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# Overview of endoscopic retrograde cholangiopancreatography (ERCP) in adults

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Literature review current through: **Sep 2023**.

This topic last updated: **Jun 26, 2023**.

## INTRODUCTION

Endoscopic retrograde cholangiopancreatography (ERCP) is an advanced endoscopic procedure in which a specialized side-viewing upper endoscope is guided into the duodenum, allowing for instruments to be passed through the ampulla of Vater and into the biliary and pancreatic ducts. The ducts are opacified by injecting a contrast medium, thereby permitting radiographic visualization and therapeutic interventions. ERCP-guided interventions are used for management of a variety of pancreaticobiliary disorders (eg, removal of bile duct stones, relief of biliary obstruction).

ERCP is a complex procedure that requires specialized training and experience, and it is associated with higher rates of serious complications than other endoscopic procedures (eg, upper endoscopy, colonoscopy). It is important to use strategies to prevent ERCP-related complications and to recognize complications early so that treatment can be initiated.

This topic will provide an overview of ERCP including indications, patient preparation, post-procedure care, and complications.

Specific ERCP-guided interventions are discussed separately:

- (See "[Endoscopic stenting for malignant biliary obstruction](#)".)
- (See "[Endoscopic balloon dilation for removal of bile duct stones](#)".)

- (See ["Endoscopic management of postcholecystectomy biliary complications"](#).)
- (See ["Pancreatic stenting at endoscopic retrograde cholangiopancreatography \(ERCP\): Indications, techniques, and complications"](#).)

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## PATIENT SELECTION

**Indications** — The role of ERCP in managing pancreaticobiliary disorders is mostly a therapeutic one because other methods of diagnostic testing (eg, magnetic resonance imaging with magnetic resonance cholangiopancreatography, endoscopic ultrasound) provide high diagnostic accuracy without the risks associated with ERCP (eg, acute pancreatitis) [1]. In addition, the use of ERCP appears to be increasing with time, despite the focus on therapeutic indications only [2].

Indications for ERCP-guided interventions include [3-5]:

- Choledocholithiasis (see ["Choledocholithiasis: Clinical manifestations, diagnosis, and management"](#)).
- Acute cholangitis (see ["Acute cholangitis: Clinical manifestations, diagnosis, and management"](#)).
- Drainage of malignant biliary obstruction (eg, pancreatic cancer, hilar cholangiocarcinoma) (see ["Endoscopic stenting for malignant biliary obstruction"](#)).
- Post-surgical biliary complications (eg, biliary stricture, bile leak) (see ["Liver transplantation in adults: Endoscopic management of biliary adverse events"](#) and ["Endoscopic management of postcholecystectomy biliary complications"](#)).
- Management of complications related to acute or chronic pancreatitis (eg, pancreatic duct stricture, pancreatic stones) (see ["Pancreatic stenting at endoscopic retrograde cholangiopancreatography \(ERCP\): Indications, techniques, and complications"](#)).
- Extrahepatic biliary strictures related to primary sclerosing cholangitis (see ["Primary sclerosing cholangitis in adults: Management"](#), section on 'Endoscopic therapy').
- Endoscopic therapy for some patients with sphincter of Oddi dysfunction .

**Contraindications** — ERCP is usually contraindicated in conditions where the risk of complications is high, and thus, the risks outweigh the potential benefits of the procedure. However, some patients who are at high risk for complications, such as those with acute severe

cholangitis associated with sepsis and cardiorespiratory dysfunction, may undergo interventional ERCP to relieve biliary obstruction because of the high risk of mortality related to severe cholangitis. (See ["Acute cholangitis: Clinical manifestations, diagnosis, and management"](#), section on 'Prognosis'.)

Relative contraindications to ERCP include:

- Patients who cannot tolerate monitored anesthesia care or general anesthesia (see ["Anesthesia for gastrointestinal endoscopy in adults"](#))
- Patients with an untreated hemostatic disorder who are deemed to be at high risk for bleeding by the advanced endoscopist (see ["Gastrointestinal endoscopy in patients with disorders of hemostasis"](#))
- Patients with gastrointestinal (luminal) obstruction may undergo endoscopy, but the examination is limited to an area proximal to the level of obstruction (see ["Enteral stents for the palliation of malignant gastroduodenal obstruction"](#))
- Patients with type III sphincter of Oddi dysfunction

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## PATIENT PREPARATION

The preprocedure preparation for patients undergoing ERCP is similar to that described for patients undergoing upper gastrointestinal endoscopy with the following additions:

- Preprocedure testing – Most patients who require interventional ERCP will have had laboratory tests (eg, complete blood count and prothrombin time/international normalized ratio, liver biochemical tests, pancreatic enzymes) as part of the diagnostic evaluation for the underlying condition, thereby mitigating the need additional laboratory testing. (See ["Overview of upper gastrointestinal endoscopy \(esophagogastroduodenoscopy\)"](#), section on 'Patient preparation'.)
- Adjusting medications – The management of antiplatelet and anticoagulant therapy in patients undergoing ERCP is typically individualized, managed in conjunction with the prescribing specialist, and is discussed separately. (See ["Management of antiplatelet agents in patients undergoing endoscopic procedures"](#) and ["Management of anticoagulants in patients undergoing endoscopic procedures"](#).)
- Sedation/anesthesia – The procedure is typically performed using monitored anesthesia care or general anesthesia. Anesthetic management for endoscopic procedures including

preprocedure fasting is discussed separately. (See ["Anesthesia for gastrointestinal endoscopy in adults"](#).)

- Antibiotic prophylaxis – The use of antibiotic prophylaxis is determined by patient's risk factors for procedure-related infection. For example, patients with malignant hilar obstruction in whom complete biliary drainage is unlikely receive antibiotic prophylaxis ( [table 1](#)). The risk factors for infection and prophylactic antibiotic regimens are discussed separately. (See ["Antibiotic prophylaxis for gastrointestinal endoscopic procedures"](#).)
- Patients with allergy to radiologic contrast – Adverse reactions to contrast agents for ERCP are very rare, as contrast agents are not injected intravenously but instead are used to opacify the biliary and pancreatic ducts [6,7]. Thus, preprocedure measures are not typically needed for patients with a history of allergy to iodinated contrast. (See ["Patient evaluation prior to oral or iodinated intravenous contrast for computed tomography"](#) and ["Uncommon complications of endoscopic retrograde cholangiopancreatography \(ERCP\)"](#), section on 'Contrast allergy'.)
- Patients with cardiac implantable electronic devices – During ERCP, electrocautery using monopolar current is used for sphincterotomy. Patients with cardiac implantable electronic devices require a preprocedure evaluation for compatibility with monopolar current, and this is discussed separately. (See ["Perioperative management of patients with a pacemaker or implantable cardioverter-defibrillator"](#).)

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## INFORMED CONSENT

The process of informed procedural consent is based upon the interactions between the clinician and the patient and includes a clear explanation of the procedure and its risks, benefits, and alternatives. Informed procedural consent is discussed in more detail separately. (See ["Informed procedural consent"](#).)

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## PROCEDURE

**Positioning** — ERCP is typically performed with the patient in the prone position. However, ERCP can be performed in the supine position if needed. As an example, supine positioning may be required for patients with a recent abdominal surgical wound or with external drains or tubes. The supine position may be also chosen to improve fluoroscopic visualization of hilar anatomy or to facilitate airway management.

Performing ERCP with the patient in the supine position may be more technically challenging for some endoscopists as some adjustment in endoscopic technique is required. However, data have suggested that outcomes (ie, cannulation rates, procedure times) were not significantly different for ERCP that is performed with the patient in the supine position compared with the prone position [8].

ERCP can be performed with the patient in the left lateral decubitus position which may be more comfortable for some patients, particularly those with conditions such as limited cervical movement, pregnancy, or recent abdominal surgery. However, interpretation of fluoroscopic images of the main hepatic confluence, intrahepatic bile ducts, and pancreatic duct is not as reliable in the left lateral position, and thus the left lateral position is not generally used during ERCP [9-11].

**Gas insufflation** — We use carbon dioxide for insufflating the gastrointestinal lumen during ERCP, and use of carbon dioxide is increasingly common during gastrointestinal endoscopy. (See "[Overview of colonoscopy in adults](#)", section on '[Colonoscope advancement and mucosal inspection](#)'.)

Gas insufflation distends the bowels and may lead to post-ERCP abdominal pain. However, carbon dioxide is rapidly absorbed by the gastrointestinal mucosa and delivered to the lungs by the circulation, whereas ambient air is not readily absorbed [12].

Data have suggested that carbon dioxide insufflation during ERCP resulted in less post-procedure pain but without increased risk of cardiopulmonary complications [13,14]. In a meta-analysis of nine trials including 1014 patients who underwent ERCP, carbon dioxide insufflation resulted in less abdominal pain at one hour, three hours, and six hours after ERCP compared with air insufflation [13]. Carbon dioxide use resulted in lower risk of complications overall (odds ratio [OR] 0.59, 95% CI 0.37-0.93). A concern with carbon dioxide insufflation has been the possible association with increased risk of hypercapnia [15], but this has not been supported by most studies [16-18].

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## POST-PROCEDURE CARE

After the procedure, patients are recovered from anesthesia, and this is discussed separately. (See "[Anesthesia for gastrointestinal endoscopy in adults](#)", section on '[Post-anesthesia care](#)'.)

Routine post-procedure care includes:

- Post-procedure monitoring – For patients who undergo ERCP on an outpatient basis, the duration of post-procedure monitoring ranges from two to six hours to observe the patient for early complications such as pancreatitis. Some advanced endoscopists routinely admit patients to the hospital for one night after the procedure.
- Diet – Following the procedure, most advanced endoscopists instruct patients who are at increased risk for complications such as pancreatitis to resume a diet limited to clear liquids for the first 24 hours after ERCP [19]. Such patients may then resume their normal diet if they tolerate clear liquids. Risk factors for post-ERCP pancreatitis (eg, difficult cannulation of the ampulla, prior history of pancreatitis) are discussed separately. (See ["Post-endoscopic retrograde cholangiopancreatography \(ERCP\) pancreatitis", section on 'Definition and epidemiology'.](#))

Patients without risk factors for complications are instructed to consume clear liquids only for four to six hours after ERCP (or for the remainder of the day if the procedure was performed in the late afternoon). If clear liquids are tolerated, then patients may advance to solid food [20].

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## COMPLICATIONS

**Incidence** — ERCP is generally regarded as a safe procedure. However, ERCP has been associated with a higher rate of complications than most other endoscopic procedures despite technologic advances, adherence to safety protocols, and advanced endoscopy training programs [21]. (See ["Overview of colonoscopy in adults", section on 'Adverse events'.](#))

Reported rates of ERCP-related complications overall have ranged from 7 to 12 percent, and mortality rates have ranged from 0.1 to 1.4 percent [22-26]. As an example, in a systematic review of 21 studies involving 16,855 patients who underwent ERCP, the overall complication rate was 7 percent, and the rate of serious complications was 2 percent [26]. Furthermore, despite technologic progress and safety measures, rates of procedure-related mortality have not decreased over time [2]. One possible reason is that ERCP has evolved into mainly a therapeutic procedure; thus, the procedure-related risks include those associated with the diagnostic examination and with the intervention. (See ['Risk factors'](#) below.)

Data have suggested that all-cause mortality rates beyond 30 days post-ERCP were higher compared with rates within the 30-day window; however, deaths were most often related to underlying disease. In a registry study including over 16,000 patients who underwent ERCP, all-cause mortality rates at three months post-ERCP were higher compared with rates within 30

days (12 versus 5 percent) [27]. Most deaths that occurred beyond 30 days post-procedure were due to cancer (75 percent) [27].

**Risk factors** — Some ERCP-related complications are due to the effect of procedural sedation (eg, hypotension), while others are due to the endoscopy itself or to an intervention. (See ['Anesthesia-related complications'](#) below.)

Observational studies have identified risk factors for ERCP-related complications [2,25,28-37]:

- Procedure-related factors (eg, difficulty of cannulation, biliary sphincterotomy, precut [access] sphincterotomy) (see ["Precut \(access\) papillotomy"](#)).
- Patient-related factors (eg, surgically-altered anatomy, sphincter of Oddi dysfunction, periampullary diverticulum, cirrhosis, older age, and end-stage kidney disease).
- Hospital- and advanced endoscopist-related factors (eg, low ERCP case volume, procedure timing for selected conditions [eg, acute cholangitis]) [38].

Hospital and endoscopist procedure volume has been linked to risk of complications [39-41]. In a systematic review including 13 studies and nearly 60,000 ERCPs, higher endoscopist-related procedure volume was associated with lower risk of adverse events compared with lower procedure volume (ie, <25 to <156 ERCPs annually) (odds ratio [OR], 0.65; 95% CI, 0.50-0.83) [40].

Complications related to ERCP have also been characterized based on the following factors [42,43]:

- Location – Complications may be focal, occurring at the point of endoscopic contact (eg, perforation, bleeding, pancreatitis), or a complication may affect an organ system (eg, cardiopulmonary) that was not traversed or touched by the endoscope or its related devices.
- Timing – Complications may occur early (typically within 30 days after the procedure) or late (beyond 30 days).
- Severity – The severity of complications can be assessed by duration and type of hospital stay (eg, intensive care unit); blood transfusion requirement; need for surgical, radiologic, or endoscopic interventions; and rates of morbidity and mortality ( [table 2](#)).

**Specific ERCP-related complications** — The most frequently encountered serious post-ERCP complications are pancreatitis, bleeding, infection, and perforation [22-25].



**Pancreatitis** — Acute pancreatitis is a serious complication of ERCP that may result from mechanical injury to the pancreatic duct, hydrostatic injury from contrast injection or guidewire manipulation. Risk factors, prevention, and management of post-ERCP pancreatitis are discussed separately. (See "[Post-endoscopic retrograde cholangiopancreatography \(ERCP\) pancreatitis](#)".)

**Bleeding** — Bleeding during ERCP is typically related to instrumentation such as biliary and/or pancreatic sphincterotomy. Prevention and management of post-ERCP bleeding are discussed separately. (See "[Post-endoscopic retrograde cholangiopancreatography \(ERCP\) bleeding](#)".)

**Infection** — Infections occurring after ERCP may be related to incomplete drainage of an infected biliary system, obstruction of the cystic duct, infected pancreatic fluid collection, or rarely, contaminated endoscopic equipment. The prevention and management of infectious complications related to ERCP are discussed separately:

- (See "[Infectious adverse events related to endoscopic retrograde cholangiopancreatography \(ERCP\)](#)".)
- (See "[Preventing infection transmitted by gastrointestinal endoscopy](#)".)
- (See "[Antibiotic prophylaxis for gastrointestinal endoscopic procedures](#)".)

**Perforation** — ERCP may be complicated by perforation of the esophagus, stomach, or small intestine. The risk factors, diagnosis, and management of post-ERCP perforation are presented separately. (See "[Post-ERCP perforation](#)".)

**Other complications** — Several rare complications have been associated with ERCP including gas embolism, pneumothorax, and pneumoperitoneum. These and other uncommon complications are discussed separately. (See "[Uncommon complications of endoscopic retrograde cholangiopancreatography \(ERCP\)](#)".)

**Sphincterotomy-related complications** — Biliary sphincterotomy refers to cutting the biliary sphincter and intraduodenal segment of the common bile duct using high frequency current applied with a sphincterotome that is inserted into the papilla [44]. Sphincterotomy is often used to facilitate biliary interventions such as stone extraction.

Rates of sphincterotomy-related complications overall have ranged from 3 to 12 percent [45]. Sphincterotomy-related perforations are typically retroperitoneal. Other interventions that are performed in addition to sphincterotomy (eg, stone extraction, biliary stent placement) may also contribute to the risk of complications. Rates of specific sphincterotomy-related complications (eg, bleeding, pancreatitis) are discussed separately. (See "[Endoscopic biliary sphincterotomy](#)".)



**Anesthesia-related complications** — Complications related to procedural sedation and anesthesia (eg, hypoxemia, hypotension) are discussed separately [46]. (See ["Anesthesia for gastrointestinal endoscopy in adults"](#), section on 'Complications' and ["Adverse events related to procedural sedation for gastrointestinal endoscopy in adults"](#).)

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## SPECIAL POPULATIONS

**Patients with surgically-altered anatomy** — For patients with surgically-altered anatomy (eg, Roux-en-Y anatomy), it is frequently challenging or impossible to access the ampulla of Vater (or the bilioenteric/pancreatoenteric anastomosis) using a standard duodenoscope due to the length of the small bowel that must be traversed. To overcome these issues, innovative approaches to ERCP have been developed. These approaches are discussed separately:

- (See ["Endoscopic retrograde cholangiopancreatography \(ERCP\) after Billroth II reconstruction"](#).)
- (See ["ERCP in patients with Roux-en-Y anatomy"](#).)

**Pregnant patients** — Pregnancy is associated with an increased risk of gallstone formation, and some pregnant patients develop complications related to gallstones that require intervention. The approach to performing ERCP in pregnant patients while minimizing risk to the mother and fetus are discussed separately. (See ["Endoscopic retrograde cholangiopancreatography \(ERCP\) in pregnancy"](#).)

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## QUALITY INDICATORS

Multiple quality indicators have been proposed for ERCP [4,47]:

- Documenting appropriate indication for ERCP (performance target >90 percent)
- Achieving cannulation of the ducts of interest in patients with a native papilla and without surgically-altered anatomy (performance target >90 percent)
- Achieving extraction of common bile duct stones that are <1 cm in size in patients with normal bile duct anatomy (performance target ≥90 percent)
- Successful stent insertion for patients with nonhilar biliary obstruction (performance target ≥90 percent)
- Tracking rates of post-ERCP pancreatitis (no specific benchmark was provided)

Proficiency in ERCP is based on achievement of cannulation, accurately interpreting endoscopic and radiologic images, and successful sphincterotomy and stent placement when necessary.

Determination of competency varies by geographic region. Specialty societies have published guidance on privileging and credentialing [48], and guidelines from the American Society for Gastrointestinal Endoscopy (ASGE) can be found [here](#).

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## MALPRACTICE

Little is known about the financial burden of specific endoscopic complications in terms of claims against clinicians for compensation, but studies have looked at malpractice claims related to endoscopic procedures [21,49-51]. In a database study including 1901 endoscopy-related closed claims from a trade association of professional liability insurance carriers, 217 closed claims (11 percent) involved ERCP, while colonoscopy cases were the most commonly reported (788 claims [41 percent]) [50]. In terms of mean payment amount, ERCP ranked the highest per claim (USD \$374,794). Claim payments for colonoscopy and ERCP increased over time, with an average increase of 16 percent per year for colonoscopy and 22 percent per year for ERCP.

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## 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: Endoscopic retrograde cholangiopancreatography \(ERCP\)](#)".)

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## 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 5<sup>th</sup> to 6<sup>th</sup> 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 10<sup>th</sup> to 12<sup>th</sup> 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 \(endoscopic retrograde cholangiopancreatography\) \(Beyond the Basics\)](#)")
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## SUMMARY AND RECOMMENDATIONS

- Endoscopic retrograde cholangiopancreatography (ERCP) is an advanced endoscopic procedure in which a specialized side-viewing upper endoscope is guided into the duodenum, allowing for instruments to be passed through the ampulla of Vater and into the biliary and pancreatic ducts. The ducts are opacified by injecting a contrast medium, thereby permitting radiographic visualization and therapeutic interventions. (See '[Introduction](#)' above.)
- The role of ERCP in managing pancreaticobiliary disorders is mostly a therapeutic one because other methods of diagnostic testing (eg, magnetic resonance cholangiopancreatography, endoscopic ultrasound) provide high diagnostic accuracy without the risk of ERCP-related complications. Indications for ERCP-guided interventions include choledocholithiasis, endoscopic therapy for biliary strictures, and drainage of malignant biliary obstruction. (See '[Indications](#)' above.)
- ERCP is typically performed with the patient in the prone position. However, ERCP can be performed in the supine position if needed (eg, patients with a recent abdominal surgical wound). (See '[Procedure](#)' above.)
- ERCP is generally regarded as a safe procedure. However, ERCP is associated with higher rates of complications than most other endoscopic procedures despite technologic advances, adherence to safety protocols, and advanced endoscopic training programs. Reported rates of ERCP-related complications overall have ranged from 7 to 12 percent, and mortality rates have ranged from 0.1 to 1.4 percent. (See '[Incidence](#)' above.)
- Risk factors for ERCP-related complications include (see '[Risk factors](#)' above):
  - Procedure-related factors (eg, difficulty of cannulation, biliary sphincterotomy, precut [access] sphincterotomy)
  - Patient-related factors (eg, surgically-altered anatomy, sphincter of Oddi dysfunction, periampullary diverticulum)
  - Hospital- and advanced endoscopist-related factors (eg, low ERCP case volume, procedure timing for selected conditions [eg, acute cholangitis])

- The most frequently encountered serious post-ERCP complications are:
  - Pancreatitis (see "[Post-endoscopic retrograde cholangiopancreatography \(ERCP\) pancreatitis](#)")
  - Bleeding (see "[Post-endoscopic retrograde cholangiopancreatography \(ERCP\) bleeding](#)")
  - Infection (see "[Infectious adverse events related to endoscopic retrograde cholangiopancreatography \(ERCP\)](#)")
  - Perforation (see "[Post-ERCP perforation](#)")
- Quality indicators can be monitored to help assure that ERCP is performed safely. Quality indicators may include documentation of the rates of cannulation of the common bile duct, extraction of common bile duct stones, successful stent insertion, and post-ERCP pancreatitis. (See '[Quality indicators](#)' above.)

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## GRAPHICS

### Patients who require antibiotic prophylaxis for endoscopic procedures

Patient group	Procedures that require prophylaxis	Comments*
<b>Specific patient groups</b>		
Patients with cirrhosis and acute GI bleeding	All endoscopic procedures	Patients with cirrhosis and acute GI bleeding require antibiotics as part of their routine treatment, even if they are not undergoing an endoscopic examination.
Cirrhosis with ascites	Procedures that are high risk for infection or bacteremia <sup>¶</sup>	Studies supporting using prophylactic antibiotics in patients with cirrhosis and ascites are lacking. We believe it is prudent to provide prophylaxis in this group of patients, given the risk of bacterial translocation.
Severe neutropenia (ANC <500 cells/mm <sup>3</sup> ) Advanced hematologic malignancy	Procedures that are high risk for infection or bacteremia <sup>¶</sup>	Studies supporting using prophylactic antibiotics in patients at increased risk for infection are lacking. We believe it is prudent to provide prophylaxis in this group of patients, given their increased risk for infection.  Prophylaxis is not recommended for patients who are immunocompromised for other reasons.
Synthetic vascular grafts within six months of graft placement	Procedures that are high risk for infection or bacteremia <sup>¶</sup>	When possible, elective procedures should be performed before a synthetic graft is placed or delayed for six months following graft placement. If a procedure is necessary within six months of graft placement, we generally

		will give antibiotic prophylaxis for high-risk procedures.
Procedure	Patients/conditions that require prophylaxis	Comments*
<b>For patients NOT falling into one of the above mentioned groups</b>		
Upper endoscopy		
<ul style="list-style-type: none"> <li>With or without biopsy, polypectomy, esophageal stricture dilation, endoscopic sclerotherapy, or band ligation of varices</li> </ul>	None	
<ul style="list-style-type: none"> <li>With PEG/PEJ tube insertion</li> </ul>	All patients	The ASGE guidelines recommend pre-procedural screening for MRSA in areas where MRSA is endemic and attempting decontamination before placing the feeding tube.
Colonoscopy or flexible sigmoidoscopy, with or without biopsy or polypectomy	None	Patients undergoing peritoneal dialysis should have the procedure done with the peritoneum empty. However, this recommendation differs from that of the ASGE, which recommends antibiotic prophylaxis for patients undergoing peritoneal dialysis prior to lower GI endoscopy, and the ISPD, which recommends antibiotic prophylaxis for patients undergoing colonoscopy with polypectomy.
ERCP	<p>Cholangitis</p> <p>Biliary obstruction without cholangitis if complete drainage is unlikely (eg, in patients with malignant hilar carcinoma or primary sclerosing cholangitis)</p> <p>Biliary complications following liver transplantation if drainage</p>	<p>Patients with cholangitis should receive antibiotics as part of their routine treatment. Additional prophylaxis is not required.</p> <p>If drainage is not successful, antibiotics should be started. Once drainage has been established, antibiotics can be</p>

	is unlikely	discontinued if there is no cholangitis.
EUS-FNA of cystic lesions	Mediastinal cysts	The ASGE recommends antibiotic prophylaxis for all patients undergoing EUS-FNA of cystic lesions. However, we reserve it for patients with mediastinal cysts since they appear to be at increased risk of infection. We do not provide antibiotic prophylaxis for EUS-FNA of pancreatic cysts because there are insufficient data to support their use in this setting. Antibiotics are typically continued for three to five days after the procedure.
EUS-FNA of solid lesions along the GI tract	None	
Interventional EUS procedures <sup>Δ</sup> , natural orifice transluminal endoscopic surgery (NOTES)	All patients	

NOTE: Refer to other table on antibiotic prophylaxis for endoscopic procedures for specific regimens.

GI: gastrointestinal; ANC: absolute neutrophil count; AHA: American Heart Association; ASGE: American Society for Gastrointestinal Endoscopy; PEG: percutaneous endoscopic gastrostomy; PEJ: percutaneous endoscopic jejunostomy; MRSA: methicillin-resistant *Staphylococcus aureus*; ISPD: the International Society for Peritoneal Dialysis; ERCP: endoscopic retrograde cholangiopancreatography; EUS: endoscopic ultrasound; FNA: fine-needle aspiration.

\* The recommendations in this table are generally consistent with guidelines from the ASGE and AHA except as noted here.

¶ Procedures that are high risk for bacteremia or infection include dilation of esophageal strictures, endoscopic sclerotherapy, ERCP, EUS-FNA, and PEG/PEJ tube placement.

Δ Interventional EUS procedures include drainage of walled-off pancreatic necrosis, biliary drainage, and fine-needle injection of cysts/tumors.

Recommendations summarized from:

1. ASGE Standards of Practice Committee, Khashab MA, Chithadi KV, et al. Antibiotic prophylaxis for GI endoscopy. *Gastrointest Endosc* 2015; 81:81.
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Graphic 99536 Version 5.0

## Grading system for the major complications of endoscopic retrograde cholangiopancreatography (ERCP) and endoscopic sphincterotomy

	<b>Mild</b>	<b>Moderate</b>	<b>Severe</b>
<b>Pancreatitis</b>	Amylase at least three times normal at more than 24 hours after the procedure, requiring admission or prolongation of planned admission to two to three days	Hospitalization of 4 to 10 days	Hospitalization of more than ten days, hemorrhagic pancreatitis, phlegmon or pseudocyst, or intervention (percutaneous drainage or surgery)
<b>Bleeding</b>	Clinical (not just endoscopic) evidence of bleeding, hemoglobin drop <3 g, and no need for transfusion	Transfusion (four units or less), no angiographic intervention or surgery	Transfusion (five units or more) or intervention (angiographic or surgical)
<b>Cholangitis</b>	Temperature of >38°C for 24 to 48 hours	Febrile or septic illness requiring more than three days of hospital treatment or endoscopic or percutaneous intervention	Septic shock or surgery
<b>Perforation</b>	Possible, or only very slight leak of fluid or contrast, treatable by fluids and suction for three days or less	Any definite perforation treated medically for 4 to 10 days	Medical treatment for more than 10 days, or intervention (percutaneous or surgical)

*Adapted with permission from: Cotton PB, et al. Endoscopic sphincterotomy complications and their management: An attempt at consensus. Gastrointest Endosc 1991; 37:383.*

Graphic 71241 Version 7.0

## Contributor Disclosures

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Contributor disclosures are reviewed for conflicts of interest by the editorial group. When found, these are addressed by vetting through a multi-level review process, and through requirements for references to be provided to support the content. Appropriately referenced content is required of all authors and must conform to UpToDate standards of evidence.

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