults", section on 'Patient selection'.)

- **Postprocedure instructions** – We emphasize in the postprocedure instructions that patients should contact their clinician or seek medical care if they develop new abdominal pain (or worsening of existing pain) following the procedure. This is important for identifying patients with post-ERCP pancreatitis so that therapy can be initiated.

  After the patient has recovered from procedural anesthesia, oral intake is limited to clear liquids until the following day. If clear liquids are tolerated, patients may resume their normal diet gradually over the next four to six hours.

It is also important for the endoscopist and endoscopy staff to have adequate training, experience, and volume of cases [33]. Rates of post-ERCP pancreatitis are typically tracked as a quality indicator [32,34].

Pharmacologic prophylaxis

Rectal nonsteroidal anti-inflammatory drugs — We agree with society guidelines that endorse the use of nonsteroidal anti-inflammatory drugs (NSAIDs; administered rectally) to reduce the incidence of post-ERCP pancreatitis in patients undergoing ERCP who do not have

contraindications for NSAIDs [11,35]. We typically give indomethacin suppository 100 mg or diclofenac suppository 100 mg immediately before ERCP [11,32].

Contraindications for rectal NSAIDs include pregnancy at ≥30 weeks gestation, history of skin disease such as Steven-Johnson syndrome, or NSAID allergy [36,37]. Contraindications and adverse events associated with NSAIDs are discussed in more detail separately. (See "Nonselective NSAIDs: Overview of adverse effects".)

Rectally administered NSAIDs are first-line pharmacologic prophylaxis because they have resulted in lower risk of post-ERCP pancreatitis [38-40]. In a meta-analysis of 21 trials including 6134 patients undergoing ERCP, the risk of post-ERCP pancreatitis was lower in patients who received rectally administered NSAIDs compared with placebo (6.7 versus 12.4 percent, relative risk [RR] 0.54, 95% CI 0.45-0.65) [40]. In another meta-analysis of 21 trials including 6854 patients undergoing ERCP, patients who received rectally administered NSAID prophylaxis had lower rates of post-ERCP pancreatitis compared with placebo (6.8 versus 12.9 percent) [39]. However, in both meta-analyses, NSAIDs given by a nonrectal route did not lower the risk of post-ERCP pancreatitis.

Preprocedure NSAID dosing has been associated with lower risk of post-ERCP pancreatitis. In a trial including 2600 patients undergoing ERCP, indomethacin was given either before ERCP routinely or after ERCP selectively to high-risk patients [31]. In a subgroup analysis of 586 high-risk patients (ie, all patients received indomethacin), the risk of post-ERCP pancreatitis was lower with preprocedure NSAID dosing compared with postprocedure dosing (6 versus 12 percent, RR 0.47, 95% CI 0.34-0.66) [31].

NSAIDs inhibit several mediators of the inflammatory cascade that are thought to play a role in the pathogenesis of acute pancreatitis (ie, prostaglandins and phospholipase A2) [3,41].

Other pharmacologic strategies — We do not routinely use sublingual nitrates as a preventive strategy for patients undergoing ERCP. However, some society guidelines suggest that nitrates may be a reasonable alternative for prophylaxis in patients in whom NSAIDs and aggressive intravenous hydration are not options [11]. (See 'Other strategies' below.)

Data suggest that sublingual nitrates resulted in lower risk of post-ERCP pancreatitis; however, possible adverse effects such as hypotension limit their use. In a meta-analysis of 11 trials including over 2000 patients, sublingual nitroglycerin (glyceryl trinitrate) resulted in lower risk of post-ERCP pancreatitis compared with placebo (odds ratio [OR] 0.47, 95% CI 0.28-0.78) [42]. Nitrates combined with rectal NSAIDs may provide more benefit than NSAIDs alone [43,44]. In a trial including 886 patients undergoing ERCP, diclofenac suppository plus sublingual isosorbide

dinitrate resulted in lower risk of post-ERCP pancreatitis compared with diclofenac alone (RR 0.59, 95% CI 0.37-0.95) [44].

Other pharmacologic strategies have been studied for preventing post-ERCP pancreatitis; however, data have suggested uncertain or no benefit. Thus, the following pharmacologic strategies are not routinely used for prophylaxis: allopurinol [45-52], antibiotics [53,54], antioxidants [55], aprepitant [56], botulinum toxin [57-59], C1 inhibitor [60], calcitonin [61,62], glucagon [63], glucocorticoids [45,64], heparin [65,66], interleukin-10 [67-69], magnesium sulfate [70], nifedipine [71,72], pentoxifylline [73], platelet-activating factor [74], protease inhibitors [75-78], risperidone alone or combined with ulinastatin [79,80], secretin [81-83], semapimod [84], somatostatin and its analog octreotide [85-89], topical epinephrine [90-92], and topical lidocaine [93,94].

Preventive endoscopic techniques — Endoscopic strategies for reducing the risk of post-ERCP pancreatitis include techniques for minimizing trauma to the biliary orifice and reserving pancreatic duct manipulation (ie, contrast injection, cannulation) for patients in whom evaluation of the pancreatic duct is required. (See "Chronic pancreatitis: Management", section on 'Endoscopic therapy'.)

Cannulation technique — Strategies related to cannulation technique include:

- **Limit standard cannulation attempts** – We generally limit the number of cannulation attempts to ≤5 attempts (or a maximum duration of five minutes) because trauma to the biliary orifice is a potential risk factor for post-ERCP pancreatitis [16,95].

- **Use guidewire-assisted cannulation as the initial method** – We agree with society guidelines that support routine use of guidewire-assisted cannulation as the primary method for accessing the common bile duct [35,96]. For some patients, cannulation methods may be combined by injecting a small amount of contrast to define the anatomy of the distal common bile duct and help direct the guidewire [97]. Thus, if unintentional injection of the pancreatic duct occurs, it is limited to the very distal part of the duct.

  Guidewire-assisted biliary cannulation is an effective cannulation method that results in lower risk of post-ERCP pancreatitis [98]. In a meta-analysis of 15 trials comparing guidewire-assisted cannulation with conventional contrast-assisted technique in 4426 patients, guidewire-assisted cannulation resulted in lower rates of post-ERCP pancreatitis (3.9 versus 7.7 percent, RR 0.51, 95% CI 0.36-0.72) and higher rates of successful cannulation without using alternative methods (85 versus 78 percent, RR 1.06, 95% CI 1.01-1.12) [98].

If the guidewire-assisted technique is unsuccessful after five cannulation attempts, we proceed with an alternative technique for cannulating the common bile duct such as precut (access) sphincterotomy. This method is typically reserved for patients with difficult biliary access (ie, >5 minutes or >5 contacts with the papilla without achieving cannulation). In a meta-analysis of six trials including 898 patients undergoing ERCP, early use of precut sphincterotomy resulted in lower risk of post-ERCP pancreatitis compared with persistent standard cannulation technique (ie, use of precut as a salvage maneuver only) [21,99]. Technical aspects of standard biliary sphincterotomy and precut sphincterotomy are discussed separately. (See "Precut (access) papillotomy" and "Endoscopic biliary sphincterotomy".)

Other endoscopy-related measures — Other endoscopy-related considerations include:

- **Gas insufflation** – We typically use carbon dioxide gas for insufflation during ERCP to decrease the risk of postprocedural abdominal pain. (See 'Differential diagnosis' below.)

- **Use of electrocautery** – Thermal injury from electrocautery may cause papillary edema that may obstruct the outflow of pancreatic secretions [3]. While several electrosurgery devices and techniques have been studied, none have been conclusively associated with lower risk of post-ERCP pancreatitis (see "Endoscopic biliary sphincterotomy", section on 'Electrosurgical devices'):

  - Use of blended current – Most endoscopists use blended current, consisting of cutting current and coagulation, for biliary sphincterotomy rather than pure cutting because blended current has been associated with lower risk of procedure-related bleeding [100]. However, in a meta-analysis of four trials including over 800 patients who had ERCP with sphincterotomy, there were no significant differences in the rates of pancreatitis between blended current and pure-cutting current [100].

  - Microprocessor-controlled generators – Most endoscopists in the United States and Europe use electrosurgical devices that automatically regulate the intensity and blend of current based on tissue resistance, and such continuous regulation may result in more optimal delivery of thermal energy. However, limited data suggest that use of such generators does not lower the risk of post-ERCP pancreatitis [101].

Pancreatic stenting for higher-risk patients — The decision to place a prophylactic pancreatic stent is individualized and informed by patient risk factors, technical factors encountered during the procedure, risk of adverse events associated with stenting, endoscopist expertise, and endoscopist preference [102]. For example, we typically place a pancreatic duct stent for patients with one or more of the following conditions:

- Repeated, unintentional guidewire insertion or contrast opacification of the pancreatic duct
- Pancreatic sphincterotomy
- Double guidewire biliary cannulation (ie, intentional placement of a guidewire into the pancreatic duct to facilitate biliary cannulation)

The proposed benefit of pancreatic stent placement is related to facilitating pancreatic drainage and relieving intraductal pressure from papillary edema. However, pancreatic stenting has been associated with several potential adverse events including technical challenges that may lead to increased papillary edema (without achieving ductal decompression) and the risk of stent migration [103,104].

The indications, technical aspects, efficacy, and adverse events associated with prophylactic pancreatic stent placement are discussed in more detail separately. (See "Prophylactic pancreatic stents to prevent ERCP-induced pancreatitis: When do you use them?".)

Other strategies — Data from clinical trials suggested that large volume or "aggressive" intravenous hydration (usually defined as lactated Ringer solution bolus of 20 mL/kg periprocedure, followed by 3 mL/kg/hour for eight hours) was effective for reducing the risk of post-ERCP pancreatitis [35,105-107]. However, use of this strategy in clinical practice may be limited because it requires inpatient hospitalization for administering the total volume of fluid. Thus, it may not be feasible for patients who are treated in an outpatient setting. In addition, some patients may be at increased risk for fluid overload (eg, patients with cardiac or kidney disease). In a meta-analysis of 12 trials including 3524 patients undergoing ERCP, aggressive intravenous hydration resulted in lower risk of post-ERCP pancreatitis compared with standard-volume hydration (OR 0.47, 95% CI 0.34-0.66) [35]. There were no significant differences in adverse events between the groups. These data support intravenous hydration as a preventive strategy, although the optimal regimen is uncertain. (See "Management of acute pancreatitis", section on 'Fluid replacement'.)

Peri-procedural fluid management is discussed in detail separately. (See "Intraoperative fluid management" and "Anesthesia for gastrointestinal endoscopy in adults".)

PATIENTS WITH POST-ERCP PANCREATITIS

Clinical manifestations — Clinical manifestations of post-ERCP pancreatitis are the same as those seen in patients with acute pancreatitis due to other causes. These typically include epigastric and/or left upper quadrant pain, abdominal tenderness with palpation, and elevated

amylase and lipase levels. (See "Clinical manifestations and diagnosis of acute pancreatitis", section on 'Clinical features'.)

Diagnosis — The diagnosis of post-ERCP pancreatitis is suspected in patients with new or worsening abdominal pain following ERCP.

The diagnosis is established in patients with abdominal pain who have elevated amylase and/or lipase >3 times the upper limit of normal more than 24 hours after ERCP and who require hospital admission or prolongation of a planned postprocedure admission [9-11].

Abdominal imaging is not required for the diagnosis, although imaging (eg, computed tomography [CT] scan) may be obtained to exclude other causes of postprocedure abdominal pain (eg, duodenal perforation) when the diagnosis of post-ERCP pancreatitis is uncertain. (See 'Differential diagnosis' below.)

Cases of post-ERCP pancreatitis that were established with radiographic imaging have been reported in patients with elevated amylase levels in the absence of abdominal pain [108]. However, we do not routinely check amylase levels in patients without new or worsening abdominal pain after ERCP. Pancreatic enzyme elevations are common following ERCP, although for most patients such elevations are not associated with clinical features of pancreatitis (eg, abdominal pain, abdominal tenderness). The diagnosis of acute pancreatitis is discussed in more detail separately. (See "Clinical manifestations and diagnosis of acute pancreatitis", section on 'Diagnosis'.)

If pancreatic enzyme levels that were obtained shortly after ERCP are normal but the suspicion for acute pancreatitis remains high, the patient remains hospitalized, and we repeat laboratory testing at least four hours after the procedure. For patients with acute pancreatitis, amylase and lipase start to rise several hours after the onset of symptoms. Serum amylase rises within 6 to 12 hours of the onset of symptoms, whereas serum lipase rises within four to eight hours of the onset of symptoms and peaks at 24 hours [109]. The accuracy and pattern of pancreatic enzyme elevations in patients with acute pancreatitis are discussed in more detail separately. (See "Clinical manifestations and diagnosis of acute pancreatitis", section on 'Pancreatic enzymes and products'.)

Differential diagnosis — For patients with abdominal pain following ERCP, the differential diagnosis includes:

- **Perforation** – Patients with a duodenal perforation may present with diffuse abdominal pain, abdominal distension, abdominal tenderness, fever, and/or leukocytosis. Timing for the onset of symptoms typically ranges from immediately to several hours after ERCP. If

perforation is suspected, abdominal imaging (eg, CT scan) should be obtained to exclude free air (intraperitoneal or retroperitoneal). (See "Post-ERCP perforation", section on 'Clinical manifestations and diagnosis'.)

- **Abdominal pain from gas insufflation** – Gas insufflation distends the bowel and may lead to post-ERCP abdominal pain. Patients typically have abdominal distension on physical examination.

  We usually use carbon dioxide for insufflating the gastrointestinal lumen during endoscopy because carbon dioxide is rapidly absorbed by the mucosa. In addition, data suggest that use of carbon dioxide results in less postprocedural abdominal pain, and this is discussed separately. (See "Overview of endoscopic retrograde cholangiopancreatography (ERCP) in adults", section on 'Gas insufflation'.)

For patients in whom the etiology of abdominal pain is uncertain, we obtain imaging (CT scan) to exclude other sources.

Disease severity and management — The severity of acute post-ERCP pancreatitis is classified as follows [12]:

- Mild acute pancreatitis is characterized by the absence of organ failure and local or systemic complications.
- Moderately severe acute pancreatitis is characterized by transient organ failure (resolves within 48 hours) and/or local or systemic complications without persistent organ failure (>48 hours).
- Severe acute pancreatitis is characterized by persistent organ failure that may involve one or multiple organs.

The classification and predictors of severity are reviewed in more detail elsewhere. (See "Predicting the severity of acute pancreatitis".)

The management of post-ERCP pancreatitis is the same as that for acute pancreatitis from other causes, and this is discussed in detail separately. (See "Management of acute pancreatitis".)

Most episodes of post-ERCP pancreatitis are mild and require only a short hospital stay for bowel rest and intravenous hydration [14]. Patients who develop severe pancreatitis may require prolonged hospitalization in the intensive care unit with nutritional support. The complications of and prognosis for patients with acute pancreatitis are discussed separately.

(See "Clinical manifestations and diagnosis of acute pancreatitis", section on 'Natural history and complications'.)

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Acute pancreatitis" and "Society guideline links: Endoscopic retrograde cholangiopancreatography (ERCP)".)

INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Beyond the Basics topics (see "Patient education: ERCP (endoscopic retrograde cholangiopancreatography) (Beyond the Basics)" and "Patient education: Acute pancreatitis (Beyond the Basics)")

SUMMARY AND RECOMMENDATIONS

- **Background** – Acute pancreatitis is the most frequent adverse event associated with endoscopic retrograde cholangiopancreatography (ERCP), and it can lead to serious complications including pancreatic necrosis and organ failure. The reported overall incidence of post-ERCP pancreatitis has ranged from 3.5 to 9.7 percent. (See 'Definition and epidemiology' above.)

- **Risk factors** – The development of post-ERCP pancreatitis is likely related to increased pressure within the main pancreatic duct that results from periampullary inflammation caused by instrumentation during ERCP. Thus, some risk factors are related to increased inflammation in the region of the ampulla and pancreatic head (table 1). (See 'Risk factors' above.)

- **Preventive strategies** – The goal of prevention is to reduce the risk of post-ERCP pancreatitis and associated adverse events (eg, organ failure, pancreatic necrosis). Preventive strategies typically include a combination of pharmacologic prophylaxis and endoscopic techniques. For some higher-risk patients, additional interventions such as pancreatic duct stenting may be used:

  - **Pharmacologic prophylaxis** – For patients undergoing ERCP, we suggest pharmacologic prophylaxis with a rectally administered nonsteroidal anti-inflammatory drug (NSAID) rather than no drug prophylaxis because rectal NSAIDs are effective for lowering the risk of post-ERCP pancreatitis (**Grade 2B**). We typically give indomethacin suppository 100 mg or diclofenac suppository 100 mg immediately before ERCP. (See 'Rectal nonsteroidal anti-inflammatory drugs' above.)

  - **General endoscopic strategies** – Endoscopic strategies for reducing the risk of post-ERCP pancreatitis include (see 'Preventive endoscopic techniques' above):

    - Using techniques that minimize trauma to biliary orifice (limiting cannulation attempts, guidewire-assisted cannulation method)

    - Reserving pancreatic duct manipulation for patients in whom evaluation of the pancreatic duct is required

  - **Pancreatic duct stenting** – The decision to place a prophylactic pancreatic stent is individualized and informed by patient risk factors, technical factors encountered during the procedure, risk of adverse events associated with stenting, endoscopist expertise, and endoscopist preference. The technical aspects and adverse events associated with prophylactic pancreatic stent placement are discussed separately. (See "Prophylactic pancreatic stents to prevent ERCP-induced pancreatitis: When do you use them?".)

- **Patients with post-ERCP pancreatitis**

  - **Clinical manifestations and diagnosis** – The diagnosis of post-ERCP pancreatitis is suspected in patients with new or worsening abdominal pain following ERCP. (See

'Patients with post-ERCP pancreatitis' above.)

The diagnosis is established in patients with abdominal pain who have elevated amylase and/or lipase >3 times the upper limit of normal more than 24 hours after ERCP and who require hospital admission or prolongation of a planned postprocedure admission.

- **Management** – The management of post-ERCP pancreatitis is the same as that for acute pancreatitis from other causes, and this is discussed in detail separately. (See "Management of acute pancreatitis".)

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Topic 629 Version 40.0

GRAPHICS

Risk factors for post-ERCP pancreatitis

Procedure-related factors	Patient-related factors
▪ Difficult cannulation of the bile duct* ▪ Repeated guidewire cannulation into the main pancreatic duct ▪ Multiple injections of contrast material or other fluid into the main pancreatic duct ▪ Balloon dilation of an intact biliary sphincter ▪ Pancreatic sphincterotomy ▪ Endoscopic snare papillectomy	▪ Younger age (<55 years) ▪ Female sex ▪ History of pancreatitis related to ERCP or any cause ▪ Suspected type I or II sphincter of Oddi dysfunction

Refer to UpToDate content on preventing post-ERCP pancreatitis.

ERCP: endoscopic retrograde cholangiopancreatography.

* We generally limit the number of cannulation attempts to ≤5 attempts (or maximum duration of 5 minutes) because trauma to the biliary orifice has been associated with post-ERCP pancreatitis.

Graphic 138341 Version 1.0

Contributor Disclosures

Andrea Tringali, MD, PhD Consultant/Advisory Boards: Boston Scientific [Cholangioscopy]; Olympus [Cholangioscopy]. All of the relevant financial relationships listed have been mitigated. **Silvano Loperfido, MD** No relevant financial relationship(s) with ineligible companies to disclose. **Guido Costamagna, MD, FACG** Grant/Research/Clinical Trial Support: Boston Scientific [Endoscopic retrograde cholangiopancreatography]; Cook [Endoscopic retrograde cholangiopancreatography]; Olympus [Endoscopic retrograde cholangiopancreatography]. Consultant/Advisory Boards: Cook [Endoscopic retrograde cholangiopancreatography, therapeutic endoscopy]; Olympus [Endoscopic retrograde cholangiopancreatography, therapeutic endoscopy]. All of the relevant financial relationships listed have been mitigated. **Douglas G Adler, MD, FACG, AGAF, FASGE** Consultant/Advisory Boards: Abbvie [Endoscopy]; Boston Scientific [Endoscopy]; Endorotor [Endoscopy]; Merit [Endoscopy]; Olympus [Endoscopy]. Speaker's Bureau: Abbvie [Pancreatology, general GI]. All of the relevant financial relationships listed have been mitigated. **Kristen M Robson, MD, MBA, FACG** No relevant financial relationship(s) with ineligible companies to disclose.

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Conflict of interest policy

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