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Diagnostic upper gastrointestinal endoscopy

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INTRODUCTION

Endoscopic evaluation of the upper gastrointestinal tract has evolved significantly over the last 50 years. The flexible endoscope first utilized in the 1960s required the endoscopist to peer through one end of the instrument, while relying on coherent fiber-optic cables to convey an image of the gastrointestinal tract at the opposite end. This provided the first minimally invasive approach to diagnostic evaluation of the foregut. Since then the development of high-resolution video endoscopy has allowed superior images to be projected for all participants in the procedure to see. Continued improvements in the endoscope have broadened the use of this instrument from a simple window into the gastrointestinal tract to a routinely used diagnostic, screening, and surveillance tool, which proffers a continually expanding platform for therapeutic intervention. With an already wide array of techniques available and newer procedures such as natural orifice surgery being employed, familiarity with the endoscope is a fundamental requisite skill for contemporary surgeons who wish to diagnose and treat foregut pathology in a minimally invasive fashion.[8]

INDICATIONS/CONTRAINDICATIONS

Upper gastrointestinal endoscopy is indicated for evaluation in patients with a variety of symptoms as well as known medical conditions. Dyspepsia, dysphagia, odynophagia, gastroesophageal reflux disease, as well as persistent nausea and vomiting are all reasons to consider diagnostic evaluation using endoscopy. Early endoscopy should be prioritized in some of these settings when associated with "alarm" symptoms, for example, those more likely to be associated with malignant processes. Included in this category would be patients with dysphagia, weight loss, or persistent vomiting in the absence of evident pathology beyond the foregut. Other conditions associated with malignancy require careful surveillance. These include Barrett esophagus, familial adenomatous polyposis, and prior history of gastric ulcers or polyps. Situations such as gastrointestinal bleeding and ingestion of corrosives also warrant endoscopy to stratify risk, guide management decisions, and allow minimally invasive therapeutic intervention. This procedure is similarly useful for evaluation and treatment of varices in the portal hypertensive patient, and can provide access for small bowel biopsy in patients with malabsorptive disorders. Endoscopic evaluation of the foregut is also a useful adjunct in the operating room to guide intraoperative decision-making in difficult cases, or in function-restoring cases such as procedures for achalasia or gastroesophageal reflux disease[3] (**Table 5.1**).

Table 5.1 Indications and contraindications to diagnostic upper endoscopy

Indications—Diagnostic
Dyspepsia
Dysphagia
Odynophagia
Gastroesophageal reflux disease
Nausea and vomiting
Indications—Surveillance
Barrett esophagus
Familial adenomatous polyposis
History of gastric ulcers or polyps
Indications—Miscellaneous
Bleeding
Corrosive ingestion
Varices
Malabsorption disorder
Intraoperative evaluation
Contraindications—Absolute
Inability to tolerate the procedure
Inability to tolerate sedation
Contraindications—Relative
Suspected perforation
Zenker diverticulum
Uncorrected coagulopathy
Less severe comorbidities

Both absolute and relative contraindications to upper gastrointestinal endoscopy exist. One absolute contraindication is the inability to tolerate the procedure or attendant sedation due to severe medical comorbidities. A suspected perforation may be worsened by insufflation and should also deter endoscopic evaluation, unless endoscopy will be critical to therapeutic decision-making or delivery. Other conditions such as Zenker diverticulum, uncorrected coagulopathy, and less severe comorbidities such as respiratory insufficiency or recent myocardial infarction may be relative contraindications, depending on the indications and clinical setting.[3]

TECHNIQUE

Preoperative preparation

When first evaluating a patient for upper endoscopy, several issues must be addressed. The indications and potential benefit of endoscopic evaluation should be reviewed for each individual patient, as comorbidities determine the associated risk of complications and may dictate additional planning and preparation. While small-caliber nasal endoscopes may be used with local anesthesia alone in some diagnostic settings, most diagnostic and essentially all therapeutic esophagogastroduodenoscopy (EGD) is accomplished with conscious sedation or higher-level anesthesia. The need for sedation during the procedure dictates assessment of the patient's airway, American Society of Anesthesiologists (ASA) class, and comorbidities so that appropriate monitoring and anesthesia assistance are provided if higher-level sedation or airway management is required, so as to ensure patient safety. Continuous electrocardiographic and pulse oximetry as well as intermittent blood pressure monitoring are routinely employed, as the most common complications are cardiopulmonary and sedation related in nature. Capnography may also be very useful as a more sensitive indicator of respiratory depression related to sedation than pulse oximetry. The presence of significant airway impairment as judged by Mallampati classification (reference or picture) or other assessments, or attendant cardiac or pulmonary disease may dictate anesthesia involvement for closer peri-procedural monitoring and management. Coagulation disorders should also be identified and planned for accordingly. Management of anticoagulation issues peri-procedurally involves a risk-benefit analysis depending on the reasons for anticoagulation and expected procedural risks and interventions.[15] If a patient is taking anticoagulant medications, these should be held in the days prior to the procedure when such risk-benefit analysis justifies.[5]

On the day of the procedure, the patient should be instructed to take nothing by mouth for a period of 6–8 hours. Clear liquid intake closer to the procedural time in patients with normal foregut motility is likely permissible in line with ASA guidelines, if necessary.[16] Patients with motility issues or gastric outlet obstruction may require a longer period without oral intake or lavage to achieve emptying of the stomach and decrease the need for repeat evaluations due to inadequate visualization. Preprocedural motility agents such as erythromycin may be helpful in such settings and have been shown to improve visualization in the setting of upper gastrointestinal bleeding.[17] Additionally, if a patient wears dentures they should be removed at the time of the procedure. Mellinger–Sages antibiotics are currently recommended only in the setting of percutaneous gastrostomy tube placement, or intervention for bleeding in cirrhotic patients (starting at time of admission), as the

risk of infection including endocarditis with diagnostic upper endoscopy is quite low.[1,4]

As with any other invasive procedures, informed consent is an important step in preparing the patient for his or her endoscopic evaluation. The potential risks range from bleeding or infection to less likely but more devastating complications like perforation and must be disclosed in the preoperative setting. Because of their relative frequency compared to other complications, cardiopulmonary complications related to sedation should also be reviewed. Discussion of any therapeutic interventions being contemplated should be held beforehand as well, and the patient should have a chance to ask any questions. A more detailed discussion of procedure-related complications occurs later in this chapter.[5]

Equipment

The standard features of an upper endoscope include a control head, bending tip, and the intervening shaft, which is approximately 1 m in length. The control head is generally held in the left hand of the endoscopist. Buttons on the front are manipulated using the index and middle fingers and function as valves, which provide suction and air/water control. The two knobs on the side are turned using the thumb and allow angulation of the scope tip in four directions. The axis of the larger knob is referred to as "up and down" by convention, and the smaller knob moves "left and right." The bending section is the distal 10 cm of the endoscope and deflects the tip 180° or more. The shaft of the endoscope houses channels for air or carbon dioxide insufflation, water, suctioning, and passage of instruments for biopsy or other therapeutic devices.[2,12]

The endoscopic tower includes a light source, imaging processor, and irrigation bottle, and often includes a video screen. Other devices may also be housed on the tower, including units for thermal energy intervention and carbon dioxide insufflators.

Patient positioning

The patient is placed in the left lateral decubitus position facing the endoscopist for standard EGD. Supine position may be used in certain settings such as planned gastrostomy placement or intraoperative endoscopy. The head should be supported on a small pillow. Intravenous access is preferably obtained in the right upper extremity to allow easy access to the access site. A bite block is placed between the teeth to facilitate scope passage and prevent damage to the instrument during the

procedure. Supplemental oxygen is provided via nasal cannula, and monitoring devices are attached to the patient. Elevating the head of the bed slightly and angling the neck so the mouth faces downward are maneuvers to minimize aspiration risk during the procedure. Sedating medications can be administered once the patient is appropriately positioned.[6,7,9]

Passing the endoscope

Prior to insertion of the scope, the air, irrigation, suction, and image projection should all be tested so troubleshooting the equipment can occur prior to the start of the procedure. As the endoscopist awaits an appropriate level of sedation, he or she should position the scope in front of the patient and rehearse the tip angulation. The natural curvature of the scope and the position of the patient should be noted and can help in facilitating easy passage and manipulation of the scope. The tip should be well lubricated with water-soluble lubricant.

The end of the scope should be held in the right hand approximately 30 cm from the tip. This position allows passage of the scope without need for regrasping before the cricopharyngeus muscle is negotiated, but avoids too much length, which can cause buckling and hinder attempts to intubate the upper esophagus. The axis of the bending portion should be positioned to move in the superior and inferior directions of the patient's midline. The tip is inserted while straight through the bite block over the tongue and then slowly angled inferiorly with the larger knob once the posterior pharynx is reached. Rehearsal of this movement prior to starting the procedure is useful and ensures proper alignment of the scope in the direction of the esophagus.

Once passage is initiated, the endoscopist should focus on the video screen projecting the endoscopic view. Gentle movements of the scope limit gagging and avoid tissue trauma. The larger knob should now manipulate movement of the tip in the anterior and posterior midline plane. By torquing the scope with the right hand, right and left movements can be easily performed. As the scope enters, orientation can be achieved by keeping the midline centered. The pale surface of the tongue will be anterior and the darker red palate will be seen posterior. The laryngeal cartilages and vocal cords should be identified anteriorly once past the epiglottis. Posteriorly, a small slit behind the arytenoid cartilages is seen and marks the esophageal opening. The piriform sinuses are also seen flanking each side of this opening.

Advancement of the scope posteriorly toward the esophageal opening is done gently. Asking the patient to swallow can help facilitate relaxation of the cricopharyngeal sphincter. The view through the scope may be obscured when this

sphincter is closed against the scope tip. With gentle pressure while the patient swallows, the scope can be guided into the esophagus as the sphincter relaxes. This maneuver requires smooth, gentle movements, and the scope should only be advanced when minimal resistance is encountered and visualization remains adequate.[6,9,12]

There are several other approaches that may be utilized to initially pass the endoscope. The commonly used technique under direct visualization described previously is typically adequate and optimal. Blind insertion can also be performed but is more commonly used with a side-viewing scope such as that used for endoscopic retrograde cholangiopancreatography (ERCP). This technique requires knowledge of anatomical landmarks and coordinates scope movements depending on the length of scope that has passed. Depending on the size of the patient, the cricopharyngeus is usually encountered around 15–18 cm from the incisors, and the patient is asked to swallow to facilitate scope passage. The endoscopist uses tactile feel to guide the tip in, and if resistance is encountered, must stop to avoid injury.

Some physicians use their fingers to assist in blind insertion. The second and third fingers are placed over the tongue to guide the scope over them into the posterior pharynx. The bite block is placed on the scope initially and then slid in place between the teeth once the scope has passed. Disadvantages of blind techniques include higher risk of iatrogenic injury and difficulty encouraging sedated patients to follow commands that aid in scope passage. Furthermore, if insertion is performed without the bite block in place, the patient may bite the scope or the physician's fingers.[6,12]

STEPS OF DIAGNOSTIC EVALUATION

Once intubation of the esophagus is achieved, an evaluation of the upper gastrointestinal tract should be performed in a methodical approach to ensure thorough evaluation. The esophagus, stomach, and proximal duodenum are all inspected regardless of the inciting indication. As with initial intubation of the esophagus, manipulation of the scope should be gentle to avoid scope trauma to the mucosa, which may confound diagnosis or cause injury to the patient. Specific findings of common pathologies that may be seen on evaluation are described in the section "Common Pathology."

Esophagus

The esophagus is first evaluated as the endoscope is advanced downward and again

at the end of the procedure while withdrawing the scope. The appearance of the mucosa of the esophagus should be noted. Peristalsis may occur, and insufflation of gas can be used to maintain an open lumen to adequately visualize the entire esophagus. When the scope tip is at the level of a structure within the esophagus, its position can be measured by noting the length of scope passed in relation to the incisors. The gastroesophageal (GE) junction is generally encountered approximately 38–40 cm from the incisors. The site at which the pale mucosa of the esophagus meets the darker red mucosa of the stomach is the squamocolumnar junction and is referred to as the "Z line." The hiatus of the diaphragm can be observed as a constriction of the esophagus during inspiration and normally is within 2 cm of this line. By asking the patient to sniff, this constriction appears more prominent.[6,12]

Stomach

The stomach is evaluated once the scope is advanced past the GE junction. To facilitate relaxation of any torque on the scope, the right hand should let go of the endoscope, and the endoscopist should step back from the table, allowing the endoscope to straighten. With the patient in left lateral position, the scope should then orient so that the lesser curvature is at the 12 o'clock position and the greater curvature is at the 6 o'clock position in the visual field. The anterior stomach wall will be on the left and the posterior wall on the right. The cardia, fundus, body, and antrum are all inspected sequentially while insufflating to maintain an adequate view. Any pooled gastric contents should be suctioned so no lesions are missed, and the risk of reflux or aspiration is decreased. The mucosa, blood vessels, and gastric folds should be evaluated, and distensibility and peristalsis should be assessed. With the previously described orientation, the rugal folds should run parallel toward the pylorus. Once the pylorus is encountered, it can be intubated for further exploration of the duodenum. As the scope is backed away from the pylorus and antrum, the final step in evaluating the stomach is to retroflex and examine the hiatus. To obtain this view, the endoscope should be positioned in the antrum. The tip is then deflected upward using the thumb on the large knob, and the left hand is rotated 90° counterclockwise. With the scope in this position, the cardia is visualized, and the scope shaft can be withdrawn to achieve a closer view of the hiatus. Torque applied with the right hand allows circumferential visualization of all areas in the proximal stomach from this retroflexed position. Occasional fine adjustments of the smaller right/left knob may help with optimal visualization. The incisura is similarly best inspected from this position before allowing the endoscope to return to its fully

straightened position.[9,10]

Duodenum

Intubation of the pylorus allows inspection of the duodenum. The opening should be centered in the endoscopic view. It is easiest to manipulate the left and right movements with torque and up and down deflections with the larger knob. In most patients, the scope can be easily passed through the pylorus. The surgeon may need to wait for a spasm to pass and advance only when the sphincter relaxes. If undue resistance is encountered, this may signify stenosis. It is helpful to avoid overdistention of the stomach when preparing to negotiate the pylorus, which may facilitate pyloric spasm. Occasionally a small burst of suction applied when the endoscope is peering through the pyloric opening may engender entry. It should also be remembered that some of the best viewing of the duodenal bulb may be accomplished through the pylorus, rather than after it has been passed.

When the scope is advanced into the duodenal bulb, the momentum usually propels it into the distal bulb. To evaluate this area, the scope must be backed out slowly with slight deflections of the tip to ensure all mucosa is inspected. Lesions in this area can be easily missed due to the propensity of the scope to slip back into the stomach, and particular care should be taken to visualize all aspects of the bulb. Passage of the scope into the distal duodenum is the next step and can be challenging due to the superior duodenal angle, depending on patient anatomy. This sharp turn connects the duodenal bulb to the descending duodenum and must be navigated to gain access to the remainder of the duodenum. As the duodenum sweeps posteriorly, the luminal view often disappears. To advance past this turn, the right hand should release the scope while the left hand manipulates the larger knob so the tip deflects slightly upward. Rotation of the left hand 90° clockwise facilitates negotiation of the angle into the descending duodenum. This is followed by pulling back on the scope, allowing paradoxical advancement into the more distal duodenum as the instrument moves from a looped, greater curve position in the stomach to a lesser curve and straightened position. Continued evaluation of the distal duodenum can be accomplished as desired by advancing the scope under direct luminal inspection. If recurrent looping in the stomach occurs and limits more distal duodenal intubation, gentle pressure on the epigastrium may help overcome this.[9]

WITHDRAWAL OF THE ENDOSCOPE

At the conclusion of the procedure, the endoscope should be straightened out and any air in the stomach should be suctioned. Desufflation decreases postprocedure discomfort related to gastric distension. It is important to reinspect all surfaces during scope withdrawal to ensure pathology is not missed. As the tip is backed out of the cardia into the esophagus, small amounts of gas may need to be instilled to maintain an open lumen for a final look at the esophageal mucosa. The right hand should slowly withdraw the scope. Fine movements with the larger knob and torque of the right hand should be used to keep the lumen centered as the scope is removed.[12]

SPECIMEN COLLECTION

During endoscopic evaluation, lesions may be identified that warrant biopsy of tissue for microscopic examination. Specimens should be obtained using cupped forceps passed through the instrument insertion channel. Lesions should be centered in front of the endoscope. It is easiest to keep the forceps relatively close to the scope tip and approach the lesion by moving the scope instead of the forceps themselves, as fine control becomes more difficult when the forceps extend far beyond the tip of the endoscope. It is helpful to know that the suction and biopsy channel is at 6 o'clock on the endoscopic visual field, so positioning pathology or material to be suctioned in that location will facilitate the task. With the forceps in the open position, the jaws of the same should be pressed against the lesion, closed, and the forceps pulled back quickly to obtain the specimen. Some forceps are spiked, which allows multiple specimens to be taken and secured on the spike before withdrawing the biopsy forceps.

A few additional tissue sampling principles are useful to help ensure an appropriate piece of tissue is obtained to maximize the diagnostic yield. Ulcers should be biopsied at the rim in four quadrants. Biopsy of the center is usually only helpful if the sample will be used to identify a viral process. Neoplastic lesions may have necrotic portions, so if possible, avoid taking the biopsy from these areas as they lack the architecture to make an accurate histologic diagnosis. Esophageal lesions should be approached with the scope pressed against the wall and the forceps kept close to the tip of the scope. Submucosal lesions are difficult to sample with standard forceps. In such settings, biopsy-on-biopsy techniques may be utilized, or more advanced therapeutic tools such as endoscopic ultrasound-guided tissue acquisition, large particle biopsy, endoscopic mucosal resection, and endoscopic submucosal dissection may be considered. Advanced skills and equipment are required for these interventions.[6]

NORMAL FINDINGS

Mastery of the technique of upper gastrointestinal endoscopy along with knowledge of the expected normal appearance of foregut anatomy are necessary for successful diagnostic evaluation. Pictures of normal findings in the esophagus, stomach, and duodenum are provided in the following section (**Figures 5.1 through 5.6**).

Normal findings on upper gastrointestinal endoscopy

Figure 5.1 Esophagus—midportion of esophagus.

Figure 5.2 Esophagus—normal Z-line.

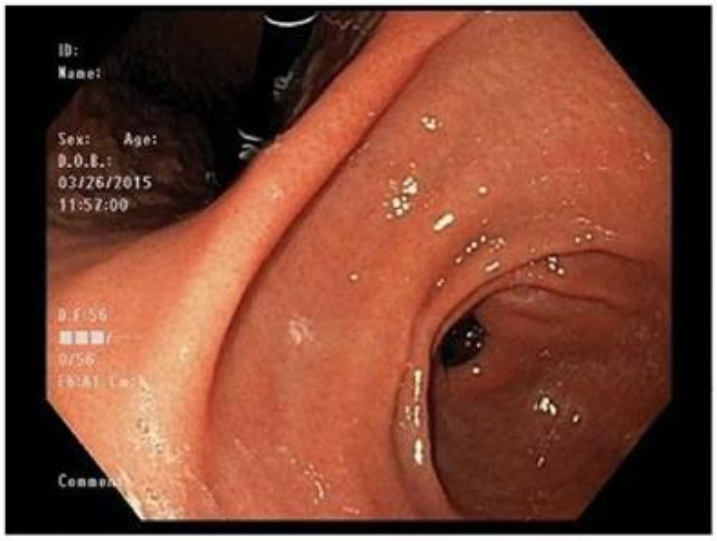

Figure 5.3 Stomach—retroflexed view demonstrating normal mucosa at the angularis or incisura.