2 N. GI ENDOSCOPY SURGERY

Endoscopy Surgery Pearls

- Pre-sedation lidocaine gargle can be used for oral endoscopic procedures: very rare risk of methemoglobinemia; anaphylactic reactions; increased risk of aspiration.
- The patient may need to hold products containing aspirin or NSAIDs (e.g., Motrin) for 3-7 days before the procedure. Notify the gastroenterologist if the patient is on any blood thinners such as coumadin, plavix, lovenox, or heparin preoperatively.
- The physician can "tattoo" a questionable area in the gastrointestinal tract with indigo carmine (India ink) to help relocate the spot in a future scope procedure or during a laparoscopic or laparotomy procedure.
- Endoscopy can be done through an abdominal stoma with patient in supine position.

Anesthetic implications- consistent throughout endoscopic surgeries

Goal & issues-anesthesia	• Either CO_2 or air is commonly flushed into gastrointestinal system during endoscopy putting increased pressure either up towards the mouth or downward. Patients with any fluid in their upper GI tract have an increased risk of aspiration.
Monitors (routine plus)	• Minimal monitoring includes pulse oximetry, EKG, and blood pressure readings should be measured and recorded every 5 minutes during the procedure.
Positioning	• Left lateral with right knee pulled up and left leg straight. • Supine.
IV access	• One PIV is usually sufficient.
Eye care	• Confirm left eyelid closed and eye has no pressure on it in left lateral position.
Temperature issues	• Keep patient covered as much as possible with a blanket.
Antiemetics	• Prophylactic ondansetron can be given; propofol reduces PONV.
Preinduction	• Oxygen is given via nasal cannula or simple facemask. CO_2 monitoring is a helpful adjunct, accomplished by placing the CO_2 sample line within the facemask or in the proximity of the nasal cannula.
Induction	• Conscious sedation usually done for amnesia and to decrease movement.

	• A propofol drip, versed (midazolam), ketamine, fentanyl can all be used. • Propofol 2-4 mg/kg bolus dose. • Endoscopic procedures often require deep sedation to the point of general anesthesia because of their prolonged duration, potential for increased pain, need for maintaining still position, and risk of aspiration, bleeding or perforation. • Some procedures, such as the POEM procedure, require GETA.
Maintenance	• Propofol infusion. • Dexmedetomidine 4-20 mcg IV bolus can also be helpful.
Notes	• Though patients are usually breathing spontaneously and not intubated for endoscopic procedures, it is considered TIVA general anesthesia if the patient does not respond appropriately to command. • Have all equipment for intubation and ventilation (ambu bag at a minimum), as well as drugs needed for induction, readily available.
IVF and volume requirements	• Euvolemia.

Endoscopic procedure anesthesia

The vast majority of endoscopic procedures are performed in an outpatient setting with a narcotic (Demerol or fentanyl) and a benzodiazepine. A trend toward more sedation with hypnotic agents is underway. The primary anesthetics used are

Versed (midazolam) and **Propofol** for anxiety and sedation. In our practice, we have found that using just Propofol as the sole anesthetic for most endoscopic procedures is sufficient and safe with good amnesia effects.

Benadryl may be used as an adjunct to increase sedation, it provides a synergistic effect with Versed and Propofol and may help to decrease the amounts of other anesthetics needed. However, it does depress the central nervous system and patients should be closely monitored during and after the procedure.

There is an increased risk of respiratory depression with **opioid** administration if sedatives have been given. However, it may be beneficial to administer opioids, such as fentanyl 0.25-0.5 mcg/kg to blunt sympathetic response and aid in MAC anesthesia. Reversal agents, flumazenil (benzodiazepine reversal) and Narcan (opioid reversal) should be available and administered if needed.

Several different local anesthetics (Prilocaine, benzocaine, cetacaine; rarely lidocaine) can cause a fatal methemoglobinemia reaction if used more than the maximum dosages. Methemoglobinemia causes the hemoglobin to be incapable of carrying oxygen or carbon dioxide; also, the oxy-hemoglobin dissociation curve is shifted to the left, impairing delivery of oxygen at the tissue level. Methylene blue 2 mg/kg can be used in the treatment of methemoglobinemia, with high flow oxygen.

For upper endoscopies, Robinul 0.1-0.2 mg IV to decrease mouth and oropharynx secretions; lidocaine 1mg/kg IV can decrease airway reactivity, oropharynx sensitivity, and gagging.

Endoscopic procedures anesthesia - pediatric: Lidocaine lollipops can be used to prepare a child for an upper gastrointestinal procedure. Oral, nasal or rectal benzodiazepines are utilized before IV sedation is given. Potentially serious airway complications are possible with this patient population as their tongues are larger, their airways smaller, and even small amounts of mucous or edema can increase this resistance further.

A pediatric colonoscopy often takes longer with greater sedation needs because good bowel cleansing is difficult on these patients. Risk of aspiration and often the need for general anesthesia is greater. Depending on the patient's acuity and reason for the procedure, children may be done in either an outpatient surgical center or in the hospital. A thorough preoperative evaluation and history and physical are important. The local anesthetic, Prilocaine, is not recommended for use in infants.

Endoscopic procedures levels of anesthesia

As the levels of sedation run along a continuum, it is not possible to predict how an individual patient will respond to anesthetic drugs, therefore, a trained anesthesia provider (a qualified practitioner in airway management and advanced life support) must be present in any situation where a patient could potentially transition between mild or moderate sedation to deep sedation or general anesthesia. The provider must be able to "rescue" any patient who progresses to a deeper level of anesthesia than initially planned. For example, a patient who is planned for moderate or deep sedation may pass into deep sedation or general anesthesia and cannot maintain a patent airway or maintain oxygenation/ventilation. This results in hypoventilation, hypoxia, and/or hypotension and requires cardiovascular support.

minimal sedation: "anxiolysis", normal response to voice commands; cognitive function and physical coordination may be impaired-

- airway: unaffected
- spontaneous ventilation: unaffected
- cardiovascular function: unaffected

moderate sedation: : "conscious sedation"; purposeful response (not reflexive withdraw) to voice commands or touch-

- airway: no intervention required
- spontaneous ventilation: adequate
- cardiovascular function: usually maintained

deep sedation: : depression of consciousness; cannot be easily aroused-

- airway: intervention may be required
- spontaneous ventilation: may be inadequate; jaw thrust to positive pressure ventilation may be needed
- cardiovascular function: usually maintained

general anesthesia: : unarousable with any stimuli-

- airway: intervention often required
- spontaneous ventilation: frequently inadequate
- cardiovascular function: may be impaired

Endoscopic procedures - patient factors necessitating anesthesia services

- ASA III – V
- Potential difficult airway
- Morbid obesity
- Obstructive sleep apnea
- Aspiration potential
- Emergency procedure
- Prolonged or complex procedures

GASTROINTESTINAL ENDOSCOPIC SURGERIES

Colonoscopy / Sigmoidoscopy

Surgery: a diagnostic endoscopic exam that uses a lighted, flexible endoscopic tube to transmit images of an examination of the entire large colon (approximately five feet in length from the rectum to the ileocecal valve) and the distal part of the small bowel to a video screen.

Indications and anatomy: – anus, sigmoid colon, ascending /transverse /descending colon.

Diagnostic: performed to detect and biopsy ulcers and bleeding, polyps, diverticuli, tumors, inflammation, to detect the early signs of colon or rectal cancer, to follow-up after abnormal barium x-rays; for complaints of diarrhea, constipation, a change in bowel patterns, rectal bleeding or anemia.

Therapeutic: cauterization or laser treatments of polyps, tumors, or bleeding; dilation; stent placement.

Operative procedure: the colonoscope is inserted into the rectum and advanced rather quickly to the cecum and the appendiceal opening or until the ileocecal valve (where the large and small intestine meet at the lower right quadrant) is visualized. The physician then slowly withdraws the scope, carefully examining all sides of the colon. (In some centers, it is required for the anesthesia provider to make note of the time the scope is at the ileocecal valve to confirm that the gastroenterologist allows enough time to properly examine the bowel on withdrawal of the scope). A snare or forcep "bite" of tissue is done to biopsy at the site of any unusual polyps, growths, or mass. A grounding pad may need to be placed for cautery excision if needed. Either at the beginning of the procedure or at the end, the scope is folded into a U-shape to visualize the distal rectum and anal canal which cannot be examined completely with the antegrade view. Usually a sigmoidoscopy is done in conjunction with a colonoscopy.

If a mass or an unresectable lesion is found, an ink tattoo can be placed with an injection catheter to mark the exact location of the lesion for relocation at a future endoscopy or to help the surgeon locate the lesion at the time of a laparotomy/laparoscopy.

Anesthetic implications- colonoscopy / sigmoidoscopy

See implications consistent throughout endoscopic surgeries

Goal & issues- anesthesia	• These patients are NPO for twelve hours (except for the bowel prep itself) and present with dehydration and may manifest hypovolemia. • Position may need to be changed during the procedure to facilitate passage of scope. • Most stimulation occurs when colon insufflated and endoscope rounding turns in the colon (splenic and hepatic flexures).
Surgical complications	• Risk of intestinal perforation, aspiration possible especially with abdominal compression to reduce loop formation.
Notes	• A colonoscopy is becoming a routine screening test for people ages 50 years of older. Re-screenings, after one normal colonoscopy, are done every five to ten years. Patient's with disease are rescreened again according to the physician's judgement.

Cryotherapy or radiofrequency ablation for Barrett's Esophagus

Surgery: endoscopic treatment of high-grade dysplasia in the esophagus.

Indications and anatomy: Barrett's esophagus is a complication of chronic gastroesophageal reflux disease (GERD); it refers to an abnormal change in the cells of the lower esophagus causing a premalignant condition. High-grade dysplasia and early stages of adenocarcinoma can be treated with cryotherapy or radiofrequency ablation, left untreated, a malignant sequela of Barrett's has a mortality rate of over 85%.

Current treatment options for Barrett esophagus include continued surveillance, endoscopic resection or ablation, and surgery (esophagectomy).

Within endoscopic resection, there are 2 treatment options: mucosal resection or endoscopic submucosal dissection for removal of lesions en bloc. Endoscopic resection is frequently performed in conjunction with radiofrequency ablation and cryotherapy with liquid nitrogen or carbon dioxide. For limited surface areas, argon plasma coagulation and bipolar probes are a less expensive alternative, although they may have higher recurrence rates.

Operative procedure: cryotherapy is most commonly performed with liquid nitrogen, which is delivered to the mucosal surface at -176° C in a spray pattern to freeze the tissue, fracturing cell membranes and denaturing proteins. The treatment effect is minimal at first, with the development of a cherry red appearance and slight ooze of blood in the tissue compared with the tissues normal salmon pink appearance. Within days, the tissue sloughs off and potentially heals with neosquamous epithelium in an acid-suppressed state. Patients undergo a follow-up examination in 2 to 3 months, at which time retreatment is performed for any residual areas of Barrett esophagus. Usually, 1 to 5 treatment sessions are needed, depending on the length of the Barrett esophagus and the response to treatment.

The effectiveness of cryotherapy appears to be up to 96% for eradication of high-grade dysplasia, 75% for eradication of all dysplasia, and 50% for eradication of all intestinal metaplasia. However, long-term data are lacking.

Radiofrequency ablation (RFA): that uses heat energy to destroy disease esophageal tissue in the same manner as cryotherapy can also be done.

Anesthetic implications- cryotherapy for Barrett's Esophagus

See implications consistent throughout endoscopic surgeries

Goal & issues- anesthesia	• Patient must be NPO for 8 hours for solids and 4 hours for liquids before the procedure. A bowel prep is not needed. • Sharing airway with esophageal approach, maintaining oxygen saturations can be difficult. Be prepared for intubation. • Pre-sedation lidocaine gargle can be used for oral endoscopic procedures: very rare risk of methemoglobinemia; anaphylactic reactions; increased risk of aspiration.

	• A mouth piece is inserted between the upper and lower teeth to prevent the patient from biting down on the scope. • Lowering the chin down towards the sternum and providing jaw thrust can aid the physician in passing the scope into esophagus. • Most stimulation occurs when introducing the endoscope into mouth, past the tongue and into esophagus.
Surgical complications	• Bleeding, esophageal or stomach perforation, chest pain following procedure.

Endoscopic retrograde cholangiopancreatography (ERCP)

Surgery: this diagnostic endoscopic procedure uses a specially designed side-viewing endoscope which combines upper endoscopy and fluoroscopy to diagnose and treat pancreas and biliary disorders. This permits visualization from the mouth down to the duodenum through the sphincter of Oddi (muscular valve that controls opening of ampulla of Vater - union of the common bile and pancreatic duct) where a catheter and guidewires are inserted into the ampulla and contrast dye is injected to allow visualization of the biliary and pancreatic ducts.

Diagnostic and interventional: allows direct visualization, find and remove a gallstone in the common bile duct; diagnose diseases of the liver, bile ducts, or pancreas; or perform a cytology brush test (to take cells from a tissue to test). The opening to the ampulla can be enlarged by sphincterotomy with an electrified wire called sphincterotome to help with stone extraction.

Indications and anatomy: to diagnose problems in the liver, gallbladder, bile ducts, and pancreas. The drainage ducts from these organs are sometimes called the biliary tree. May be used to discover the reason for jaundice, pancreatitis, upper abdominal pain, and unexplained weight loss. A stone may be obstructing the common bile duct.

Operative procedure: the lighted flexible endoscope is passed through the esophagus, stomach, and duodenum until reaching the very small opening into the biliary tree where the gall bladder, liver, and pancreas drain into the duodenum (common bile duct entrance). A small tube is passed through the endoscope so that dye can be injected into the biliary tree and x-rays can be taken. If the exam shows a stricture of the ducts or gallstones, instruments can be threaded through the scope to remove a stone or dilate a stricture; biopsies can also be taken. A papillotomy is an incision in the common bile duct distal muscle; it enlarges the duct opening facilitating stone removal. A catheter may be left in the duct for temporary drainage.

As with other endoscopy techniques, images of the stomach, duodenum, pancreatic and biliary ductal systems are transmitted to a video screen. Retrograde refers to the direction the contrast dye is injected to visualize the bile duct system and the pancreas.

Positioning:

- Left lateral, partially prone; left arm extended above the head and right arm tucked at the side of the body.
- Position may need to be changed during the procedure.
- Some patients are left in the supine position.

Anesthetic implications- Endoscopic retrograde cholangiopancreatography (ERCP)

Goal & issues- surgical	• An ERCP can take 30 minutes to several hours. • Antibiotics are ordered in patients with bile duct obstruction or with a pancreatic pseudocyst. (Infective endocarditis may result from the bacteremia released during the ERCP). • Sharing airway with esophageal endoscopy, maintaining oxygen saturations can be difficult. Be prepared for intubation. *In our practice, these patients are intubated.* • Pre-sedation lidocaine gargle can be used for oral endoscopic procedures: very rare risk of methemoglobinemia; anaphylactic reactions; increased risk of aspiration.
Goal & issues- anesthesia	• For sedation, oxygen is given via nasal cannula. CO_2 monitoring is a helpful adjunct, accomplished by placing the CO_2 sample line within the proximity of the nasal cannula. • Lowering the chin down towards the sternum can aid the physician in passing the scope through the oropharynx. If passage is still difficult, thrusting the jaw forward can help. • All opioids can cause spasm of the sphincter of Oddi and should be avoided until the end of the exam. If an opioid is needed, give Demerol (least spasm of sphincter of Oddi). • The most stimulating parts of the case are when the physician inserts the endoscope over the tongue and through the oropharynx, blows air into the duodenum, and when balloon dilation of the duct is performed.

	• Biliary flow from the common bile duct into the duodenum in controlled by the sphincter of Oddi. Glucagon can be used to inhibit intestinal motility and to reduce tone in the sphincter of Oddi decreasing biliary pressure. 1 unit = 1 mg glucagon, 0.25-2 mg given IV or 1-2 mg IM. • FYI- Of all the endoscopic procedures, adequate sedation is most important in the case of ERCP which involves the delicate placement of a catheter into a specific duct (pancreatic or common bile duct for dye injection and the associated ampullary sphincterotomy that involves the cautery destruction of the ampullary sphincter to allow common bile duct stone extraction.
IV access	• Having the intravenous needle (IV) in the hand/arm closest to the anesthesia provider can make it easier to assess and access the IV site if the patient is in a left lateral/partially prone position.
Eye care	• Confirm left eyelid closed and eye has no pressure on it in left lateral position. • If general anesthesia is given, taped the eyes closed and place pads over the eyes.
Temperature issues	• Lower body warming blanket.
Antiemetics	• Prophylactic antiemetics usually given.
Preoperative	• Patient must be NPO for 8 hours before the procedure. A bowel prep is not needed. • Pre-procedure, clarify the patient is not allergic to iodine or shrimp as contrast dye is used during the procedure.
Preinduction	• Anticholinergic (robinul, atropine) can be given to decrease oral or gastric secretions. • A mouth piece is inserted between the upper and lower teeth to prevent the patient from biting down on the scope.
Induction	• GETA is often done. If general anesthetic is given and the patient requires intubation, a reinforced ETT may be used to prevent endotracheal compression as the endoscope is passed into the esophagus. • Conscious sedation can be done for amnesia and to decrease movement. Usually need to keep them quite deep to prevent movement or discomfort. A propofol drip, versed (midazolam), ketamine, fentanyl can all be used.

Maintenance	• Volatile inhaled agents with supplemental fentanyl.
Postoperative issues	• Rectal NSAID Indomethacin (two 50 mg rectal suppositories) can be given to prevent post-ERCP pancreatitis. • Major risk of an ERCP is the development of pancreatitis, (occur in up to 5% of ERCPs). This may be self-limited and mil but may require hospitalization; rarely is it life-threatening.
Surgical complications	• Risk of intestinal perforation, this is an increased risk if a sphincterotomy is performed. As the second part of the duodenum is anatomically in a retroperitoneal location, perforations due to sphincterotomies are retroperitoneal. • Cardiopulmonary complications along with bleeding and perforation of the duodenum are possible complications of an ERCP.
Preop labs	• CBC, chemistry panel; serum amylase and lipase.

Endoscopic ultrasound (EUS): an endoscope with an ultrasound probe on the tip is passed into the esophagus, stomach, and duodenum. Used to examine the gastrointestinal wall and surrounding structures (liver, pancreas, bile ducts, gallbladder). Ultrasound-guided puncture can be done to obtain tissue diagnosis of pancreatic cancer. Therapeutic applications include drainage of pancreatic pseudocysts and bile duct using fluoroscopic guidance.

Anesthetic implications- endoscopic ultrasound
See implications consistent throughout endoscopic surgeries

Goal & issues-anesthesia	• Patient must be NPO for 8 hours for solids and 4 hours for liquids before the procedure. A bowel prep is not needed. • Sharing airway with esophageal approach, maintaining oxygen saturations can be difficult. Be prepared for intubation. • Pre-sedation lidocaine gargle can be used for oral endoscopic procedures: very rare risk of methemoglobinemia; anaphylactic reactions; increased risk of aspiration. • A mouth piece is inserted between the upper and lower teeth to prevent the patient from biting down on the scope.

	• Lowering the chin down towards the sternum and providing jaw thrust can aid the physician in passing the scope into esophagus. • Most stimulation occurs when introducing the endoscope into mouth, past the tongue and into esophagus.
Surgical complications	• Risk of esophageal or stomach tear or perforation which can lead to pneumothorax and/or hemorrhage.

Enteroscopy

Surgery: a diagnostic endoscopic procedure that uses a lighted, flexible endoscopic tube to transmit images of the small intestine onto video screen; scope inserted either through mouth or anus.

Indications and anatomy: used to check for bleeding ulcers, inflammation, infection or disease, anemia with normal colonoscopy and gastroscopy. Also, to check for amyloidosis, celiac disease, Crohn's disease, vitamin B12 deficiency, infections gastroenteritis, lymphoma, tropical sprue, lactose intolerance, and unexplained diarrhea and/or gastrointestinal bleeding.

Operative procedure:

Upper scope: a mouth piece is inserted between the upper and lower teeth to prevent the patient from biting down on the scope; the endoscope is advanced.

Lower scope: a pediatric or adult colonoscope or a "push" enteroscope can be used to access the small intestine through the anus. Most often, the small bowel abnormalities can be reached with a standard endoscope, however, a longer instrument, called an enteroscope, can reach further into the small intestine. The enteroscope, a flexible tube with one balloon, is advanced through the large intestine to the small intestine. As with a colonoscopy, the scope is inserted as far as it can go initially, then slowly withdrawn to allow complete examination of the walls of the small intestine. An enteroscope/endoscope allows the physician to treat any cause of bleeding and biopsies can be done.

Double-balloon enteroscopy: two balloons attached to the endoscope can be alternately inflated and deflated creating a temporary anchor to pull the endoscope forward (caterpillar type action) to allow the physician to view the entire small bowel.

Several major difficulties can be encountered attempting an enteroscope procedure of the small intestine. This organ is in constant movement (peristalsis), the small intestine is much more mobile than the colon. Adding to the difficulty is the fact that the small intestine is seventeen feet long, making it more difficult to reach with more difficulty in pinpointing the exact locations of abnormalities for

further study or surgical resection. Tattoos can be placed if abnormal anatomy is located; finding the tattoo is easier than trying to find the lesion itself.

Alternate method to assess the small bowel:

Capsule endoscopy: *this is an outpatient procedure that requires no sedation. It is a diagnostic procedure only and no therapeutics can be done.* This procedure involves a 1-1/8-inch-long x 3/8-inch-wide wireless camera in a capsule (vitamin-sized) with a six-hour battery lifespan that contains a light source, a tiny wireless endoscopic camera and a small transmitter. After the patient swallows this "large pill", the capsule takes thousands of pictures as it moves through the digestive tract which are transmitted to a receiver attached to a wearable belt. This camera is used to take images of the region most difficult to visualize with an endoscope, the small intestine, and is useful for diagnosing obscure bleeding and Crohn's disease.

The capsule normally passes out of the digestive system in 24-48 hours and is eliminated, the patient returns the receiver to the gastroenterologist who can then review these images in detail looking for abnormalities or areas of bleeding.

Research has found this capsule better than routine endoscopy or small bowel x-rays at locating abnormalities or the source of bleeding.

Whether diagnosed by routine endoscopy, enteroscopy or capsule endoscopy, once the cause of small bowel bleeding is determined, the treatment is planned. In cases of arteriovenous malformations (AVM), a small amount of electric current can be delivered through the endoscope to destroy the abnormality. If the AVM is discovered during endoscopy, the treatment can be applied immediately without requiring further diagnostic testing. If found with the capsule, the options include a repeat endoscopy or an enteroscopy if the AVMs are within reach, or surgical assistance as described above to help reach the site. Polyps can be removed with an endoscope. Cancers require surgical removal. Other causes of small bowel bleeding can be treated medically (such as in Crohn's disease).

Positioning: left lateral position with HOB elevated 30-45 degrees. Position may need to be changed during the procedure.

Anesthetic implications- enteroscopy

See implications consistent throughout endoscopic surgeries

Goal & issues- anesthesia	• Sharing airway with esophageal approach, maintaining oxygen saturations can be difficult. Be prepared for intubation. • Pre-sedation lidocaine gargle can be used for oral endoscopic procedures: very rare risk of methemoglobinemia; anaphylactic reactions; increased risk of aspiration.

	• A mouth piece is inserted between the upper and lower teeth to prevent the patient from biting down on the scope. • Lowering the chin down towards the sternum and providing jaw thrust can aid the physician in passing the scope into esophagus. • Most stimulation occurs when introducing the endoscope into mouth, past the tongue and into esophagus for the upper scope procedure.
Temperature issues	• This procedure can be quite long, keeping the patient warm is a concern.
Surgical complications	• Excessive bleeding from the biopsy site, bowel perforation, infection, aspiration pneumonia.

Esophagogastroduodenoscopy (EGD): a diagnostic endoscopic procedure that uses a lighted, flexible endoscopic tube to transmit images of the upper part of the gastrointestinal tract (esophagus, stomach, proximal duodenum) to a video screen. *For esophageal dilation, see Chapter 2 M "Gastrointestinal surgery"*

D**iagnostic**: anemia, upper GI bleeding, nausea and vomiting, abdominal or chest pain, dyspepsia, monitor/diagnose reflux that can lead to Barrett's esophagus (precancerous lesions), difficult or painful swallowing, confirmation of celiac disease by biopsy, esophageal varices

T**herapeutic**: esophageal varices, sclerotherapy, injection of epinephrine in bleeding lesions, biopsy of polyps or any other abnormal tissue, laser therapy, removal of foreign bodies, cauterize bleeding tissue, to tamponade bleeding esophageal varices, photodynamic therapy to esophageal malignancies, drainage of pancreatic pseudocyst, to dilate or stent a stricture, to assist in the placement of a percutaneous gastrostomy feeding tube. *See Gastrostomy, percutaneous endoscopic tube (PEG) placement in Chapter 2 M "Gastrointestinal surgery"*.

Operative procedure: through the oropharynx. The lighted flexible endoscope is passed through the esophagus; biopsies can be done. A complete evaluation of the esophagus needs to include the retroflexed view of the gastric fundus / gastroesophageal junction (GEJ) performed within the stomach.

Anesthetic implications- esophagogastroduodenoscopy

See implications consistent throughout endoscopic surgeries

Goal & issues- anesthesia	• Patient must be NPO for 8 hours for solids and 4 hours for liquids before the procedure. A bowel prep is not needed. • Sharing airway with esophageal approach, maintaining oxygen saturations can be difficult. Be prepared for intubation.

	• Pre-sedation lidocaine gargle can be used for oral endoscopic procedures: very rare risk of methemoglobinemia; anaphylactic reactions; increased risk of aspiration. • A mouth piece is inserted between the upper and lower teeth to prevent the patient from biting down on the scope. • Lowering the chin down towards the sternum and providing jaw thrust can aid the physician in passing the scope into esophagus. • Most stimulation occurs when introducing the endoscope into mouth, past the tongue and into esophagus.
Induction	• This procedure always requires general anesthesia.
Surgical complications	• Risk of esophageal or stomach tear or perforation which can lead to pneumothorax and/or hemorrhage.

Peroral Endoscopic Myotomy (POEM)

Surgery: to relieve lower esophageal sphincter constriction.

Indications and anatomy: *see Esophagomyotomy (AKA Heller myotomy) in Chapter 2 M "Gastrointestinal surgery"*. To treat motility disorders of the esophagus, such as achalasia and other spastic esophageal diseases by creating a tunnel inside the esophageal wall to cut the muscle.

These patients may have already had pneumatic or bougie dilatation of the distal esophagus and/or botulinum toxin injections to relax the distal esophagus.

Includes long-standing, sigmoid shaped esophagus in achalasia, even previously failed endoscopic treatment or surgical myotomy, and other spastic esophageal motility disorders. Accumulating data about POEM demonstrate excellent short-term outcomes with minimal risk of major adverse events. However, the potential risks are greater than for any other endoscopic procedure since the endoscope is within the mediastinum.

Operative procedure: by endoscopic approach and CO_2 insufflation, an electrocautery knife creates a 2-cm submucosal longitudinal incision from mid esophagus into the proximal stomach exposing the inner circular muscle. The endoscope is inserted into the space, circular muscle bundle fibers are targeted, divided, and dissected using a spray coagulation current, avoiding massive bleeding from the larger intra-muscular vessels. After completion of the myotomy and relaxation of the distal esophagus, prophylactic antibiotic solution is sprayed inside the tunnel and the incised mucosal entry is closed with hemostatic clips. Improvement of the passage and complete closure is confirmed from inside the esophageal lumen by endoscope.

Although there is little evidence, many experts suggest that posterior myotomy may have an advantage for relief of dysphagia, and anterior myotomy may be better in the prevention of gastroesophageal reflux disease.

****NOTES – Natural Orifice Transluminal Endoscopic Surgery**: Peroral endoscopic myotomy (POEM) is the application of esophageal myotomy to the concept of natural orifice transluminal surgery (NOTES) by utilizing a submucosal tunneling method.

Positioning: supine or left lateral.

Anesthetic implications- Peroral Endoscopic Myotomy (POEM)

Goal & issues-anesthesia	• Patient must be NPO for 8 hours for solids and 4 hours for liquids before the procedure. A bowel prep is not needed. • Pre-sedation lidocaine gargle can be used for oral endoscopic procedures in patients undergoing general anesthesia, done to help with post-procedure throat soreness. Very rare risk of methemoglobinemia; anaphylactic reactions; increased risk of aspiration. • A mouth piece is inserted between the upper and lower teeth to protect the teeth. • Lowering the chin down towards the sternum and providing jaw thrust can aid the physician in passing the scope into esophagus. • Most stimulation occurs when introducing the endoscope into mouth, past the tongue and into esophagus.
IV access	• One PIV.
Eye care	• Eyes taped closed after induction.
Temperature issues	• Lower body warming blanket.
Antiemetics	• Prophylactic antiemetics usually given.
Preinduction	• Sedation given for anxiolysis and amnesia.
Induction	• Requires GA/OETT and positive pressure ventilation to reduce complications associated with CO_2 insufflation.
Maintenance	• Volatile agents with supplemental fentanyl.
Surgical complications	• Pneumo/Capnothorax, pneumo/capnoperitoneum, tension capnopericardium with cardiac arrest, subcutaneous emphysema.
Notes	• Patients are usually admitted for 23-hour observation and discharged on clear liquid diet.