Overview of upper gastrointestinal endoscopy (esophagogastroduodenoscopy)

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INTRODUCTION

Upper gastrointestinal (GI) endoscopy (esophagogastroduodenoscopy [EGD]) includes visualization of the oropharynx, esophagus, stomach, and proximal duodenum, with real-time assessment and interpretation of the findings encountered. This topic will review factors associated with performing an upper endoscopy, including indications, patient preparation, technical aspects, tissue sampling, and complications. Detailed discussions of specific diagnostic and therapeutic interventions carried out during an upper endoscopy and special considerations for upper endoscopy in the setting of the COVID-19 pandemic are presented separately. (See "Endoscopic interventions for nonmalignant esophageal strictures in adults" and "Methods to achieve hemostasis in patients with acute variceal hemorrhage" and "Overview of the treatment of bleeding peptic ulcers" and "Barrett's esophagus: Surveillance and management" and "Overview of the treatment of achalasia" and "Overview of endoscopic resection of gastrointestinal tumors" and "COVID-19: Issues related to gastrointestinal disease in adults", section on 'Implications for endoscopy' and "Wireless video capsule endoscopy".)

PATIENT SELECTION

Indications — In general, upper endoscopy is recommended if the results are likely to influence management of the patient, if empiric treatment for a suspected benign disorder has been

unsuccessful, if the procedure can be used as an alternative to or to investigate a finding on radiographic evaluation, or if a therapeutic maneuver may be needed. Diagnostic, screening/surveillance, and therapeutic indications for upper endoscopy are outlined in the table (table 1) [1]. In addition, upper endoscopy is indicated if the results would affect the management of other diseases (eg, a patient with a history of upper gastrointestinal (GI) bleeding who requires anticoagulation or treatment with a nonsteroidal anti-inflammatory drug). Upper endoscopy is generally not indicated when the results will not affect management or for periodic surveillance of benign lesions unless surveillance of a premalignant condition is warranted.

Contraindications — Relative contraindications for upper GI endoscopy include:

- Patients who cannot tolerate moderate sedation, monitored anesthesia care (MAC), or general anesthesia in whom unsedated upper endoscopy is not feasible (see "Sedation-free gastrointestinal endoscopy")
- Patients who are hemodynamically unstable
- Patients with GI obstruction
- Patients with abnormal coagulation studies (platelet count <20,000/microL), particularly if biopsies or therapeutic maneuvers are anticipated

In addition, patient selection must take into account not only the indication(s) for the procedure but also patient-related factors, such as comorbid illnesses, that might increase the risk of performing an upper endoscopy or make the examination more difficult. As with any procedure, patients in whom the risks of upper endoscopy are believed to outweigh the benefits should not undergo the procedure. Whether the procedure is urgent or elective, decisions regarding the timing of endoscopy and the management of antiplatelet agents in such patients should involve both the gastroenterologist(s) and prescribing clinician(s) caring for the patient. (See "Management of antiplatelet agents in patients undergoing endoscopic procedures" and "Noncardiac surgery after percutaneous coronary intervention", section on 'Our approach'.)

PREPROCEDURE CONSIDERATIONS

Prior to the procedure, patients should be evaluated for other factors that may affect the ability to safely and successfully perform an upper endoscopy.

Presedation assessment — Patients require a presedation evaluation to identify underlying conditions that may increase risk and to create a plan for procedural sedation that minimizes

risk while managing coexisting medical conditions. Presedation assessment should include an evaluation of the following:

- Anatomic considerations such as a small mouth or a limited range of motion in the jaw (factors that may make it difficult to insert the protective mouth piece), a limited range of motion of the neck that may make correct patient positioning difficult, or the presence of a Zenker's diverticulum, which increases the difficulty and risk of esophageal perforation during esophageal intubation.

- Comorbid illnesses that may increase the risks associated with sedation.

- Use of medications such as benzodiazepines, narcotics, or cannabis that may increase a patient's tolerance to the effects of sedation [2-5]. This includes taking a complete history of factors that might make sedation more difficult, such as prior difficulties with sedation, narcotic or benzodiazepine use, diminished mental capacity, and agitation or severe anxiety. It also includes considering whether the patient has any characteristics that pose an increased risk for aspiration (eg, ascites, nonempty stomach, active bleeding), difficult airway management (eg, obesity, nonvisibility of the uvula, prior history of difficult intubation), or increased cardiopulmonary complications of endoscopy (eg, comorbidities, obesity, older age, etc).

Patient preparation

Diet — Patients should follow preoperative fasting guidelines as they would for any type of anesthetic (table 2). Specifically, the American Society of Anesthesiologists (ASA) guidelines state that patients should fast for a minimum of two hours after ingestion of clear liquids and six hours after ingestion of light meals before sedation is administered. [6]. The period of fasting may need to be longer if there is known or suspected delayed gastric emptying [2]. In emergency situations that cannot be delayed, the airway may need to be protected by endotracheal intubation. (See "Gastrointestinal endoscopy in adults: Procedural sedation administered by endoscopists" and "Adverse events related to procedural sedation for gastrointestinal endoscopy in adults" and "Sedation-free gastrointestinal endoscopy".)

Medications

General guidance — Most medications can be continued up to the time of endoscopy and are usually taken with a small sip of water. The morning doses of some medications may need to be adjusted prior to upper endoscopy, such as medications for diabetes, due to decreased oral intake around the time of the procedure.

Antithrombotics — Decisions regarding the management of antiplatelet agents or anticoagulants must take into account the risk of bleeding engendered by maintaining the patient on the agent through the procedure and the risk of a thromboembolic event if the agent is discontinued in the periprocedural period [7]. In general, aspirin and nonsteroidal anti-inflammatory drugs can be continued safely in patients having an upper endoscopy. (See "Management of anticoagulants in patients undergoing endoscopic procedures" and "Management of antiplatelet agents in patients undergoing endoscopic procedures" and "Gastrointestinal endoscopy in patients with disorders of hemostasis".)

Antibiotic prophylaxis — As the risk of infection related to routine diagnostic upper endoscopy is low, antibiotic prophylaxis is generally not recommended. However, antibiotic prophylaxis for an upper endoscopy is recommended for patients with one of the following:

- Patients with cirrhosis undergoing endoscopy for an acute gastrointestinal (GI) bleed
- Prior to percutaneous endoscopic gastrostomy/jejunostomy tube placement
- Patients with severe neutropenia (absolute neutrophil count <500 cells/mm^3) or advanced hematologic malignancies who are undergoing procedures associated with a high risk of bacteremia (eg, dilation of esophageal strictures, endoscopic sclerotherapy) [8] (table 3 and table 4) (see "Antibiotic prophylaxis for gastrointestinal endoscopic procedures")

Preprocedure testing in selected patients — It is generally recommended that patients **not** undergo routine preprocedure laboratory testing, chest radiography, or electrocardiography [9]. Instead, preprocedure testing should be used selectively based on the patient's medical history, physical examination findings, and procedural risk factors.

Our recommendations are consistent with 2014 guidelines from the American Society for Gastrointestinal Endoscopy (ASGE) that recommend preprocedure testing in the following settings [9]:

Laboratory studies

- Pregnancy testing for females of childbearing potential who provide an uncertain pregnancy history or who have a history suggestive of a current pregnancy (particularly if fluoroscopy is going to be used).
- Coagulation studies for patients with active bleeding, a known or suspected bleeding disorder (including a history of abnormal bleeding), an increased risk of bleeding due to medication use (eg, ongoing anticoagulant use, prolonged antibiotic use), prolonged biliary obstruction, malnutrition, or other conditions associated with acquired

coagulopathies. For patients taking vitamin K antagonists (eg, warfarin), we check an international normalized ratio (INR) prior to the procedure. We do not check coagulation studies for patients who are receiving direct oral anticoagulants if the medication has been held for an appropriate amount of time prior to the procedure (algorithm 1) [10]. (See "Management of anticoagulants in patients undergoing endoscopic procedures", section on 'High or uncertain risk procedures'.)

- Hemoglobin/hematocrit for patients with pre-existing significant anemia or active bleeding, or if there is a high risk of significant blood loss during the procedure.
- Blood typing for patients with active bleeding, anemia, or low platelets who are likely to need a blood transfusion.
- Serum chemistry testing for patients with significant endocrine, renal, or hepatic dysfunction if medications are to be used that may further impair function.

Imaging — Chest radiograph for patients with new respiratory symptoms or decompensated heart failure.

Informed consent — Informed consent is obtained prior to all GI endoscopic procedures. Informed consent is a process that involves discussing the procedure (including administration of sedation) and the associated risks, benefits, alternatives, and limitations. (See "Informed procedural consent".)

PROCEDURE

Equipment — Routine upper endoscopy is performed using a high-definition white-light endoscope. In addition, multiple options are available to enhance visualization during endoscopy, though many require specialized equipment and training. (See "Magnification endoscopy" and "Chromoendoscopy" and "Confocal laser endomicroscopy and endocytoscopy" and "Barrett's esophagus: Evaluation with optical chromoscopy".)

Routine upper gastrointestinal (GI) endoscopy may be broken down into its component parts:

- Oral intubation with the endoscope
- Oropharyngeal examination
- Esophageal examination
- Examination of the esophagogastric junction (EGJ; also referred to as the gastroesophageal junction)
- Gastric examination, including retroflexion

- Traversing the pylorus
- Duodenal examination
- Tissue sampling
- Therapeutic maneuvers

Endoscopic technique

Patient position and topical anesthetic — For upper GI endoscopy, patients are typically placed on their left side with their neck flexed forward. A preprocedure simulation of the up and down maneuver that will be necessary to pass the endoscope from the mouth to the upper esophageal sphincter is recommended to assure proper orientation of all equipment.

Benzocaine spray or gel is used in some endoscopy centers for topical pharyngeal anesthesia. However, it may not improve patient tolerance of the procedure when intravenous sedation is also being used, and it is rarely associated with methemoglobinemia [11]. (See 'Complications' below and "Methemoglobinemia", section on 'Topical anesthetics'.)

Insertion and esophageal intubation — The upper endoscope is introduced into the mouth under direct visualization, allowing for limited visualization of the tongue, other structures in the mouth, and ultimately the hypopharynx. The endoscopist can often view the epiglottis, the vocal cords, both piriform sinuses, and the arytenoid cartilages (picture 1). In patients at risk for squamous neoplasia, particular attention should be given to both raised lesions and flat areas of discoloration with sharp borders in the oropharynx, as well as during inspection of the squamous esophagus below [12].

The cricopharyngeus muscle and esophageal orifice appear below the opening to the trachea, seemingly between the piriform sinuses. The endoscope is passed posteriorly toward the upper esophageal sphincter, which is at the level of the thyroid cartilage, 15 to 18 cm from the incisors. The upper esophageal sphincter is passed under direct visualization, often with the assistance of insufflation, a gentle chin lift, and slight application of pressure. We use only CO_2 gas to insufflate the lumen of the GI tract for inspection, rather than air, to decrease the incidence of overdistension and its accompanying discomfort.

Esophageal intubation should be done slowly and gently, in part to avoid intubation of a Zenker's diverticulum since doing so can lead to a perforation. A Zenker's diverticulum is an outpouching of the posterior oropharynx just proximal to the upper esophageal sphincter caused by decreased compliance of the upper esophageal sphincter. Care must also be taken in patients with known or suspected proximal esophageal strictures, which can make esophageal intubation difficult and can increase the risk of perforation. (See "Zenker's diverticulum".)

Esophagus and esophagogastric junction — Following intubation of the esophagus, the tubular esophagus is examined. The esophagus is typically approximately 25 cm in length. The esophagus is examined both on insertion of the scope and on withdrawal of the instrument after inspection of the stomach and duodenum. Withdrawal should be carried out slowly and with adequate CO_2 insufflation to ensure complete visualization.

The EGJ is generally approximately 40 cm from the incisors. There are both anatomic and histologic markers that separate the esophagus from the stomach. However, landmarks differentiating the esophagus from the stomach may be difficult to identify due to movement of the esophagus and stomach during the examination. The top of the gastric folds is the landmark generally believed to represent the EGJ. In patients without Barrett's esophagus, this is also the area of the squamocolumnar junction. The squamocolumnar junction is the area where the squamous epithelial lining of the esophagus meets the columnar lining of the stomach. Because this transition from squamous to columnar epithelium is typically uneven around the circumference of the lumen, it is also referred to as the Z-line. The transition from squamous to columnar epithelium results in a color change. The columnar mucosa of the stomach is salmon colored, whereas the squamous mucosa is pale pink (picture 2). In patients without a hiatus hernia, the EGJ also corresponds with the lower esophageal sphincter, though the lower esophageal sphincter is extrinsic and cannot be seen endoscopically. (See "Hiatus hernia", section on 'Anatomy and physiology of the esophagogastric junction'.)

Important features include the color of the mucosa and evidence of erythema, erosions, ulcers, strictures, rings, webs, varices, or diverticula. Hiatus hernias are frequently identified during upper endoscopy. A hiatus hernia is a condition where some portion of the stomach has herniated through the esophageal hiatus in the crural diaphragm. In this situation, the columnar-lined mucosa and top of the gastric folds will be seen proximal to the extrinsic narrowing of the lumen caused by the diaphragmatic pinch. Hiatus hernias may be seen during retroflexed examination of the stomach as well. (See "Hiatus hernia", section on 'Upper endoscopy'.)

Stomach — The stomach is entered after passing the region of the EGJ. Initial visualization is usually of the relatively large folds of the greater curvature of the stomach (picture 3). The examination usually proceeds along the greater curvature of the stomach towards the pylorus (figure 1).

Certain techniques improve examination of the stomach and minimize the risk of complications. These include:

- **Insufflation of the stomach** – The stomach should be insufflated to allow for inspection, but excessive insufflation should be avoided as gastric distension can induce retching or belching.

- **Suctioning fluid in the fundus** – The pool of gastric fluid in the fundus seen upon entering the stomach should be suctioned. This improves visualization of the area and minimizes the risk of reflux of gastric fluid and possible aspiration. However, care should be taken to avoid applying suction to the mucosa, as doing so may create suction artifacts that appear as abnormal mucosa. In addition, since any contact between the endoscope and the mucosa can result in trauma, it is best to examine the mucosa throughout the upper GI tract while avoiding contact with the mucosa.

- **Inspection** – While all areas of the stomach should be carefully examined, particular attention should be paid to the incisura, which is an area of the angularis along the lesser curvature.

- **Retroflexion** – Adequate visualization of the proximal stomach and EGJ is achieved through retroflexion. Retroflexion allows the endoscopist to see areas that are not well visualized during the initial direct examination (figure 2). The technique involves the following:

  - Distending the stomach with CO_2.
  - Advancing the endoscope to the region of the angularis on the lesser curvature in the antrum or the distal gastric body.
  - Turning the endoscope up-down dial to the maximal up position to achieve a 140- to 160-degree bend at the tip of the endoscope.
  - Locking the wheels of the endoscope to increase stiffness of the tip of the endoscope.
  - Withdrawing the endoscope to pull the tip of the endoscope toward the EGJ (picture 4).
  - Rotating the endoscope to obtain a 360-degree view of the upper stomach.

  Hiatus hernias are particularly easy to see when the endoscope is in the retroflexed position (picture 5). It is important to note that items placed through the endoscope's accessory channel, such as a biopsy forceps, may be difficult to use when the endoscope is in the retroflexed position, and thus may need to be passed to the tip of the instrument before retroflexion is performed. In addition, care is required to ensure that the

retroflexed endoscope does not become entrapped within a hiatus hernia or in the esophagus. This is normally done by making sure that the retroflexed endoscope is not pulled into the hernia or the esophagus.

Pyloric intubation — The pylorus is traversed under direct visualization (picture 6). Opening the pylorus for passage of the endoscope sometimes requires insufflation, gentle pressure, and patience in patients who have particularly active or motile pyloric regions.

In patients with a "J-shaped" stomach, intubating the pylorus may be difficult as extreme angulation of the endoscope may be required. Attempts to traverse the pylorus in such patients may result in significant looping in which the shaft of the endoscope presses on the greater curvature of the stomach. The pressure applied to the gastric wall by the loop can result in patient discomfort. In such circumstances, removing air from the stomach or application of external pressure on the abdominal wall in the left upper quadrant may help with passage of the endoscope through the pylorus.

Duodenum — After passing through the pylorus, the endoscope enters the duodenal bulb. The endoscope is then advanced through the duodenal sweep and into the second portion of the duodenum. The duodenal bulb is often devoid of characteristic features, though there may be raised bumps and polypoid areas representing either prominent Brunner's glands or heterotopic foci of gastric mucosa. The duodenum distal to the bulb has distinctive circular rings called valvulae conniventes (picture 7).

The ampulla of Vater is found in the second portion of the duodenum and is the site where the common bile duct and pancreatic duct empty into the duodenum. While the ampulla may be seen with a standard forward-viewing endoscope, a more complete examination of the ampulla requires the use of a side-viewing duodenoscope (the same endoscope used for endoscopic retrograde cholangiopancreatography). This is not done routinely as part of an upper endoscopy and requires specialized skills and equipment. However, it may be required for some patients, such as those with familial adenomatous polyposis, who are undergoing screening for ampullary adenomas. If examination of the ampulla is required, the examination should be performed with an endoscopist who is trained in the use of a side-viewing duodenoscope. (See "Familial adenomatous polyposis: Screening and management of patients and families", section on 'Screening'.)

Diagnostic and therapeutic maneuvers — A variety of diagnostic and therapeutic maneuvers can be carried out during upper endoscopy. The most common diagnostic maneuver is tissue sampling.

Tissue sampling methods — Tissue sampling is an important part of many upper endoscopic procedures [13,14]. Specimens obtained during procedures can be sent for histologic, cytologic, or microbiologic analysis, depending on the type of sample and clinical indication for tissue sampling. When submitting samples, it is helpful to provide the pathologist, cytologist, or microbiologist with details such as the clinical history, specimen-specific location and appearance, and the question to be answered. Including the endoscopy report and photographs of the area in question can also provide useful clinical context.

- **Biopsy** – A biopsy forceps is placed though the accessory channel of the endoscope and advanced to the target area, and the forceps is opened and closed to obtain a pinch biopsy. Many forceps have a "spike" that allows for the acquisition of more than one sample per pass of the forceps.

  The tubular esophagus may be difficult to biopsy because the forceps comes out of the accessory channel parallel to the wall of the esophagus. This problem can be solved by the "turn-in" technique, where the tip of the endoscope is turned to be more perpendicular to the wall of the esophagus (or anywhere in the upper GI tract where this is an issue), allowing for a more direct angle in which to obtain a biopsy. This technique may be augmented by suctioning of the mucosa into the biopsy forceps, which is opened close to the tip of the endoscope before tissue acquisition, allowing for a larger sample to be obtained with each "bite" of the biopsy forceps.

  Typically, biopsy forceps can only sample mucosal lesions. If a submucosal lesion is encountered, it may be possible to perform stacked or tunneled biopsies in which the same location is biopsied multiple times with the hope of obtaining deeper samples. This frequently is unsuccessful and increases the risk of perforation (especially in the esophagus), so it should be done with extreme caution. Submucosal lesions typically require assessment by endoscopic ultrasound to fully characterize and to provide tissue samples if indicated.

  When urgent diagnosis of suspected cancer is needed in a hospital setting, endoscopic forceps biopsies can be processed by frozen section or by smashing small specimens for immediate cytology preparation. This may save time and avoid repeat procedures if delayed processed biopsies are negative [15].

- **Brushings** – A brush within a sheath is placed through the accessory channel of the endoscope and advanced to the target area. The brush head is advanced out of the sheath, and the endoscopist gently brushes the area of interest.

- **Polypectomy** – Polypectomy is carried out in a manner similar to that used during colonoscopy. Small polyps may be removed using a biopsy forceps. Larger polyps can be removed using snares that are passed down the accessory channel of the endoscope. Lesions larger than approximately 2 cm may require removal using specialized techniques. (See "Overview of endoscopic resection of gastrointestinal tumors", section on 'Endoscopic resection techniques'.)

- **Full-thickness gastric biopsy** – Using a specialized over-the-scope metal clip with a built-in snare, a full-thickness biopsy may be obtained to assess submucosal lesions and nerve plexus. (See "Endoscopic clip therapy in the gastrointestinal tract: Bleeding lesions and beyond", section on 'Uses for over-the-scope endoscopic clips'.)

Other interventions — Other diagnostic and therapeutic interventions that can be performed include:

- Endoscopic hemostasis (see "Overview of the treatment of bleeding peptic ulcers", section on 'Endoscopic therapy' and "Methods to achieve hemostasis in patients with acute variceal hemorrhage", section on 'Initial management' and "Angiodysplasia of the gastrointestinal tract", section on 'Endoscopic treatment' and "Argon plasma coagulation in the management of gastrointestinal hemorrhage" and "Endoscopic clip therapy in the gastrointestinal tract: Bleeding lesions and beyond" and "Mallory-Weiss syndrome", section on 'Rebleeding risk')

- Dilation of esophageal strictures, gastric outlet stenoses, and anastomotic strictures (see "Endoscopic interventions for nonmalignant esophageal strictures in adults" and "Gastric outlet obstruction in adults", section on 'Management' and "Gastrointestinal endoscopy in patients who have undergone bariatric surgery", section on 'Stomal (anastomotic) stenosis')

- Stent placement for benign or malignant disease (see "Endoscopic stenting for palliation of malignant esophageal obstruction" and "Endoscopic palliation of esophageal cancer" and "Enteral stents for the palliation of malignant gastroduodenal obstruction")

- Ablation of Barrett's esophagus (see "Barrett's esophagus: Treatment with radiofrequency ablation")

- Endoscopic mucosal resection of gastrointestinal tumors (see "Overview of endoscopic resection of gastrointestinal tumors")

- Percutaneous endoscopic gastrostomy tube placement (see "Gastrostomy tubes: Complications and their management")
- Foreign body removal (see "Ingested foreign bodies and food impactions in adults" and "Foreign bodies of the esophagus and gastrointestinal tract in children")
- Pneumatic dilation, botulinum toxin injection, or peroral endoscopic myotomy (POEM) (see "Pneumatic dilation and botulinum toxin injection for achalasia")
- Placement of a wireless video capsule (see "Wireless video capsule endoscopy", section on 'Capsule ingestion')
- Placement of esophageal acid monitoring devices (see "Clinical manifestations and diagnosis of gastroesophageal reflux in adults", section on 'Ambulatory esophageal pH monitoring')
- Endoscopic therapy for gastroesophageal reflux (see "Radiofrequency treatment for gastroesophageal reflux disease")
- Endoscopic treatment of a Zenker's diverticulum (see "Zenker's diverticulum", section on 'Flexible endoscopy')

Interventions for limited visualization — Visualization during upper GI endoscopy may be hindered due to several reasons.

- **Excessive motility** – Excessive motility in the stomach or small bowel may make careful examination difficult. While patience may be all that is necessary to allow the bowel to "quiet" and allow the entire examination to be completed, the use of medications to slow the bowel, including glucagon (0.5 mg intravenously [IV]), is an option. This may be particularly helpful when therapeutic maneuvers are being carried out (eg, argon plasma coagulation of an angiodysplasia).
- **Foam and mucus** – The use of an irrigating syringe or irrigating device is often sufficient to clear away bubbles and excessive mucus that are obscuring the view of portions of the upper GI tract during endoscopy. If irrigation is unsuccessful, agents that lower the surface tension of bubbles (eg, simethicone) and mucolytic agents (eg, N-acetylcysteine) may be used [16].
- **Retained debris** – Residual gastric contents not only impede complete visualization but also increase the risk of aspiration. Irrigation is insufficient to remove small residual gastric material. Specialized suction devices are also available to help clear the stomach in

the setting of upper GI bleeding. Prokinetic agents (eg, erythromycin) administered prior to endoscopy may facilitate passage of retained debris or blood. (See "Approach to acute upper gastrointestinal bleeding in adults", section on 'Prokinetics'.)

- **Altered anatomy** – Abnormal anatomy (eg, a paraesophageal hernia) or surgically altered anatomy (eg, bariatric surgery) may make completion of upper endoscopy more difficult. Specific maneuvers, such as changing the patient's position or the application of external abdominal pressure to "splint" the stomach, may facilitate instrument passage in some situations. (See 'Pyloric intubation' above and "Gastrointestinal endoscopy in patients who have undergone bariatric surgery".)

Quality indicators — A number of quality indicators for upper endoscopy have been proposed, of which some have been designated priority quality indicators [17-19].

- **Inspection time** – Inspection of the esophagus, stomach and duodenum should last for at least seven minutes from intubation to extubation in a diagnostic examination in a patient who has not undergone an upper endoscopy within the last three years [20,21]. A slower, more careful examination has been shown to identify more pathology. In patients with Barrett's esophagus, for example, a longer inspection time has been associated with a higher rate of dysplasia detection [22].

- **Photodocumentation and reporting** – All endoscopic procedures should include a complete report detailing the extent of the tissue examined and all normal and abnormal findings encountered. Photodocumentation greatly enhances the record and should be included [20,23]. In 2015, the European Society of Gastrointestinal Endoscopy (ESGE) recommended that the endoscopist take at least 10 photos during an upper endoscopy to include the following locations: proximal esophagus, distal esophagus, Z-line and diaphragm indentation, cardia and fundus in inversion, corpus in forward view including lesser curvature, corpus in retroflex view including greater curvature, angulus in partial inversion, antrum, duodenal bulb, and second part of duodenum. Additional images have been suggested in higher-risk patients being screened for gastric cancer [24]. Images of any abnormalities found during upper endoscopy should be documented.

- **Additional metrics** – Additional priority indicators (American Society for Gastrointestinal Endoscopy/American College of Gastroenterology/American Gastroenterological Association) include the following unless contraindicated [23]:

  - Endoscopic treatment of ulcers with active bleeding or with nonbleeding visible vessels (target greater than 98 percent).

- Plans for assessing *Helicobacter pylori* infection for patients diagnosed with gastric or duodenal ulcers are documented (target greater than 98 percent).
- Administration of prophylactic antibiotics in patients with cirrhosis with acute upper GI bleeding before esophagogastroduodenoscopy (EGD; target greater than 98 percent).
- Use of proton pump inhibitors for suspected peptic ulcer bleeding (target greater than 98 percent).

COMPLICATIONS

Serious complications of upper endoscopy are rare. The overall complication rate of upper gastrointestinal (GI) endoscopy is 0.15 percent [25,26]. Complication rates are lower for diagnostic endoscopy without therapeutic maneuvers at 0.0002 percent [27].

- **Cardiopulmonary complications** – Cardiopulmonary complications can result from procedural sedation. The overall incidence of cardiopulmonary complications is low. In a prospective survey of 14,149 upper endoscopies and a retrospective study of 21,011 endoscopic procedures, the rates of early cardiopulmonary events were 2 to 5.4 per 1000 cases, and mortality rates, which included cases of aspiration pneumonia, pulmonary embolism, and myocardial infarction, were 0.3 to 0.5 per 1000 cases [28,29]. (See "Adverse events related to procedural sedation for gastrointestinal endoscopy in adults".)

  Risk factors for the development of cardiopulmonary complications of endoscopy include advanced age, underlying comorbid illness (especially pulmonary disease), dementia, anemia, obesity, and endoscopy performed for emergency indications [3]. Adverse events resulting from oversedation include hypoxemia, hypoventilation, airway obstruction, hypotension, vasovagal episodes, arrhythmias, and aspiration. The frequency of such unplanned cardiopulmonary events has been shown to be associated with increasing American Society of Anesthesiologists (ASA) scores (table 5) [3]. (See "Preoperative evaluation for anesthesia for noncardiac surgery", section on 'ASA physical status'.)

- **Methemoglobinemia** – Topical anesthetics such as benzocaine are a common cause of methemoglobinemia. Methemoglobinemia may be clinically suspected in this setting by the presence of cyanosis or hypoxia that does not resolve with oxygen supplementation. Patients have a normal arterial PO2 (PaO_2) obtained by arterial blood gas assessment, and/or the presence of dark red or brownish to blue blood. (See "Methemoglobinemia".)

Methemoglobin is an altered state of hemoglobin in which the ferrous (Fe2+) irons of heme are oxidized to the ferric (Fe3+) state. The ferric hemes of methemoglobin are unable to bind oxygen. In addition, the oxygen affinity of any accompanying ferrous hemes in the hemoglobin tetramer is increased [30]; as a result, the oxygen dissociation curve is "left-shifted," and oxygen delivery to the tissues is impaired. The diagnosis and management of methemoglobinemia are discussed in detail separately. (See "Methemoglobinemia".)

- **Bleeding** – Bleeding rarely occurs following diagnostic upper endoscopy. While the risk may be increased in patients with thrombocytopenia or coagulopathies, diagnostic upper endoscopy is generally thought to be safe in patients with platelet counts as low as 20,000/microL [31]. The risk of bleeding is increased with therapeutic maneuvers such as esophageal dilation, percutaneous endoscopic gastrostomy tube placement, or endoscopic mucosal resection. (See "Complications of endoscopic esophageal stricture dilation", section on 'Hemorrhage' and "Overview of endoscopic resection of gastrointestinal tumors", section on 'Adverse events' and "Gastrostomy tubes: Complications and their management", section on 'Bleeding' and "Gastrointestinal endoscopy in patients with disorders of hemostasis".)

- **Perforation** – Upper endoscopy is the most common cause of esophageal perforation. It is more common when therapeutic maneuvers are carried out and in patients with esophageal diverticula. The estimated risk of esophageal perforation varies with the procedure being performed [32]:

  - Diagnostic endoscopy with a flexible endoscope: 0.03 percent
  - Stricture dilation: 0.09 to 2.2 percent
  - Sclerotherapy: less than 1 percent
  - Pneumatic dilation for achalasia: 2 to 6 percent

  The diagnosis and management of esophageal perforations is discussed elsewhere. (See "Complications of endoscopic esophageal stricture dilation" and "Complications of endoscopic esophageal stricture dilation", section on 'Esophageal perforation' and "Surgical management of esophageal perforation".)

- **Infection** – The risk of infection related to GI endoscopy is low, though there have been cases of hepatitis B, hepatitis C, and bacterial transmission related to breaches in protocols for proper endoscope disinfection. (See "Preventing infection transmitted by gastrointestinal endoscopy" and 'Antibiotic prophylaxis' above and "Antibiotic prophylaxis for gastrointestinal endoscopic procedures".)

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.)

- Basics topics (see "Patient education: Upper endoscopy (The Basics)")
- Beyond the Basics topics (see "Patient education: Upper endoscopy (Beyond the Basics)")

SUMMARY AND RECOMMENDATIONS

- **Procedure** – Upper endoscopy (esophagogastroduodenoscopy [EGD]) includes visualization of the oropharynx, esophagus, stomach, and proximal duodenum, with real-time assessment and interpretation of the findings encountered. Routine upper endoscopy is performed using a high-definition white-light endoscope. (See 'Equipment' above.)
- **Patient selection** – Upper gastrointestinal (GI) endoscopy is indicated in the diagnostic evaluation of signs and symptoms of a wide variety of GI disorders as well as for therapeutic interventions (table 1). (See 'Indications' above.)
- **Contraindications** – Relative contraindications for upper GI endoscopy include:
  - Patients who cannot tolerate moderate sedation, monitored anesthesia care (MAC), or general anesthesia in whom unsedated upper endoscopy is not feasible.
  - Patients who are hemodynamically unstable.
  - Patients with GI obstruction.
  - Patients with severe coagulation abnormalities (platelet count ≤20,000/microL), particularly if biopsies or therapeutic maneuvers are anticipated. (See

'Contraindications' above.)

- **Presedation assessment** – Patients require a presedation evaluation to identify underlying conditions that may increase risk and to create a plan for procedural sedation that minimizes risk while managing coexisting medical conditions. (See 'Presedation assessment' above.)

- **Patient preparation** – Prior to elective upper GI endoscopy, patients should fast for a minimum of two hours after ingestion of clear liquids and six to eight hours after ingestion of light meals, and sometimes longer if there is known or suspected delayed gastric emptying. Most medications can be continued up to the time of endoscopy and are usually taken with a small sip of water. The morning doses of some medications may need to be adjusted prior to upper endoscopy, such as medications for diabetes. The decision of whether to stop antiplatelet agents or anticoagulants must take into account the procedure-related risk of bleeding and the risk of periprocedural thrombosis. Antibiotic prophylaxis is only indicated in selected patients undergoing upper endoscopy (table 3 and table 4). (See 'Patient preparation' above.)

- **Preprocedure testing** – Preprocedure testing is not routinely required in all patients and should be used selectively based on the patient's medical history, physical examination findings, and procedural risk factors. (See 'Preprocedure testing in selected patients' above.)

- **Complications** – Complications of upper endoscopy include complications due to sedation, related to the endoscopy, and complications related to diagnostic and therapeutic maneuvers. (See 'Complications' above.)

REFERENCES

1. ASGE Standards of Practice Committee, Early DS, Ben-Menachem T, et al. Appropriate use of GI endoscopy. Gastrointest Endosc 2012; 75:1127.
2. ASGE Standards of Practice Committee, Early DS, Lightdale JR, et al. Guidelines for sedation and anesthesia in GI endoscopy. Gastrointest Endosc 2018; 87:327.
3. Sharma VK, Nguyen CC, Crowell MD, et al. A national study of cardiopulmonary unplanned events after GI endoscopy. Gastrointest Endosc 2007; 66:27.

4. Cohen LB, Delegge MH, Aisenberg J, et al. AGA Institute review of endoscopic sedation. Gastroenterology 2007; 133:675.
5. Imasogie N, Rose RV, Wilson A. High quantities: Evaluating the association between cannabis use and propofol anesthesia during endoscopy. PLoS One 2021; 16:e0248062.
6. American Society of Anesthesiologists Committee. Practice guidelines for preoperative fasting and the use of pharmacologic agents to reduce the risk of pulmonary aspiration: application to healthy patients undergoing elective procedures: an updated report by the American Society of Anesthesiologists Committee on Standards and Practice Parameters. Anesthesiology 2011; 114:495.
7. ASGE Standards of Practice Committee, Acosta RD, Abraham NS, et al. The management of antithrombotic agents for patients undergoing GI endoscopy. Gastrointest Endosc 2016; 83:3.
8. ASGE Standards of Practice Committee, Khashab MA, Chithadi KV, et al. Antibiotic prophylaxis for GI endoscopy. Gastrointest Endosc 2015; 81:81.
9. ASGE Standards of Practice Committee, Pasha SF, Acosta R, et al. Routine laboratory testing before endoscopic procedures. Gastrointest Endosc 2014; 80:28.
10. Abraham NS, Barkun AN, Sauer BG, et al. American College of Gastroenterology-Canadian Association of Gastroenterology Clinical Practice Guideline: Management of Anticoagulants and Antiplatelets During Acute Gastrointestinal Bleeding and the Periendoscopic Period. J Can Assoc Gastroenterol 2022; 5:100.
11. Davis DE, Jones MP, Kubik CM. Topical pharyngeal anesthesia does not improve upper gastrointestinal endoscopy in conscious sedated patients. Am J Gastroenterol 1999; 94:1853.
12. Muto M, Minashi K, Yano T, et al. Early detection of superficial squamous cell carcinoma in the head and neck region and esophagus by narrow band imaging: a multicenter randomized controlled trial. J Clin Oncol 2010; 28:1566.
13. Cohen J. The impact of tissue sampling on endoscopy efficiency. Gastrointest Endosc Clin N Am 2004; 14:725.
14. ASGE Standards of Practice Committee, Sharaf RN, Shergill AK, et al. Endoscopic mucosal tissue sampling. Gastrointest Endosc 2013; 78:216.
15. Wright ER, Bakis G, Srinivasan R, et al. Intraprocedural tissue diagnosis during ERCP employing a new cytology preparation of forceps biopsy (Smash protocol). Am J Gastroenterol 2011; 106:294.

16. Chen X, Dai N, Deng Y, et al. Premedication with reformulated simethicone and sodium bicarbonate improves mucosal visibility during upper gastrointestinal endoscopy: a double-blind, multicenter, randomized controlled trial. BMC Gastroenterol 2021; 21:124.
17. Cohen J, Pike IM. Defining and measuring quality in endoscopy. Gastrointest Endosc 2015; 81:1.
18. Rizk MK, Sawhney MS, Cohen J, et al. Quality indicators common to all GI endoscopic procedures. Am J Gastroenterol 2015; 110:48.
19. ASGE Endoscopy Unit Quality Indicator Taskforce, Day LW, Cohen J, et al. Quality indicators for gastrointestinal endoscopy units. VideoGIE 2017; 2:119.
20. Bisschops R, Areia M, Coron E, et al. Performance measures for upper gastrointestinal endoscopy: a European Society of Gastrointestinal Endoscopy (ESGE) Quality Improvement Initiative. Endoscopy 2016; 48:843.
21. Yang LS, Thompson AJ, Taylor ACF, et al. Quality of upper GI endoscopy: a prospective cohort study on impact of endoscopist education. Gastrointest Endosc 2022; 96:467.
22. Gupta N, Gaddam S, Wani SB, et al. Longer inspection time is associated with increased detection of high-grade dysplasia and esophageal adenocarcinoma in Barrett's esophagus. Gastrointest Endosc 2012; 76:531.
23. Park WG, Shaheen NJ, Cohen J, et al. Quality indicators for EGD. Am J Gastroenterol 2015; 110:60.
24. Yao K. The endoscopic diagnosis of early gastric cancer. Ann Gastroenterol 2013; 26:11.
25. ASGE Standards of Practice Committee, Ben-Menachem T, Decker GA, et al. Adverse events of upper GI endoscopy. Gastrointest Endosc 2012; 76:707.
26. Geraci G, Pisello F, Modica G, et al. [Complications of elective esophago-gastro-duodenoscopy (EGDS). Personal experience and literature review]. G Chir 2009; 30:502.
27. Wolfsen HC, Hemminger LL, Achem SR, et al. Complications of endoscopy of the upper gastrointestinal tract: a single-center experience. Mayo Clin Proc 2004; 79:1264.
28. Quine MA, Bell GD, McCloy RF, et al. Prospective audit of upper gastrointestinal endoscopy in two regions of England: safety, staffing, and sedation methods. Gut 1995; 36:462.
29. Arrowsmith JB, Gerstman BB, Fleischer DE, Benjamin SB. Results from the American Society for Gastrointestinal Endoscopy/U.S. Food and Drug Administration collaborative study on complication rates and drug use during gastrointestinal endoscopy. Gastrointest Endosc 1991; 37:421.
30. Taleb M, Ashraf Z, Valavoor S, Tinkel J. Evaluation and management of acquired methemoglobinemia associated with topical benzocaine use. Am J Cardiovasc Drugs 2013;

13:325.

31. Silvis SE, Nebel O, Rogers G, et al. Endoscopic complications. Results of the 1974 American Society for Gastrointestinal Endoscopy Survey. JAMA 1976; 235:928.
32. Chirica M, Champault A, Dray X, et al. Esophageal perforations. J Visc Surg 2010; 147:e117.

Topic 13928 Version 31.0

GRAPHICS

Indications for upper gastrointestinal endoscopy

Diagnostic examination
Upper abdominal symptoms that fulfill any of the following criteria: ▪ Are unresponsive to empiric therapy ▪ Are associated with alarm symptoms ▪ New-onset symptoms in a patient greater than 50 years of age
Dysphagia
Odynophagia
Persistent or recurrent esophageal reflux despite therapy
Persistent vomiting of unknown cause
Active or recent upper GI bleeding
Presumed chronic blood loss and iron deficiency anemia if any of the following are present: ▪ There is clinical suspicion of an upper GI source ▪ Colonoscopy is negative
Lesion seen on upper GI tract imaging
Acute caustic ingestion
When sampling of tissue or fluid is indicated
Evaluation of diarrhea in a patient suspected of having small bowel disease (eg, celiac disease)
Intraoperative evaluation of anatomic reconstructions
Screening/surveillance
Dysplasia surveillance in patients with Barrett's esophagus
Gastric cancer screening in selected patients*
Screening for upper GI malignancies in patients with polyposis syndromes or Lynch syndrome
Screening for esophageal varices in patients with portal hypertension
Screening for squamous cell carcinoma in patients with a history of caustic ingestions
Examination to identify upper GI pathology that might influence the treatment of other disorders (eg, evaluating a patient with a history of upper GI bleeding prior to initiating anticoagulation)
Therapeutic
Treatment of bleeding upper GI tract lesions
Prophylactic variceal banding

Removal of foreign bodies
Placement of feeding or drainage tubes
Removal of selected polypoid lesions*
Dilation of stenotic lesions
Management of achalasia
Palliation of stenoses due to neoplasms
Endoscopic therapy of intestinal metaplasia
Management of operative complications (eg, dilation of anastomotic strictures)

GI: gastrointestinal.

* See text for details.

Data for table collected from: Appropriate use of GI endoscopy. Gastrointest Endosc 2012; 75:1127.

Graphic 66596 Version 4.0

Fasting guidelines of international anesthesia societies

Anesthesia society	Fasting requirements at time of induction	Comments
American Society of Anesthesiologists, 2017[1,2]	▪ 2 hours clear liquids, excluding alcohol ▪ 4 hours breast milk ▪ 6 hours nonhuman milk, formula, light meal ▪ 8 hours or more for fatty meal, fried food, meat ▪ Chewing gum allowed up until induction	▪ Healthy patients, not in labor, elective surgery ▪ Light meal defined as toast or cereal with clear liquid ▪ Healthy adults should drink carbohydrate containing clear liquids up to 2 hours prior to surgery
European Society of Anesthesiology and Intensive Care[3,4]	▪ Adults: • 2 hours clear liquids • 6 hours milk, solid food • Chewing gum and sucking hard candy allowed up until induction	▪ Encourage oral fluid up to 2 hours
	▪ Children: • 1 hour clear liquids • 3 hours breast milk • 4 hours formula or nonhuman milk, light breakfast (weak recommendations) • 6 hours other solid food	▪ Encourage oral fluid up until fasting time
Australian and New Zealand College of Anaesthetists[5]	▪ Adults: • 2 hours clear liquids • 6 hours limited solid food	▪ Guidelines may not apply to patients who are at increased risk of perioperative regurgitation or vomiting ▪ Up to 400 mL of clear liquid up to 2 hours prior to induction for adults is likely safe
	▪ Children >6 months of age: • 1 hour clear liquids (≤3 mL/kg) • 4 hours breast milk • 6 hours formula and limited solid food	

	▪ Children <6 months of age: • 1 hour clear liquids (≤3 mL/kg) • 3 hours breast milk • 4 hours formula	
Association of Anaesthetists in Great Britain and Ireland[6]	▪ 2 hours clear liquids ▪ 4 hours breast milk ▪ 6 hours solid food, formula and cow's milk	▪ Gum chewing treated as clear
Canadian Anesthesiologists' Society[7]	▪ 1 hour clear liquids for children ▪ 2 hours clear liquids for adults ▪ 4 hours breast milk ▪ 6 hours for solid food, infant formula, nonhuman milk, expressed breast milk fortified with additions	▪ Encourage oral clear liquids up until fasting time
Scandinavian Society of Anaesthesiology and Intensive Care Medicine[8]	▪ 2 hours clear liquids ▪ 4 hours breast milk and infant formula ▪ 6 hours solid food and cows milk ▪ 2 hours chewing gum and any tobacco product ▪ Up to 1 hour prior to induction, 150 mL of water	▪ 2 hours for preoperative carbohydrate drinks intended for preoperative nutrition
German Society of Anesthesiology and Intensive Care[9]	▪ 2 hours clear liquids ▪ 4 hours breast milk and infant formula ▪ 6 hours meal	
Pediatric societies		
Joint statement from Association of Paediatric Anaesthetists of Great Britain and Ireland, European Society for Paediatric Anaesthesiology, L'Association Des Anesthésistes-Réanimateurs	▪ 1 hour clear liquids for children up to 16 years of age	▪ Encourage intake of clear liquids

Pédiatriques d'Expression Française[10]		
Canadian Pediatric Anesthesia Society[11]	▪ 1 hour clear liquids for children	▪ Encourage intake of clear liquids
The Society for Paediatric Anaesthesia of New Zealand and Australia[12]	▪ 1 hour clear liquids for children	▪ Encourage intake of clear liquids

GERD: gastroesophageal reflux disease.

References:

1. *Practice Guidelines for Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration: Application to Healthy Patients Undergoing Elective Procedures: An Updated Report by the American Society of Anesthesiologists Task Force on Preoperative Fasting and the Use of Pharmacologic Agents to Reduce the Risk of Pulmonary Aspiration. Anesthesiology 2017; 126:376.*
2. *Joshi GP, Abdelmalak BB, Weigel WA, et al. 2023 American Society of Anesthesiologists Practice Guidelines for Preoperative Fasting: Carbohydrate-containing Clear Liquids with or without Protein, Chewing Gum, and Pediatric Fasting Duration-A Modular Update of the 2017 American Society of Anesthesiologists Practice Guidelines for Preoperative Fasting. Anesthesiology 2023; 138:132.*
3. *Smith I, Kranke P, Murat I, et al. Perioperative fasting in adults and children: guidelines from the European Society of Anaesthesiology. Eur J Anaesthesiol 2011; 28:556.*
4. *Frykholm P, Disma N, Andersson H, et al. Pre-operative fasting in children: A guideline from the European Society of Anaesthesiology and Intensive Care. Eur J Anaesthesiol 2022; 39:4.*
5. *Australian and New Zealand College of Anaesthetists. Guideline on pre-anaesthesia consultation and patient preparation. Available at: https://www.anzca.edu.au/getattachment/d2c8053c-7e76-410e-93ce-3f9a56ffd881/PS07-Guideline-on-pre-anaesthesia-consultation-and-patient-preparation (Accessed on September 8, 2021).*
6. *Association of Anaesthetists of Great Britain and Ireland. Pre-operative Assessment and Patient Preparation - The Role of the Anaesthetist. Available at: https://anaesthetists.org/Home/Resources-publications/Guidelines/Pre-operative-assessment-and-patient-preparation-the-role-of-the-anaesthetist-2 (Accessed on October 8, 2021).*
7. *Dobson G, Chow L, Denomme J. et al. Guidelines to the Practice of Anesthesia: Revised Edition 2023. Can J Anesth 2023; 70:16–55.*
8. *Søreide E, Eriksson LI, Hirlekar G, et al. Pre-operative fasting guidelines: an update. Acta Anaesthesiol Scand 2005; 49:1041.*
9. *Verbandsmitteilung DGAI. Praeoperatives Nuechternheitsgebot bei elektiven Eingriffen. Anaesthesiol Intensivmed 2004; 12:722.*
10. *Thomas M, Morrison C, Newton R, Schindler E. Consensus statement on clear fluids fasting for elective pediatric general anesthesia. Paediatr Anaesth 2018; 28:411.*
11. *Rosen D, Gamble J, Matava C, Canadian Pediatric Anesthesia Society Fasting Guidelines Working Group. Canadian Pediatric Anesthesia Society statement on clear fluid fasting for elective pediatric anesthesia. Can J Anaesth 2019; 66:991.*
12. *Society for Paediatric Anaesthesia in New Zealand and Australia. Available at: https://www.anzca.edu.au/getattachment/d2c8053c-7e76-410e-93ce-3f9a56ffd881/PS07-Guideline-on-pre-anaesthesia-consultation-and-patient-preparation (Accessed on October 22, 2021).*

Graphic 94641 Version 19.0

Antibiotic prophylaxis for endoscopic procedures

Patient condition	Procedure contemplated	Antibiotic prophylaxis
High risk:		
Prosthetic heart valve or prosthetic material used for valve repair History of endocarditis Unrepaired cyanotic congenital heart disease (including palliative shunts and conduits) Repaired congential heart disease with residual defects at the site of or adjacent to a prosthetic device Completely repaired congenital heart defects with prosthetic material or device during the first six months after the repair Cardiac valvulopathy in a transplanted heart	Stricture dilation Variceal sclerotherapy ERCP/obstructed biliary tree	Not recommended
	Other endoscopic procedures, including EGD and colonoscopy (with or without biopsy/polypectomy), variceal ligation	Not recommended
Moderate risk:		
Most other congenital abnormalities Acquired valvular dysfunction (eg, rheumatic heart disease) Hypertrophic cardiomyopathy Mitral valve prolapse with regurgitation or thickened leaflets	Esophageal stricture dilation Variceal sclerotherapy	Not recommended
	Other endoscopic procedures, including EGD and colonoscopy (with or without biopsy/polypectomy), variceal ligation	Not recommended
Low risk:		
Other cardiac conditions (CABG, repaired septal defect or patent ductus, mitral valve prolapse without valvular regurgitation, isolated secundum atrial septal defect, physiologic/functional/innocent heart murmurs, rheumatic fever without valvular dysfunction, pacemakers, implantable defibrillators)	All endoscopic procedures	Not recommended
Obstructed bile duct without cholangitis	ERCP with complete drainage	Not recommended

Obstructed bile duct with cholangitis	ERCP with anticipated incomplete drainage	Recommended (continue antibiotics after procedure)
Pancreatic cystic lesion	ERCP, EUS-FNA	Recommended
Cirrhosis acute gastrointestinal bleed (required for patients with or without endoscopic procedures)	All endoscopic procedures	Recommended
Ascites, immunocompromised patient	Stricture dilation Variceal sclerotherapy Other endoscopic procedures, including EGD and colonoscopy (with or without biopsy/polypectomy), variceal ligation	No recommendation
All patients	Percutaneous endoscopic feeding tube placement	Recommended (parenteral cephalosporin or equivalent)
Vascular graft		AHA: Recommended antibiotic usage within 6 months of procedure ASGE: Antibiotics not recommended
Prosthetic joints	All endoscopic procedures	Not recommended

This summary table is based upon recommendations from the American Society of Gastrointestinal Endoscopy (Banerjee, S, Shen, B, Baron, T, et al. Gastrointest Endosc 2008; 67:791) and the American Heart Association (Wilson, W, Taubert, KA, Gewitz, M, et al. Circulation 2007; 116:1736 and Nishimura, RA, Carabello, BA, Faxon, DP, et al. Circulation 2008; 118:887). NOTE: See other table ("Antibiotic regimens: Prophylaxis for endoscopic procedures") for specific regimens.

CABG: coronary artery bypass graft; ERCP: endoscopic retrograde cholangiopancreatography; EGD: esophagogastroduodenoscopy; EUS-FNA: endoscopic ultrasound with fine needle aspiration; AHA: American Heart Association; ASGE: American Society for Gastrointestinal Endoscopy.

Modified with permission from: Hirota WK, Petersen K, Baron TH, et al. Guidelines for Antibiotic Prophylaxis for GI

Endoscopy. Gastrointest Endosc 2003; 58:475. Copyright © 2003 Elsevier.

Graphic 51133 Version 5.0

Antibiotic regimens: Prophylaxis for endoscopic procedures

Procedure	Condition(s)	Antibiotic and dose*	Interval for intraoperative re-dose for prolonged procedure (timed from initiation of preoperative dose)
High-risk endoscopic procedures needing antibiotic prophylaxis[¶ Δ]			
PEG/PEJ placement	MRSA risk absent	Cefazolin 2 g for patients weighing <120 kg, 3 g for patients weighing ≥120 kg (pediatric dose 30 mg/kg) IV within 60 minutes before procedure. **If penicillin or cephalosporin hypersensitivity:** Clindamycin 900 mg (pediatric dose 10 mg/kg) IV within 60 minutes before procedure.	Cefazolin: four hours Clindamycin: six hours
	MRSA risk present Pre-procedural screening for MRSA and attempted decontamination before feeding tube placement is recommended if practical	Vancomycin 15 mg/kg (maximum 2 g) IV infused over 60 to 90 minutes and beginning within 120 minutes before surgical incision.	Vancomycin: re-dosing is generally not required
ERCP[◇]	- Biliary obstruction AND cholangitis - Biliary obstruction unlikely to be successfully drained at ERCP (including malignant hilar	Ciprofloxacin 500 mg (pediatric dose 15 mg/kg[§]) orally given within 60 to 90 minutes prior to procedure or 400 mg (pediatric dose 10 mg/kg[§]) IV over 60	Ciprofloxacin: re-dosing is generally not required

	obstruction and primary sclerosing cholangitis) - Inadequate biliary drainage following ERCP - Biliary complications following liver transplantation if drainage is unlikely	minutes beginning within 120 minutes prior to procedure **AND/OR**	
		Amoxicillin-clavulanate 1750 mg (pediatric dose 45 mg/kg) orally within 60 minutes prior to procedure or ampicillin-sulbactam 3 grams (pediatric dose 50 mg/kg ampicillin component) IV within 60 minutes prior to procedure **OR**	Amoxicillin-clavulanate: two hours
		Ampicillin 2 grams (pediatric dose 50 mg/kg) IV **plus** gentamicin¥ 5 mg/kg (pediatric 2.5 mg/kg) IV within 60 minutes before procedure. **If penicillin hypersensitivity:** Substitute vancomycin 15 mg/kg (maximum 2 g) IV infused over 60 to 90 minutes beginning within 120 minutes before procedure plus gentamicin¥ 5 mg/kg IV (pediatric 2.5 mg/kg) within 60 minutes before procedure.	Ampicillin: two hours Vancomycin: re-dosing is generally not required Gentamicin: single dose only
		ALL above regimens are discontinued post-procedure when drainage is established absent evidence of cholangitis. For antibiotic dosing post-procedure with incomplete drainage,	

		refer to the individual Lexicomp drug information monograph.	
EUS-FNA of cystic lesion(s)‡	- Mediastinal cysts	Ciprofloxacin 500 mg orally (pediatric dose 15 mg/kg§) 60 to 90 minutes prior to procedure or 400 mg IV (pediatric dose 10 mg/kg§) IV given over 60 minutes beginning within 120 minutes prior to procedure. Continue 3 days post-procedure.	Ciprofloxacin: re-dosing is generally not required
Interventional EUS procedures including transmural or transluminal drainage of pancreatic fluid collections	- Mediastinal cysts - Pancreatic cysts - Cysts outside pancreas (excluding solid lesions) - Walled-off pancreatic necrosis	Ciprofloxacin 500 mg orally (pediatric dose 15 mg/kg§) 60 to 90 minutes prior to procedure or 400 mg IV (pediatric dose 10 mg/kg§) IV given over 60 minutes beginning within 120 minutes prior to procedure. Continue 3 days post-procedure.	Ciprofloxacin: re-dosing is generally not required
Natural orifice transluminal endoscopic surgery (NOTES)	Insufficient data to make recommendation. Antibiotic prophylaxis seems reasonable.		
High-risk patients needing antibiotic prophylaxis¶			
All endoscopic procedures with high risk of bacteremia, including procedures not listed above (eg, routine endoscopy with esophageal stricture dilation or	- Immunocompromised patients (eg, severe neutropenia [absolute neutrophil count <500 cells/mm^3], advanced hematologic malignancy)†	Amoxicillin 2 grams (pediatric dose 50 mg/kg) orally within 60 minutes before procedure **OR**	Amoxicillin: two hours
		Ampicillin 2 grams (pediatric dose 50	Ampicillin: two hours Clindamycin: six hours

endoscopic sclerotherapy); For procedures in the biliary tree (eg, ERCP with drainage or EUS-FNA of any lesion type) in a patient who is at high risk for infection, refer to antibiotic recommendations listed above	- Cirrhosis with ascites**	mg/kg) IV or IM within 60 minutes prior to procedure. **If penicillin hypersensitivity:** Clindamycin 600 mg (pediatric dose 20 mg/kg) orally within 60 minutes before procedure or 900 mg IV (pediatric dose 10 mg/kg IV) within 60 minutes prior to procedure.	

The preprocedural antibiotic recommendations presented in this table are generally consistent with those of American Society for Gastrointestinal Endoscopy[1] and the 2013 guidelines developed jointly by the American Society of Health-System Pharmacists and collaborating organizations[2]. A 2009 guideline available from the British Society of Gastroenterology[3] also recommends antibiotic prophylaxis in these conditions, but includes, in some cases, different choices and dosing regimens depending upon specific clinical scenarios. When available, recent culture and sensitivity results should be considered in selecting antibiotic prophylaxis.

PEG: percutaneous endoscopic gastrostomy; MRSA: methicillin-resistant *Staphylococcus aureus*; ERCP: endoscopic retrograde cholangiopancreatography; EUS-FNA: endoscopic ultrasound-guided fine-needle aspiration; GI: gastrointestinal.

* Pediatric dose should generally not exceed adult dose. Doses shown in table are for patients with normal renal function. Dose modification for renal impairment is needed for some agents.

¶ Antibiotic prophylaxis solely to prevent infective endocarditis is **not** recommended in patients undergoing endoscopic procedures. For patients with the highest-risk cardiac conditions (eg, prosthetic heart valve, prior endocarditis) who have ongoing GI or genitourinary tract infection or who are undergoing a procedure for which antibiotic therapy to prevent wound infection or sepsis is indicated, the American Society for Gastrointestinal Endoscopy (ASGE) and American Heart Association (AHA) suggest an antibiotic regimen that includes an agent active against enterococci (eg, ampicillin, piperacillin-tazobactam, or vancomycin). Refer to topic review of antimicrobial prophylaxis for bacterial endocarditis section on gastrointestinal tract.

Δ A separate table that summarizes the types of procedures and patients needing antibiotic prophylaxis is available in UpToDate. Low-risk endoscopic procedures that do not need routine antibiotic prophylaxis in most patients (eg, routine upper endoscopy, colonoscopy, flexible sigmoidoscopy, others) are listed in that table.

◇ Patients with cholangitis require antibiotic therapy and additional prophylaxis is not required.

§ While fluoroquinolones have been associated with an increased risk of tendinitis/tendon rupture in all ages, use of these agents for single-dose prophylaxis is generally safe.

¥ Gentamicin use for surgical antibiotic prophylaxis should be limited to a single dose given preoperatively. Dosing is based on the patient's actual body weight. For overweight and obese patients (ie, actual weight is greater than 120% of ideal body weight), a dosing weight should be used. A calculator to determine ideal body weight and dosing weight is available in UpToDate.

‡ While antibiotic prophylaxis is recommended by the ASGE for all patients undergoing EUS-FNA of cystic lesions, we generally reserve antibiotic prophylaxis for patients undergoing EUS-FNA of mediastinal lesions and in those who are at high risk for infection. Antibiotic prophylaxis is not required for patients undergoing EUS-FNA of solid lesions.

† Patients at high risk for postprocedural infections may also include those with decreased gastric acidity and motility resulting from malignancy or acid suppression.

** In patients with cirrhosis and upper gastrointestinal bleeding, antibiotics are indicated even if endoscopy is not planned.

References:

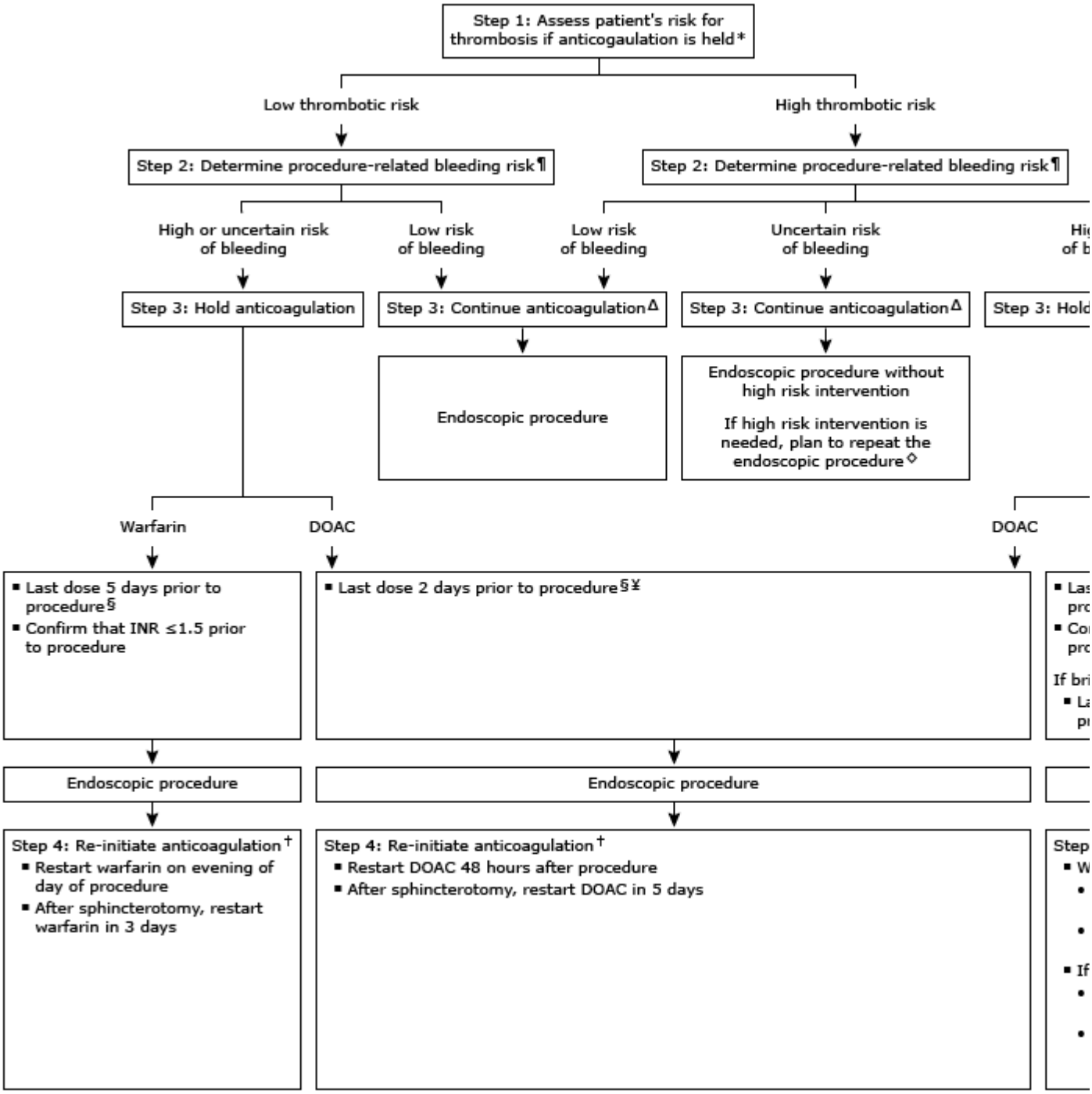
1. *ASGE Standards of Practice Committee, Khashab MA, Chithadi KV, et al. Antibiotic prophylaxis for GI endoscopy. Gastrointest Endosc 2015; 81:81.*
2. *Bratzler DW, Dellinger EP, Olsen KM, et al. Clinical Practice Guidelines for Antimicrobial Prophylaxis in Surgery. Am J Health Syst Pharm 2013; 70:195.*
3. *Allison MC, Sandoe JA, Tighe R, et al. Antibiotic prophylaxis in gastrointestinal endoscopy. Gut 2009; 58:868.*

Additional data from:

1. *Red Book: 2012 Report of the Committee on Infectious Diseases, 29th ed, Pickering LK, ed, Elk Grove Village, IL: American Academy of Pediatrics, 2012, p.808.*

Graphic 54121 Version 9.0

Management of anticoagulation for patients scheduled for elective endoscopic



This flowchart does not apply to patients with prosthetic heart valves and does not substitute for the clinical treating specialist. Refer to UpToDate content on managing anticoagulated patients in the periprocedure se

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LMW: low molecular weight; DOAC: direct oral anticoagulant; INR: international normalized ratio; ERCP: end cholangiopancreatography.

* Consult the clinician who is managing the patient's long-term anticoagulation prior to any interruption in conditions that confer a low or moderate thrombotic risk include atrial fibrillation with CHA2DS2-VASc score thromboembolism greater than 12 months previously. Examples of conditions that confer a high thrombotic

fibrillation with CHA2DS2-VASc score ≥4 or venous thromboembolism within the past 12 months. Refer to U discussion on estimating thrombotic risk.

¶ Examples of low risk procedures include upper gastrointestinal endoscopy or colonoscopy, including muc of high risk procedures include colonoscopy with polypectomy of large polyp (≥1cm) or ERCP with sphincter procedure with uncertain risk is a screening colonoscopy.

Δ For patients on warfarin, confirm that INR is ≤2.5 prior to procedure.

◇ If a lesion is found that requires a high risk intervention, the procedure is repeated while following peripr for high risk patients undergoing a high risk procedure.

§ The day of the procedure is regarded as day 0. The day of the last dose is determined by counting each ho with the procedure day (day 0). For example, warfarin is held for 5 days prior to the procedure. If the proced last dose of warfarin will be taken on day –5 (ie, the Wednesday before the procedure).

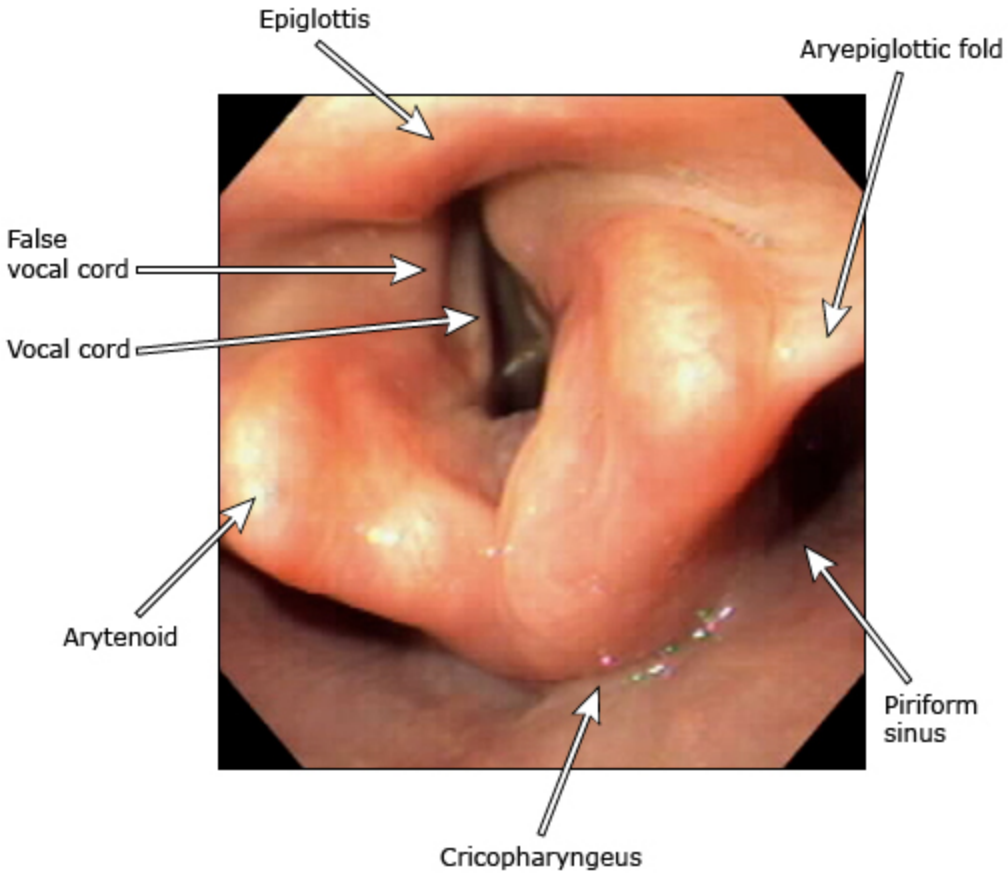
¥ For patients with renal impairment, a longer discontinuation period may be required. Please refer to UpTo for patients with renal impairment.

‡ Some patients at high risk for thromboembolism require bridging anticoagulation. Refer to other UpToDat when bridging therapy is warranted and how it is given before the procedure and resumed after the proced

† The decision to restart anticoagulation is contingent upon achieving hemostasis as determined by the end who undergo ERCP with sphincterotomy, a longer delay is needed prior to resuming anticoagulation becaus of bleeding.

Graphic 119161 Version 1.0

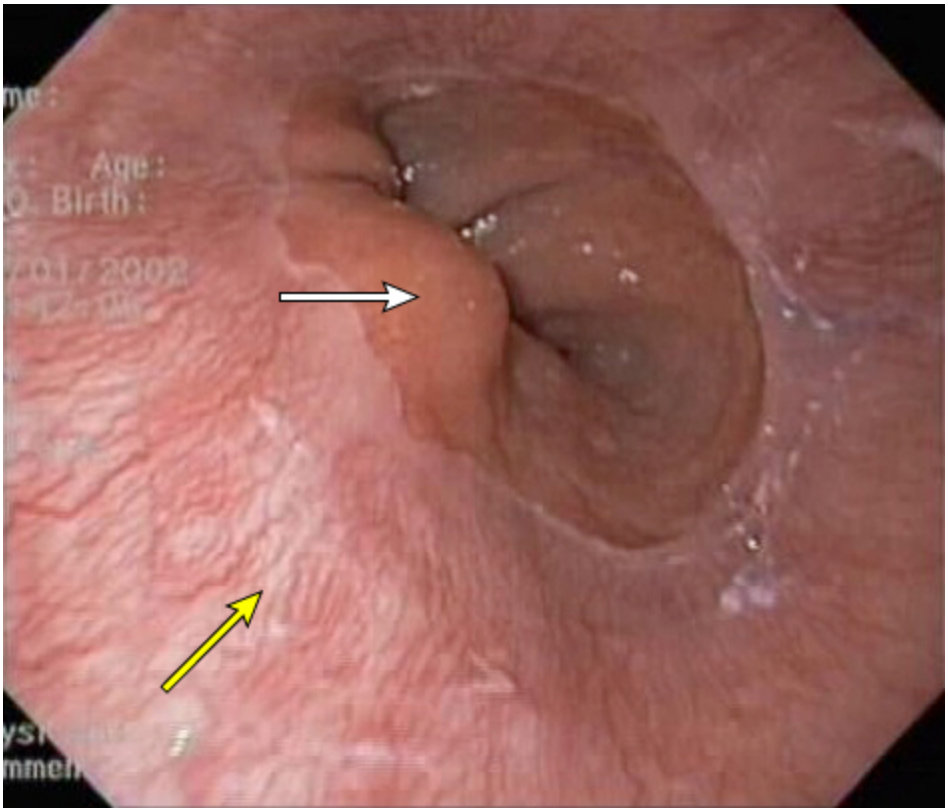
Endoscopic view of the hypopharynx



Hypopharynx as seen during esophagogastroduodenoscopy.

Graphic 82592 Version 1.0

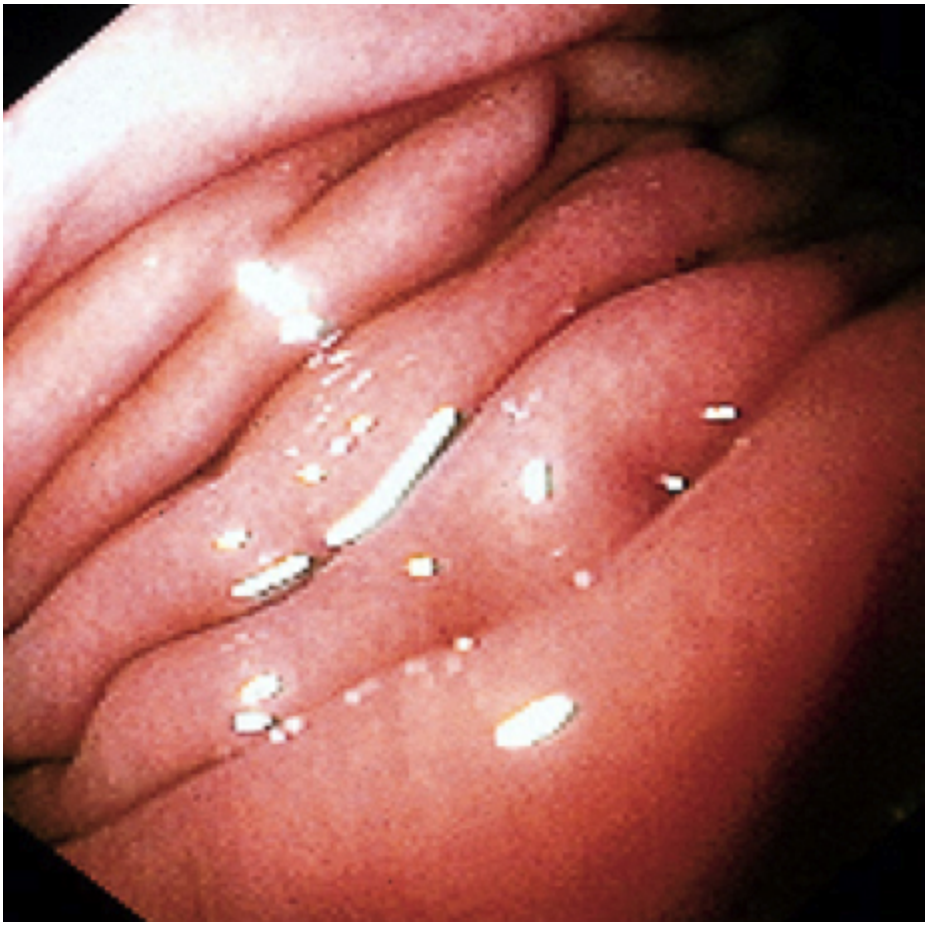
Esophagogastric junction



Esophagogastric junction as seen during esophagogastroduodenoscopy. The light pink mucosa (yellow arrow) represents the squamous lining of the esophagus, whereas the salmon-colored mucosa (white arrow) represents the columnar gastric mucosa. The squamocolumnar junction is also known as the "z-line."

Graphic 83182 Version 2.0

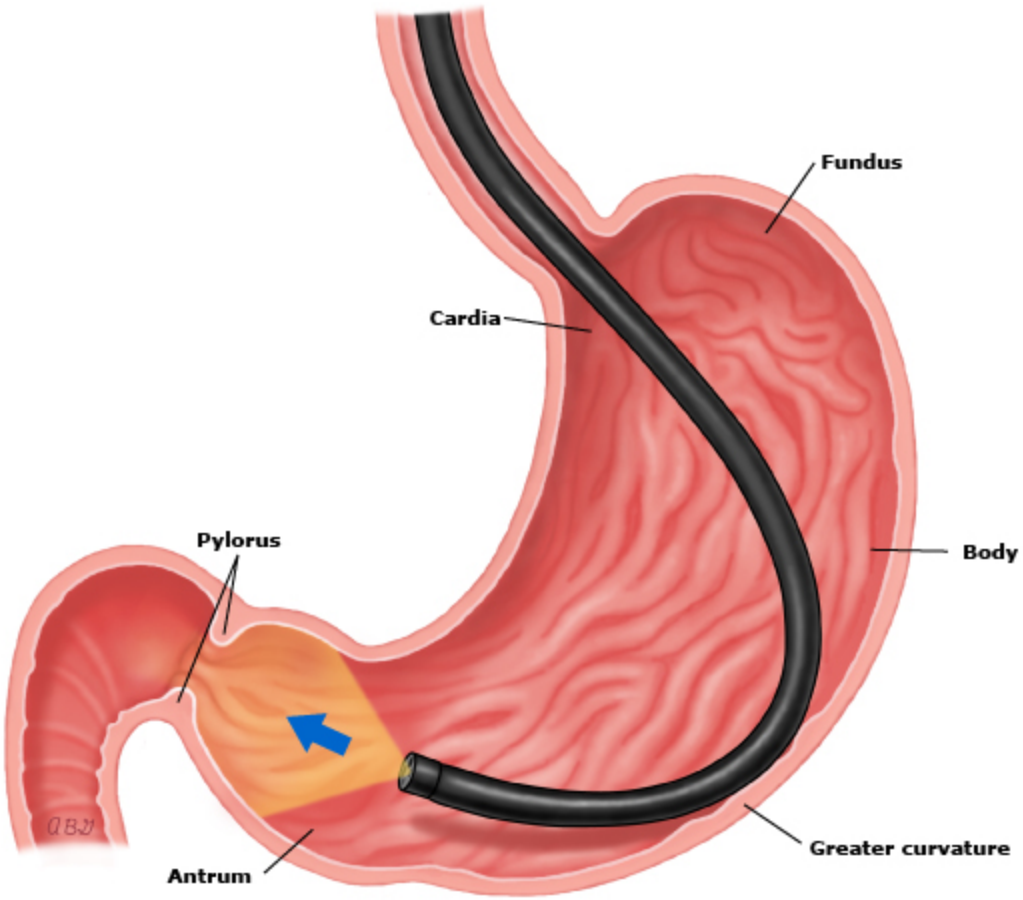
Gastric folds



Gastric folds seen upon passage of an upper endoscope into the stomach during esophagogastroduodenoscopy.

Graphic 55359 Version 1.0

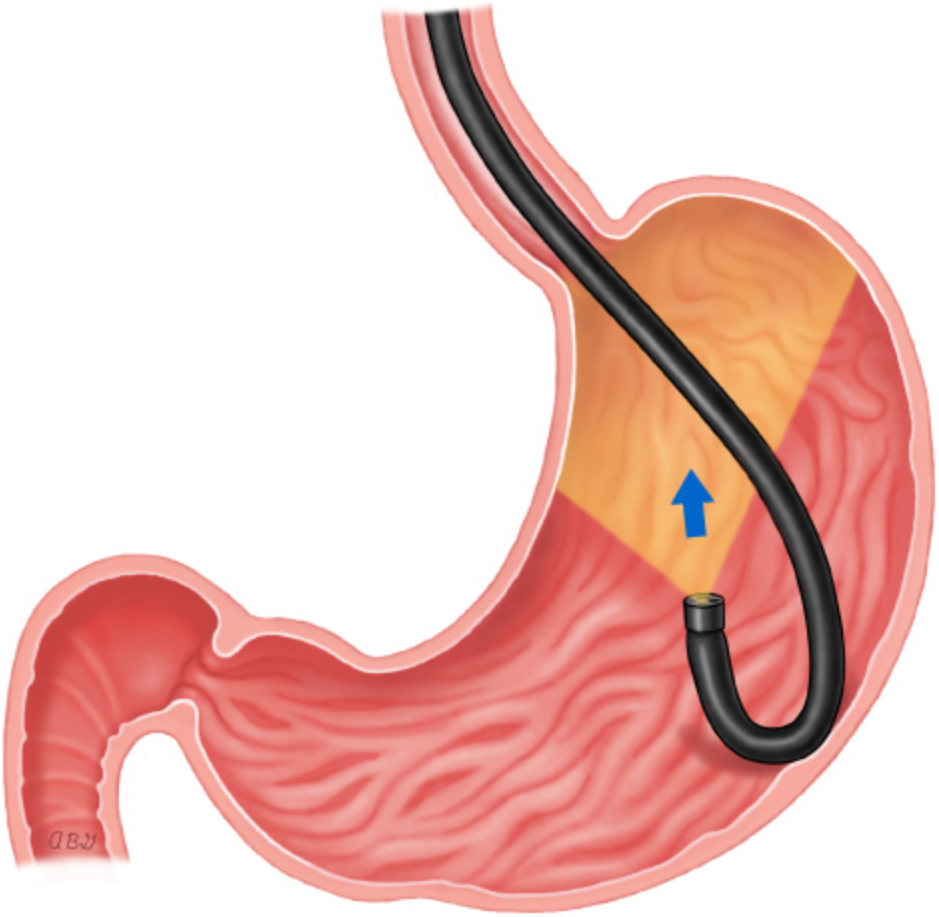
Gastric anatomy



Regions of the stomach include the cardia, fundus, body, antrum and pylorus. During endoscopy, the endoscope usually proceeds along the greater curvature of the stomach toward the pylorus.

Graphic 68173 Version 1.0

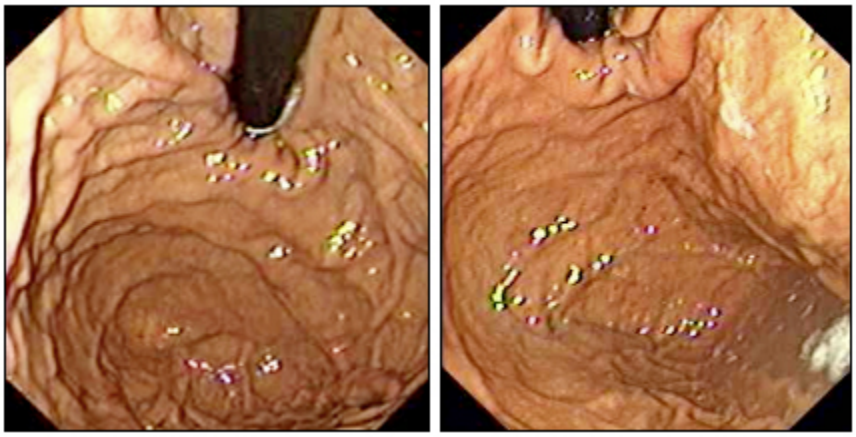
Retroflexion of endoscope within the stomach



Retroflexion of the endoscope permits visualization of portions of the stomach that are not well seen during forward-viewing with the endoscope.

Graphic 68753 Version 1.0

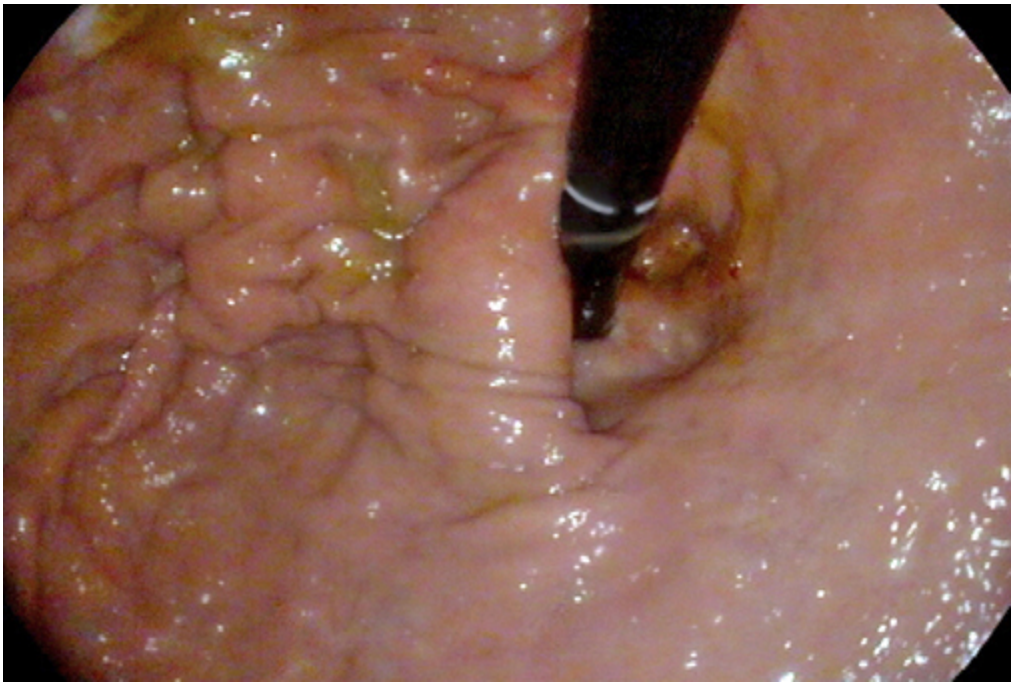
Retroflexed view of the esophagogastric junction and the proximal stomach



Appearance of the endoscope and fundus during esophagogastroduodenoscopy. The endoscope is in a retroflexed configuration to achieve visualization of the fundus and the esophagogastric junction.

Graphic 69189 Version 3.0

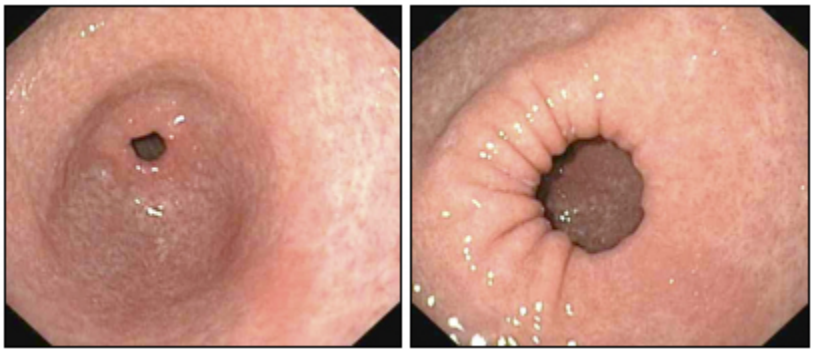
Hiatus hernia



Endoscopic view of a hiatus hernia seen from the stomach during retroflexion of the endoscope.

Graphic 83183 Version 1.0

Antrum and pylorus



Endoscopic views of the antrum (left) and pylorus (right).

Graphic 82398 Version 2.0

Endoscopic view of the duodenum

The duodenum distal to the duodenal bulb has distinctive circular rings (valvulae conniventes).

Graphic 61994 Version 2.0

American Society of Anesthesiologists Physical Status (ASA PS) Classification System

ASA PS classification	Definition	Examples, including, but not limited to:
ASA I	A normal healthy patient	Healthy, nonsmoking, no or minimal alcohol use.
ASA II	A patient with mild systemic disease	Mild diseases only without substantive functional limitations. Current smoker, social alcohol drinker, pregnancy, obesity (30<BMI<40), well-controlled DM/HTN, mild lung disease.
ASA III	A patient with severe systemic disease	Substantive functional limitations; one or more moderate to severe diseases. Poorly controlled DM or HTN, COPD, morbid obesity (BMI ≥40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESKD undergoing regularly scheduled dialysis, premature infant PCA <60 weeks, history (>3 months) of MI, CVA, TIA, or CAD/stents.
ASA IV	A patient with severe systemic disease that is a constant threat to life	Recent (<3 months) MI, CVA, TIA, or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, sepsis, DIC, ARDS, or ESKD not undergoing regularly scheduled dialysis.
ASA V	A moribund patient who is not expected to survive without the operation	Ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction.
ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes	

The addition of "E" to the numerical status (eg, IE, IIE, etc) denotes Emergency surgery (an emergency is defined as existing when delay in treatment of the patient would lead to a significant

increase in the threat to life or body part).

BMI: body mass index; DM: diabetes mellitus; HTN: hypertension; COPD: chronic obstructive pulmonary disease; ESKD: end-stage kidney disease; PCA: post conceptual age; MI: myocardial infarction; CVA: cerebrovascular accident; TIA: transient ischemic attack; CAD: coronary artery disease; DIC: disseminated intravascular coagulation; ARDS: acute respiratory distress syndrome.

Graphic 87504 Version 9.0

Contributor Disclosures

Jonathan Cohen, MD Equity Ownership/Stock Options: GI Windows [Magnetic anastomosis]; MD Medical Navigators [Advocacy and consulting]; ROM-Tech, Inc [Joint rehab]; Virtual Health Partners [Obesity]. Consultant/Advisory Boards: Micro-Tech [Endoscopy accessories]; Olympus [Gastrointestinal endoscopy, ERCP, NBI]. Other Financial Interest: Wiley [Textbook royalties]. All of the relevant financial relationships listed have been mitigated. **David A Greenwald, MD, MASGE, FACG** No relevant financial relationship(s) with ineligible companies to disclose. **John R Saltzman, MD, FACP, FACG, FASGE, AGAF** No relevant financial relationship(s) with ineligible companies to disclose. **Shilpa Grover, MD, MPH, AGAF** No relevant financial relationship(s) with ineligible companies to disclose.

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Conflict of interest policy

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