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**Section 1: Abdominal wall:**

* **Symptomatic primary inguinal hernia**
  + When the diagnosis is uncertain, get an US. Get a CT for operative planning for a massive inguinal hernia
  + For asymptomatic or minimally symptomatic patients, observation is safe
  + Open repair vs laparoscopic repair
  + Patients with incarcerated or strangulated hernias need observation and ROBF
  + TEP is contraindicated in patient with prostate surgery
  + Identify the myopectineal orifice if doing MIS surgery
* **Recurrent inguinal hernia**
  + Get a CT as part of the workup including valsalva images
  + TEP is contraindicated in patient with prostate surgery
  + Identify the myopectineal orifice if doing MIS surgery
* **Incarcerated/strangulated inguinal hernia**
  + Try to examine whether or not it’s above/below inguinal ligament (femoral vs inguinal)
  + If the diagnosis is truly in question you can get a CT, otherwise it’s largely a waste of time/money
  + They may need an NGT if they are obstructed, could check with plane films
  + Consider a laparoscopic repair as it will allow you to evaluate all the bowel, however the gold standard is an open groin approach
* **Ventral incisional hernia**
  + Distinguish this from diastasis
  + Ideal repair is a retrorectus repair, don’t forget to place drains
* **Complex abdominal wall reconstruction**
  + Workup
    - Get all prior op notes and figure out what was already done
    - Get a CT scan routinely to delineate the anatomy, look for undrained fluid collections, size of mesh, layer it’s placed, is there bowel involved, and how much abdominal wall is usable
    - Optimize factors for wound healing and nutrition
    - GN bugs on a culture should flag for potential bowel involvement or fistula
  + Macroporous mesh may be salvageable by excising all non incorporated mesh
  + Microporous mesh needs full excision (GORE-TEX, ePTFE)
  + Infected mesh is nearly never emergent, and all can pretty much be at least temporized with antibiotics +/- IR drain
  + If patients grow MRSA, you can consider taking the mesh out then treating with suppressive Bactrim for 6 months prior to definitive hernia repair
  + Could also consider botox
  + Single stage repair is reasonable using a biologic mesh if done for an infection
* **Enterocutaneous fistula**
  + If you want to confirm fluid is a fistula, check it for amylase
  + Assess for maturity of fistula on exam before considering repair, pinch test of skin, induration, softness of abdomen
  + Ensure good nutrition
  + Quantify output
  + Get a CT scan to get an idea of the anatomy and locate the fistula, you want to know about any potential hernias as well
  + Get a fistulagram with small bowel follow through
  + Things to focus on while the fistula is maturing include
    - Wound care
    - Nutrition
    - Reduction in comorbidities
  + Almost all high output fistulas will require TPN
  + PPIs and octreotide may help reduce fistula output
  + If it occurs in the first week after a surgery without extensive LOA, you can consider going back in immediately and fixing it, if there were a bunch of adhesions at index operation, then you likely will just cause more problems
  + You can try to refeed the distal end if output is higher
  + If the patient has hernias also, the main goal is to re-establish intestinal continuity, the hernia can be treated at a later time
  + Procedure
    - Enter through intact fascia away from fistula
    - Lyse all adhesions and treat any potential obstruction
    - En Bloc resection of involved bowel and any involved abdominal wall
  + If large defect noted, consult plastics for potential flap closure
  + Patients are at risk for short gut if they have 100 cm of small bowel with an IC valve or if they have 180 cm without it otherwise
  + If a fistula does not spontaneously close in the first 30 days, it likely won’t ever close spontaneously
  + Fistula maturation may take up to a year or more
* **Infected ventral hernia mesh**
  + Draining sinus wounds after mesh repair can be infected mesh, seroma, and fistula
  + Work these patients up with a CT to delineate the anatomy and evaluate for abscess or undrained fluid collections
  + CT with PO contrast can evaluate for a fistula
  + Wound culture may clue you in as well if there are GNs
* **Postoperative dehiscence**
  + Consider retention sutures
  + Many times an infection is present so a CT scan is reasonable to also look for potential dehiscence
  + You can just also open up the wound and examine the fascia if you are really concerned and just let it heal by secondary intention if needed
  + If the reason for dehiscence was technical, just redo it. If tension was a factor you have to mobilize more or use mesh or do something different
  + If the dehiscence occurs in the first week it’s reasonable to go in and just fix it, but if it’s late, you may just need to accept the hernia and fix it later
  + Debride non viable fascia before closing it!
  + If using a mesh, put omentum between the mesh and bowel

**Section 2: Upper gastrointestinal**

* **Paraesophageal hernia**
  + Rule out cardiac etiology for symptoms
  + Get UGI/EGD
  + Symptomatic patients warrant repair
  + Laparoscopic transabdominal is preferred approach
  + Four main steps
    - Complete reduction of stomach, GEJ and distal esophagus w/o tension
    - Complete reduction and excision of hernia sac
    - Crural closure
    - Fixation of the stomach in the abdomen with fundoplication or gastropexy
  + Preserve vagus nerve branches. Once mediastinal dissection is done then take down short gastritis, or do that to help with exposure.
  + Do the fundoplication over a 60 French bougie
  + I would keep these patients on a full liquid diet for the two weeks due to swelling
  + If they have concerns for perforation, tachycardia or SOB, on POD 1 get water soluble contrast study followed by CT with PO contrast to eval for leak, if present go and repair it and widely drain it
* **Gastroesophageal reflux disease (Charles)**
  + You need to identify if a HH is present or not as that affects management
  + You need objective evidence of reflux before proceeding with surgery, esophagitis is sufficient
  + Preop testing
    - UGI/barium swallow
    - Esophageal manometry
    - EGD
    - pH probe monitoring (Bravo) - placed 5 cm from LES, patients need to be off PPIs for at least 1 week prior. Normal % time with pH < 4 is 4% (remember pH < 4 is 4% of time = that’s normal, any more than that is abnormal)
  + Modifiable RFs include weight, smoking, alcohol/caffeine, eating habits, assess for response to PPIs also.
  + Counsel patients about intolerance to medications or long-term side effects and could offer surgery for either situation.
  + Patient’s with preoperative dysphagia or dysmotility should get a Toupet 270 and not a Nissen 360
  + Operative principles
    - Reduce and repair any associated hiatal hernia
    - Divide all the short gastritis
    - Create a 2 cm long floppy posterior fundoplication over a large bougie
  + If you get into into the chest and cause capnothorax, enlarge the defect, place a RRC and leave it in the chest/belly during the case, then bring out through a port at the end, connect to waterseal, and do a valsalva prior to removing the catheter and closing port sites
  + Keep these patients on FLD for 2 weeks
* **Gastric cancer**
  + Workup including labs, PE, endoscopy, and CT
  + Goals of workup are to identify extent of disease and risk stratify for surgery
  + Check supraclavicular LN, rectal exam
  + Eval for FH of genetic cancer syndromes
  + First study is EGD and Barium swallow
  + Could also get an EUS to look for LNs, +/- MRI/PET
  + Perform diagnostic lap to assess for peritoneal involvement with consideration for preoperative feeding tube placement, this could be done selectively in higher risk patients
  + Siewert classification
    - Type 1 is above GEJ
    - Type 2 is at GEJ (types ½ are managed as esophageal cancer)
    - Type 3 is below GEJ
  + Early gastric cancer is treated with gastrectomy with D1/2 lymphadenectomy
  + EMR is performed selectively and in patients who are not surgical candidates, but is not standard of care. That can be considered for tumors less than 2 cm in diameter in lower risk tumors without nodal involvement.
  + Locoregional involvement gets NAT first. This may include 5-FU and cisplatin.
  + For surgery you want at least 5 cm margins
  + For proximal third gastric tumors, they get total gastrectomy with EJ reconstruction. If the tumor is in the junction or higher, then they get an esophagectomy
  + Get frozen sections on margins before reconstructing
  + For tumors in the distal third, do a partial gastrectomy with B2 or roux-en-y recon
  + You want at least 15 nodes for your dissection and only take the spleen if you can’t salvage it
  + Preoperative NAT chemo/xrt is recommended for locally advanced cancers
  + Total gastrectomy critical steps
    - Midline laparotomy and full exploration
    - Mobilize GEJ and esophagus
    - Separate omentum and lesser sac and divide short gastritis
    - Skeletonize the celiac, splenic, and common hepatic arteries, taking their lymph nodes
    - Ligate the left and right gastric and gastroepiploic arteries at their bases
    - Divide the esophagus, stomach, and jejunum.
    - Reconstruction with EJ and JJ for REY
    - Create a J tube, place NG tube and leave drains
* **Gastrointestinal stromal tumor**
  + Get CT scan and EUS w/ FNA biopsy with IHC looking for CD 117 and ckit
  + Imatinib is given to patients who would benefit operatively from downsizing the tumor or if it’s greater than 5 cm in size, or has greater than 5 per 50 hpf mitosis
  + Second line therapy is sunitinib or third line is regorafenib
  + Operative details
    - Can be done either open or lap
    - Ensure no disease elsewhere
    - Partial gastrectomy with 1 cm margins using a stapler
    - If near pylorus consider GJ reconstruction
  + If you rupture it or find additional disease then consider adjuvant therpay
* **Splenectomy for hematologic disease**
  + First line treatment for ITP is oral steroids and IVIG
  + Splenectomy is indicated for
    - Severe bleeding
    - Failure to respond to medical therapy after 1-2 months
    - Patients who can’t take the medications
    - Patients that relapse
  + For ITP they are great candidates for lap splenectomy as it’s normal sized
  + Splenectomy for malignant indications is much riskier and less commonly done, indications may include
    - Portal HTN
    - Severe symptomatic splenomegaly
    - Transfusion dependent anemia
    - Severe thrombocytopenia
    - Uncontrollable hemolysis
  + Lap spleen steps
    - Vaccinate prior (pneumococcal (PPSV23 2 months after PCV13 and 5 years and at age 65. Don’t need to revaccinate for PCV13, haemophilus, meningococcal)
    - Have blood crossmatched just in case
    - Right lateral decubitus
    - Place ports
    - Divide splenocolic ligament and mobilize spleen cephalad
    - Take down short gastric vessels
    - Mobilize inferior pole of spleen and divide splenorenal ligament
    - Mobilize the superior pole of spleen to isolate the hilum
    - Divide hilar vessels with stapler
    - Exteriorize spleen via morcelation
    - If you encounter bleeding, have a low threshold to do hand-assit or convert to open
    - Ensure there is not an accessory spleen
* **Morbid obesity**
* **Surgical treatment of GERD in the obese patient**
  + Insurance covers bariatric surgery for patients with BMI >40 or >35 w/ complications from obesity
  + Nicotine use is a relative contraindication to surgery as is need for regular ASA/NSAIDs. IBD is another contraindication.
  + Patients with poorly controlled DM may benefit from REYGB
  + Uncontrolled reflux or severe Barrett’s are relative contraindications for sleep gastrectomy, those patients would do better from bypass
  + Consider liquid diet for a couple weeks prior to surgery
  + HHs are repaired at the time of surgery if present
  + LSG procedure
    - Take down shorts gastrics and repair HH if present
    - Insert at lesat 34 French bougie and position along lesser curve
    - Transect stomach 5 cm proximal to pylorus and go all the way up to angle of His
    - Perform intraoperative leak test
  + If you have a narrowed lumen at the end, place a stent
  + If you have a leak, oversew it and place a drain
  + Give scheduled antiemetics, CDL bari diet
  + Tachycardia is concerning for a leak, bleed, or DVT/PE
  + If concerned about a leak get a CT scan with contrast as it will identify other stuff potentially also
  + Start with EGD, test for h pylori
  + Could get UGI to look for HH
  + Could be gastric emptying, consider nuclear medicine scan
  + US for gallbladder
  + Get pH testing if considering surgery for GERD, still need objective evidence
  + Fundoplication doesn’t work for obese patients, they need bariatric surgery instead
  + Gastric bypass is the procedure of choice for obese patients with GERD
  + REY steps
    - Place ports, inspect for HH and ensuring normal small bowel anatomy
    - Begin by dividing J about 50 cm distal to LOT, divide it with stapler. Divide mesentery to the root using stapler. Then create a 100 cm Roux limb (alimentary).
    - Perform stapled side to side JJ anastomosis
    - Close the mesenteric defect with a running suture
    - Use a stapler to create a 25 mL residual gastric pouch, transecting 5 cm distal to the GEJ across the stomach
    - Bring the roux (alimentary) limb up antecolic ensuring it is not twisted before placing posterior row of sutures. Create retrogastric gastro J using 45 mm stapler then place an NG through the defect before oversewing it
    - Then do a leak test, use absorbable sutures here to prevent ulcer formation
    - Close the petersen’s mesenteric defect by suturing the mesentery of the jejunum to the colonic mesentery, do this over a 32 French bougie
    - Place a drain if concerned about a leak
    - Do not do a prophylactic chole unless they are symptomatic up front
  + Place patients on Ursodiol for 6 months post op to prevent gallstone formation, similarly consider PPI to reduce ulcer formation
  + Keep patients on liquid diet for 2 weeks, then slowly start to introduce solids
* **Gastroesophageal reflux disease after sleeve gastrectomy**
  + May be due to stenosis or reflux or undiagnosed HH
  + Treat empirically with PPIs, tums and lifestyle modifications, avoid eating at night, sleep with HOB elevated, if medial treatment doesn’t work then further evaluation is warranted
  + First get an UGI to evaluate the stomach for stenosis or stricture or HH or excessive proximal sleeve fundus
  + EGD if you are considering surgery, evaluate for esophagitis, or erosions
  + Get Bravo pH probe monitoring
  + Could also get manometry if complaints of dysphagia exist
  + Some options for reflux after a sleeve are to convert to a REY and repair HH, repair HH alone, or place Lynx magnetic beads
  + If doing a REY make sure to address any ventral hernias so you don’t incarcerate your now freely mobile small bowel
  + Can get an UGI after surgery to veryify HH repair and document size of pouch
* **Leak after bariatric surgery**
  + Work up other causes as well (PE/MI, etc)
  + Get CT with enteral contrast and IV contrast in addition to CTA of chest for PE
  + Have low threshold to do a diagnostic lap in an unstable patient which is diagnostic and therapeutic (perform a graham patch, repairing it often is not successful) and widely drain the area
  + If you go in to operate, place a J tube distally as these leaks can take as long as 3-6 months to heal
  + IR can often control the drainage +/- endoscopic stent in stable patient
  + Endoscopy may also allow one to dilate potentially contributing strictures distally, clips may also be an option but are not ideal

**Section 3: Emergency general surgery**

* **Acute appendicitis**
  + Don’t forget pregnancy test and rule out gyn issues
  + If you aren’t sure, just admit them for observation
  + McBurney’s incision is the classical open incision
  + Run the small bowel and look for other pathology as well
  + If the appendix looks normal just go ahead and remove it
  + If they have Crohn’s and the base of the appendix looks healthy, try to just remove it as you don’t want that to mask a future episode of Crohn’s or vice versa
  + In women, consider getting a trans-vaginal US if unsure
* **Perforated appendicitis**
  + Patient’s who should have interval appendectomy include
    - Older patients (concern for cancer)
    - Reccurent appendicitis
    - Persistent RLQ pain
    - Fecalith
    - And change in bowel function
  + Patients require surgery if they are failing non operative management or have frank peritonitis
  + Leave a drain!
* **Perforated duodenal ulcer**
  + Ulcer complications include bleeding, perforation, obstruction primarily
  + Get upright CXR to rule out pneuomperitoneum
  + Labs include CBC, CMP, LA, Gastrim, H. Pylori
  + You can test for H. Pylori using a monoclonal stool antigen test which can be done in about an hour
  + Non operative management is reserved for patients who are thought to have spontaneously sealed their perforation.
  + Surgery is needed when
    - Patient is hemodynamically unstable
    - Has free contrast extravasation
    - Has peritonitis
  + Resuscitate and given abx before proceeding to the OR
  + The safest technique for management of a perforated ulcer, especially in someone who has a delayed presentation, is hemodynamically unstable, or there is significant contamination is an omental patch where you just patch the defect and irrigate the crap out it
  + You may need to decide to take down any adherent tissue as it may have self sealed itself
  + You may need to do a tube duodenostomy if it’s larger than 2cm, similarly you may have to mobilize the duodenum to really see it all
  + Definitive ulcer procedure may only be performed if
    - Minimal contamination
    - Hemodynamically stable
    - AND has either history of PUD with unknown H. Pylori status or is unable to stop taking NSAIDs
      * Truncal vagotomy and pyloroplasty
        + Isolate the distal esophagus
        + Identify dissect and transect the vagal nerves and send it to pathology
        + Dissect the distal 6 cm of esophagus to ensure complete division of the nerve fibers, make sure you take the criminal nerve of Grassi
        + Mobilize the duodenum
        + Make a longitudinal incision from antrum to proximal duodenum
        + Place stay sutures at either end of the incision to facilitate closure

You can do a GJ if the duodenum is not amenable to a pyloroplasty

* + - You need 4.8 mm staples for the stomach and duodenum
    - Make sure to send the duodenum for frozen to confirm the presence of duodenal Brunner’s glands to ensure there is no retained antrum
    - Oversew the duodenal stump staple line if doing a B2 reconstruction
    - H. Pylori should be treated for two weeks using clarithromycin, amoxicillin, and a PPI, then retest to confirm that it was eradicated, counsel them on no NSAIDs ever
    - Complications a/w truncal vagotomy include
      * Diarrhea
      * Dumping syndrome
      * Bile reflux
      * Early satiety
      * Afferent and Efferently loop syndromes (B2 recon only
* **Gynecologic causes of lower abdominal pain**
  + Get a pregnancy test and pelvic and transvaginal US
  + Get a sexual history and test for STDs
  + Assess for cervical motion tenderness
  + Do a bimanual examination
    - Differential may include
      * Spontaneous abortion
      * Ectopic pregnancy
      * PID
      * Endometritis
      * Salpingitis
      * TOA
      * Uterine leiomyoma
      * Endometriosis
      * Dysmenorrhea
      * Mittelschmerz
      * Ruptured ovarian cysts
      * Hemorrhagic ovarian cysts
      * Ovarian torsion
      * Pelvic adhesive disease
  + In most cases of ovarian torsion it’s usually due to a tumor
  + Gestational sac is visible when hCG is 1500 mIU/mL
  + If no gestational sac is visible and hCG is >3000 than ectopic pregnancy is likely
  + If hCG levels are between 1500-3000 than serial levels may be drawn, it should increase by 50% every other day
  + If the ovary is twisted then untwist it and inspect for viability, bust out the spy if there is one available or use a doppler
  + Steps for salpingo-oophorectomy
    - Develop the pararectal space
    - Identify the infundibulopelvic (IP) ligament along the pelvic sidewall and incise peritoneum 1 cm lateral to this in a parallel fashion from the round ligament to the line of Toldt
    - Identify and protect the ureter and iliac vessels
    - Make a window between the ureter and ovarian vessels before ligating and dividing the ovarian vessels.
    - Mobilize the remainder of the fallopian tube and utero-ovarian ligament and divide it close to the uterus before removing the specimen
  + Any ovarian mass in a postmenopausal woman should be considered for removal given the risk for malignancy
* **Small bowel obstruction**
  + Check for hernias!
  + Do a rectal!
  + Is this a partial or a complete bowel obstruction?
  + Is there any potentially dead bowel
  + Make sure to run all the bowel if you go to the OR
  + Patient’s get surgery for SBOs if there is an inciting factor other than adhesion, for complete obstructions, and for those where dead bowel is a concern
* **Acute cholecystitis**
  + Always check for complications of gallstones including cholangitis and pancreatitis by checking LFTs and lipase
  + If you are uncertain of the diagnosis, get a HIDA scan, non visualization of the GB at 60 minutes is diagnostic
  + Biliary dyskinesia is an EF < 35%
  + If the bili isn’t that high but you are concerned about a CBD stone, get an MRCP
  + Indications for conversion to an open procedure
    - Inability to define anatomy
    - Suspected injury
    - Uncontrolled bleeding
    - Suspicion for cancer
    - Not making progress
    - Patient won’t tolerate pneumoperitoneum
* **Cholangitis**
  + If you have to surgically go in and decompress the CBD, make a small incision 1-2 cm longitudinal incision on the CBD distal to the cystic duct. Place a 5-0 PDS on each side to retract. You then need to decided if you are going to explore the CBD or place a T tube for decompression in an unstable patient. Make sure to irrigate out the duct as this may get rid of some small stones. You can also use a pediatric ureteroscope and try to do it through that using the stone basket. You also take the gallbladder out when doing this. Leave a drain. Use a 25 gauge needle to aspirate bile from the duct to confirm the structure before cutting on it.
  + Managing a T tube, keep it to gravity initially, then get a contrast study to show that it’s patent before capping it, then if they continue to do well then you can remove the tube.
* **Symptomatic cholelithiasis in pregnancy**
  + MRCP is safe in pregnant women
  + EUS can be used to look for CBD stones (no radiation) and ERCP can be performed with proper shielding
  + Cholecystectomy can be performed at any point during pregnancy and is safe.
  + IOC can be done during pregnancy with appropriate shielding
* **Surgery and clostridium difficile colitis**
  + Get stool cultures
  + For mild cases 500 mg of metronidazole TID is treatment of choice, oral vanco 125 mg q6h is next line therapy. Severe disease gets metronidazole 500 TID plus oral vanco 125 mg q6h. Vancomycin enemas can also be added on top of that.
* **Complicated diverticulitis**
  + Workup for colovesicular fistula should include a urinalysis and culture
  + If doing surgery for a colovesicular fistula, lead a drain and place a foley for 7 days
  + Mark for ostomies prior to surgery
  + Steps to left colon
    - Position supine lithotomy, foley, abx, scds, heparin
    - After prepping and draping
    - Open Hassan above umbilicus and obtain pneumoperitoneum
    - Create a hand assist port via Pfannensteil incision
    - Place two additional right abdominal ports
    - Retract sigmoids medially and dissect along the white line of toldt and mobilize the splenic flexure and take down the IMV at the base of pancreas, visualize and protect the ureter
    - Bluntly take down the fistula and mobilize the proximal rectum
    - Divide at the rectosigmoid junction then divide proximally before identify and divide the IMA and taking the mesentery
    - Perform an EEA anastomosis and perform a leak test of both the anastomosis and the bladder. If there is a leak in the bladder I would oversew that in layers and retest for a leak
    - Leave a drain and a foley
* **Colonic volvulus**
  + Sigmoid volvulus should undergo attempted reduction with a rigid proctoscope as it will allow you to pass a tube into the rectum and colon
  + If you get a pregnant patient with a sigmoid volvulus
    - 1st trimester just decompress
    - 2nd trimester operate
    - 3rd trimester just decompress
* **Necrotizing soft tissue infections**
  + Calculate a LRINEC score using CRP WBC Hgb Sodium Creatinine and Glucose
    - So you need CBC BMP and CRP
  + Use Vanc/Zosyn/Clinda
  + Remove all tissue and do a push test until the tissue doesn’t easily give way, all that tissue that does needs to be removed
  + If you need to amputate, do a guillotine amputation
* **Bleeding gastric ulcer**
  + If the airway may be compromised by agitation, emesis, or altered mental status just go ahead and intubate the patient
  + Place NG tube then get an EGD
  + Don’t forget to get antral biopsies for H. Pylori
  + Test all these patients for gastrin and start on PPI
  + If patient tests positive for H. Pylori and are treated and then test negative, they do not need any further PPI therapy
  + For unstable patients, they go to the OR, they get a laparotomy and anterior gastrotomy, the ulcer is identified and suture ligated. The gastrotomy is then closed. For stable patients who haven’t been treated maximally with PPIs or for H. Pylori then you can do a antrectomy and B2 reconstruction, send duo for frozen for brunner’s glands. Make sure to get biopsies. If they are stable and have failed all therapy previously and now are in the OR, do a antrectomy and b2 and truncal vagotomy
    - Truncal vagotomy
      * Mobilize left hepatic lobe and dissect circumferentially around the esophagus
      * Place clips on the nerve and resect a 2 cm segment and send it to pathology for both the anterior (adjacent to esophagus) and posterior (may be as far as 1 cm away from esohpagus)
  + Don’t forget to kocherize the duodenum if you plan on dividing on that
  + Distal gastrectomy
    - Kocherize
    - Divide gastrocolic ligament
    - Divide greater omentum along greater curve halfway to GEJ
    - Liage the right gastroepiploic artery near the DGA
    - Incise the gastrohepatic ligament
    - Divide the right gastric artery
    - Divide the duodenum and stomach with a stapler
    - Create a B2 reconstruction
* **Bleeding duodenal ulcer**
  + Consider erythromycin or metaclopromide to help empty the stomach
  + Remember to get antral biopsies for H. Pylori
  + During endoscopy you can get control of bleeding
    - Mechanical clips
    - Thermal energy
    - And epinephrine injection
  + First it’s EGD, then IR, then OR
  + All patients need two attempts and endoscopic intervention before consideration for surgical intervention
  + In the OR
    - Kocherize the duodenum
    - Get biopsies
    - Make a longitudinal incision over the pylorus and duodenum
    - Localize the bleed
    - Perform three point ligation by placing stitches superiorly, inferiorly, and medially taking care not to incorporate the CBD into the stitches, this ligates the GDA and it’s branches
  + If your pyloroplsaty is too long to close consider a gastroduodenoplasty where you basically perform the closure as a finney where the stomach sort of wraps onto the duodenum
  + Recurrent bleeding after surgery would be dealt with using angioembolization
  + Start high dose PPI
  + If patient has a history of treated H. Pylori and is already on PPIs then do a truncal vagotomy, make sure you divide the nerves a few cm proximal to GEJ so you don’t miss the nerve of Grassi
* **Lower gastrointestinal bleeding**
  + Differential includes
    - UGIB
    - Meckels’
    - Diverticular
    - IBD
    - Anal pathology
    - Ischemic colitis
    - AVM
    - Hemobilia
  + Stabilize the patient
  + Type and cross, get labs, have blood available
  + Work to get a lower and possible EGD done, insert NGT
  + Tools for localization
    - EGD
    - Colonoscopy
    - Angiography
    - Tagged RBC scan
    - Meckel’s scan
    - Provocative angiogram may be performed if all initial imaging is negative and only when surgery is immediately available

**Section 4: Hepatobiliary**

* **Bile duct injury**
  + Hepaticojejujostomy
    - Midline incision, careful portal dissection, kocherize the duodenum
    - Anterior only dissection on the hepatic duct
    - Create a tension free roux-en-y limb and bring it up to the RUQ through a defect in the mesocolon to the right of the middle colic vessels
    - Create a end to side HJ using interrupted 5-0 PDS
    - Repair it over a stent
  + Patients who present after 48 to 72 hours following cholecystectomy with CBD injury are best treated in a delayed fashion
* **Severe acute pancreatitis**
  + Surgery
    - Bilateral subcostal incision
    - Access the lesser sac through the gastrocolic ligament
    - Drain purulent material
    - Debride necrotic tissue
    - Placement of feeding jejunostomy
    - Axiom drains or JP drains
  + Defer cholecystectomy to a later date
* **Incidental liver mass**
  + Workup
    - Cbc, coags, cmp, hepatitis panel, CEA, CA19-9, AFP
    - For unclear malignancy potential, get a biopsy
    - If clearly malignant, they need a C-scope, mammo, EGD, and Lung imaging
      * Breast
      * Esophageal
      * Colon
      * Lung
      * Other
  + Surgery
    - Mobilize the liver
    - Use an US to identify the lesion or an MRI
    - Score the the liver and divide using a crush and clamp technique
    - Inspect bed for biliary leakage etc
    - Ways to get hemostasis during liver surgery
      * Manual compression
      * Packing
      * Pringle maneuver
      * Compress the vena cava
      * Total vascular isolation = Pringle + compression of infra and supra hepatic IVC
      * Ensure low CVP during the case
* **Liver mass in chronic liver disease**
  + Calculate a MELD
  + Chlid’s C cirrhotics don’t undergo liver surgery
  + Child’s B only gets minor liver resections
  + To test for liver functionality an ICG clearance study is the most commonly used way to calculate the future liver remnant
    - 25% is required for a normal liver
    - Patients with cirrhosis need 40-50% FLR
  + In patients with CTP class B or C liver transplant may be a more appropriate option
  + Milan criteria
    - Solitary tumor 5 cm or less
    - 3 or fewer tumors 3 cm or less w/o vascular involvement
  + Patient’s with cirrhosis need a hepatic US and AFP every 6-12 months, if you see a mass, you get an MRI, if it’s concerning for malignancy you stage them with CT chest, AFP and bone scan if needed, if benign you observe, if in between you get a biopsy. Only patients with Childs A cirrhosis without portal hypertension and platelets > 100K with FLR > 40% are candidates for resection, otherwise they need to be considered for transplant or portal vein embolization
  + Patient’s who are not candidates for surgery can get RFA or transarterial chemoembolization
  + Portal vein embolization is done to the side that you plan to take so the other side will hypertrophy, you then re-image in a month and see where you are at.
  + Make sure you operate with a low CVP to reduce bleeding!!!
  + If doing liver surgery on cirrhotics, make sure to place a remmell tourniquet around the porta just in case
  + Pars flacida is aka the gastrohepatic ligament
* **Metastatic colorectal cancer**
  + Restage them, CEA, CT scans and colonoscopy, PET scan
  + You don’t need a biopsy to treat this
  + Check a FLR
  + If patients have steatohepatitis from chemo, try to keep 40%
  + You can use portal vein embolization to help with that as well
  + For open liver resection of right side, mobilize the liver, get control of the hepatic vein outside of the liver and divide with vascular staple load. On the left, the left heparin vein is usually encountered during the parenchymal transection and then ligated
* **Obstructive jaundice**
  + PDAC
    - CA 19-9, CEA, CBC, CMP
    - CT CAP pancreas protocol
    - EUS with biopsy
    - ERCP with uncovered metal stent placement
    - Abutment is up to 180 degrees of contact
    - Encasement is > 180 degrees contact
    - Resectable tumors have no contact with arteries and minimal contact with veins
    - Borderline resectable versus locally advanced is determined by degree of involvement with vessels
    - Resectable
      * No abutment of SMA/Celiac/CHA
      * <180 SMV/PV without irregularly
    - Borderline:
      * 1-180 degree abutment of sma/celiac
      * Short segment CHA encasement amenable to reconstruction
      * >180 degree abutment of SMV/PV or contour irregularly amenable to reconstruction OR thrombosis
    - Locally advanced
      * > 180 degree around SMA/celiac artery
      * Occlusion of SMV/PV without options for reconstruction
    - Get a CT within 30 days of surgery
    - An isolated biochemical pancreatic leak in the abscess of any other clinical concerns can just be managed with the drain, you don’t have to scan those patients, however if they have a leukocytosis or other concerning findings then scan them
    - DGE gets better with time
    - Any new bloody drainage from a JP gets a CTA to look for pseudoaneurysm
    - Steps to a whipple
      * Diagnostic lap to rule out mets
      * Open incision, enter lesser sac, kocher maneuver, then isolate the SMV and test clamp GDA
      * Cholecystectomy, bile duct transection, then transect stomach
      * Divide jejunum and take down LOT
      * Transect pancreas and excise specimen
      * Portal dissection
      * Perform pancreatic anastomosis, then biliary, then GJ
      * Basically takeout everything in clockwise manner, then put it all back together counter clockwise
* **Management of incidental pancreatic cysts**
  + Serous cystadenomas can arise at any area of the pancreas, they are benign, they are more common in older women, may be a/w VHL. Symptoms may be due to size of the lesion. These do not communicate with ducts so amylase will be low, low CEA levels, thin glycogen rich fluid
  + Mucinous cystadenomas are only in women around 50 years old, often in the tail of the pancreas and are often asymptomatic. They can be malignant through and should be removed. These do not communicate with ducts so amylase will be low. These may have peripheral calcifications or mural nodules. Thick, mucinous fluid with high CEA
  + IPMNs can occur anywhere in anyone, often older people
    - BD-IPMN - those with concerning features are resected or if they are larger than 3 cm
    - MD-IPMN - all are resected
    - Can get an MRCP to see if it communicates with main duct
    - These have high amylase and CEA
  + Get an EUS and FNA of the cysts to characterize them
  + Lap distal pancreatectomy
    - Enter the lesser sac between greater omentum and colon
    - Perform intraoperative US to confirm lesion location
    - Dissect out splenic artery and divide it with a stapler
    - Then transect the splenic artery and vein at splenic hilum
    - Inspect spleen, if not viable, mobilize it by ligating short gastritis and teh splenorenal ligament
    - Medialize the spleen and free pancreatic tail
    - Divide the neck of the pancreas and oversew the pancreatic duct end and cut surface of the pancreas in a fish-mouth technique
    - Place a drain and close the abdomen
* **Refractory pain from chronic pancreatitis**
  + Get MRCP and potentially EUS to work it up and define ductal anatomy
  + Remove offending factors, like smoking and alcohol
  + Check fecal elastase and replace enzymes if needed
  + Celiac plexus block should be reserved for those who have failed medical therapy
  + If pancreatic duct is 7 mm or greater in diameter, they can get a roux en y pancreaticoJ or Puestow
  + You can also core out the head (Frey) if there is a big inflammatory mass there, in this procedure you also do the PJ like in a Puestow, send the tissue removed to path
  + Puestow procedure
    - Bilateral subcostal incision
    - Enter lesster sac
    - Kocherize the duodenum
    - Identify and open up the pancreatic duct
    - Bring a roux loop of jejunum retrocolic and anastomosis in side to side fashion
* **Symptomatic pancreatic pseudocyst**
  + Must be greater than four weeks to be considered walled off necrosis/pseudocyst
  + If you go in to do surgery and they still have a gallbladder, remove it
  + Do a longitudinal anterior gastrotomy, aspirate some of the fluid and send for culture
  + Enter the pseudocyst and biopsy the pseudocyst wall
  + Explore the cyst and evacuate it and debride any necrotic tissue
  + Perform an anastomosis at least 5 cm long using locking PDS suture
  + Cysts can’t be drained trans-gastric if they are more than 1 cm away from stomach wall
* **Gallstone Ileus**
  + These patients should have pneumobilia present on xrays
  + Make sure they are optimized for a surgery as they often are pretty sick at the time of diagnosis
  + Run the bowel and make antimesenteric longitudinal enterotomy proximal to the area of obstruction
  + Milk all stones out and close the defect transversely
  + Patients should be optimized over the next two months with consideration for a cholecystectomy if they are a good candidate, otherwise you can just observe these people knowing that this problem may develop again or they may get cholangitis

**Section 5: Colorectal**

* **Splenic flexure colon cancer**
  + Determine if they are obstructed and if so is it a closed loop obstruction
  + If patients have a closed loop obstruction, colonoscopy is contraindicated as they need to just go to surgery
  + Get a full colonoscopy if they are not completely obstructed and then get CT scan of the CAP with IV and PO contrast in addition to a CEA
  + If you can’t do a colonoscopy, a BE may suffice
  + If you are able to place a stent in someone who is nearly obstructed that’s reasonable as a bridge to surgery
  + If you go in while they are obstructed for a splenic flexure cancer, take the bowel and mesentery along the left branch of the middle colic, left colic and IMV. If they are candidates for an anastomosis, then do that, otherwise they can get an end colostomy
  + Try to get 12 nodes
  + If there is proximal bowel damage or a synchronous tumor then do a subtotal colectomy
  + Adjvant therapy is FOLFOX and 5-FU
  + Steps to left colectomy
    - Place my ports
    - Transect IMV at the level of the LOT
    - Perform a high ligation of the left colic artery
    - Complete medial to lateral mobilization of the splenic flexure of the colon
    - Transect the white line of toldt
    - Transect the splenocolic and gastrocolic ligaments
    - Create a stapled side to side functional end to end colocolonic amastomosis ensuring no twisting or tension.
  + Surveillance
    - CT cap and PE every 3 months with CEA
    - Colonoscopy within first year
  + Alternatives to colonoscopy may include
    - Flex sign and fobt
    - Ct colonography
    - BE
  + If you can place a stent in someone who is nearly obstructed just try it
  + If they have a closed loop obstruction
    - Colonoscopy with stent and biopsy
    - Surgery for partial colectomy for stable patients, otherwise end colostomy
* **Anastomotic leak after colectomy**
  + If diagnostic certainty is not know, get CT with rectal contrast
  + Could also consider CXR and PE CT
  + Leaks occurring in the first few days after surgery just need reoperation
  + Mark these patients for potential ostomies
  + Contained leaks can be managed by percutaneous drainage, bowel rest, and antibiotics
  + When you go in and operate consider either hooking it back up and diverting proximally or giving end ostomy
  + If you have a pinpoint defect in a perfect patient otherwise, you go repair it, patch it, and divert proximally
  + If you have a low colorectal anastomosis, it’s really hard to redo those, so just wash it out, widely drain it and divert proximally
  + For a right sided ileocolostomy that leaks
    - Stable: redo the anastomosis and not divert
    - Unstable: end ileostomy and tack colon up to skin or redo and DLI
  + For a left sided colocolonic anastomosis that leaks or high colorectal
    - Redo anastomosis and divert
  + For a low colorectal anastomosis that leaks
    - Washout, drain, divert
  + For obese patients, try to make ostomies in their upper abdomen as that’s generally an easier spot to put an ostomy for them
    - For these patients repair it or redo it and give them a DLI
  + These patients need good nutrition, enterostomal therapists and wound management
* **Large bowel obstruction from colon cancer**
  + In patients with an obstructing transverse colon cancer, they need to go to the OR and get resected with a colonoscopy performed of the distal segment while on the table to rule out a synchronous lesion, do this using CO2 insufflation
  + Stents have a very limited role in left sided masses and no role in a ride sided mass
* **Recurrent uncomplicated (sigmoid) diverticulitis**
  + Always get a colonoscopy at 6 weeks after resolution
  + Strictures should get surgery
  + Do these laparoscopically
  + Lap sigmoidectomy
    - Establish pneumoperitoneum
    - Make pfannensteil incision for hand port
    - Place two right sided abdominal ports and one left sided port
    - Place the IMA on stretch, score the peritoneum under it, identify the ureter then ligate the IMA
    - Mobilize along the white line of toldt and taken down splenic flexure and ligate the IMV
    - Thin mesorecum and divide the distal segment, divide the proximal segment, divide the mesentery, and remove specimen
    - Perform EEA anastomosis with leak test
* **Ischemic colitis**
  + As part of your work up rule out other causes of colitis including stool cultures, c diff assay
  + Get a colonoscopy with biopsies
  + If they are peritonitis, skip the scope and just go to the OR
  + Can be due to low flow state
  + Start antibiotics, bowel rest, NG if nauseated
  + Resect dead bowel make sure ends bleed, anastomose if stable, give an ostomy if not
  + If you have to resect colon for ischemic colitis following AAA repair, dont’ do an anastomosis just bring up an ostomy to eliminate the risk for leak and protect the graft
* **Medically refractory ulcerative colitis**
  + Make sure to rule out C dif and send stool for culture
  + Rule out toxic megacolon on exam
  + Assess their continence and history of anorectal disease
  + Things to discuss when talking about a pouch are
    - Pouchitis
    - Strictures
    - Infertility
    - Later discovery of crohn’s disease
  + Tack the transected rectal mucosa above the fascia and leave a malecot drain in overnight
  + Key steps to an IPAA
    - Lithotomy
    - Total proctocolectomy
    - Staple off terminal ileum preserving ileocolic artery
    - Staple the anorectal junction at the level of the levator muscles
    - Mobilize the small bowel and create a 15 cm long J pouch by stapling the antimesenteric sides together
    - Create anastomosis using EEA stapler
    - Divert with DLI
* **Crohn's disease with small bowel**
  + Work these patients up with CT a/p and MRI enterography
  + Determine if the stricture is inflammatory or fibrostenotic, get CRP and MRE
  + Drain any associated abscess
  + Treat acutely with steroids, consult GI possible biologics
  + First line induction therapy for mild to moderate disease is budesonide 9 mg daily then a taper, you could also do 40 of prednisone with taper to 5-10 per day
  + Biologics are for more severe disease
  + Surgery is reserved for failure of medical management or associated complications
  + Surgery acutely for inflammation is really uncommon, you need to evaluate for complications of it like bleeding or perforation
* **Neuroendocrine tumor of the appendix**
  + If discovered incidentally get 5-hiaa levels and chromogranin a, if those are elevated then stage with CT scans and octreotide scintigraphy
  + Tumors < 1 cm don’t need staging
  + Goblet cell or crypt cell are exceptions in that they always get a right colon
  + Surveillance consists of getting 5-HIAA and chromogranin a levels in addition to CT scans, octreotide scans should be obtained to evaluate for recurrence or metastasis
  + Debulking surgery and somatostain are ajuvant agents that may work for metastatic disease
* **Rectal cancer**
  + Staging is CT CAP/CEA/MRI pelvis
  + T2 gets upfront surgery
  + Neoadjuvant chemo xrt consists of 5040 cGy in 25 fractions and 5-FU
    - RECTUM has 5 letters so 5040 cGy
    - ANUS has 4 letters so 45 Gy
  + Surgery is done 2-3 months after completion of chemoxrt
  + Adjuvant chemo (capecitabine/5-FU + oxaliplatin) is for locally advanced cancer
  + Restage with endoscopy and MRI
  + Steps for LAR
    - Check for metastasis
    - Divide the superior rectal artery
    - Mobilize the left colon and splenic flexure and divide IMV
    - Perform sharp total mesorectal excision by entering the plane between the visceral and parietal layers of the endopelvic fascia
    - Identify the distal point of transection and divide using a stapler
    - Transect proximal colon
    - Perform EEA anastomosis, perform a leak test, and divert
  + Patient who get neoadjuvant chemoxrt still need adjuvant chemotherapy
  + Divert all radiated anastomoses
* **Anal carcinoma**
  + Any anus issue should get HIV testing if atypical
  + For patients who are average risk for cancer, symptoms that persiste for mroe than 6 weeks should get scoped
  + Get a thorough history and exam including a DRE and anoscopy for any new anal complaint
  + EUA should be reserved for patients with persistent symptoms or those that don’t tolerate exam in office
  + Examine inguinal lymph nodes, any abnormal node should get needle biopsy
  + Staging gets CT CAP with pelvic MRI, check for HIV and cervical cancer, C-scope always
  + Nigro protocol, 5-Fu/mitomycin c with 45 Gy radiation over 5 weeks
  + Chemo is 5-FU and cisplatin
  + Staging (dependent on size 0/2/5 cm cutoffs, not depth)
    - T1 < 2 cm
    - T2 2-4.9 cm
    - T3 5+
    - T4 invades adjacent organs
  + T1 lesions of the anal margin can be excised locally so long as you can get 2 cm margins, if margin is positive then they get re-excision, but if that’s not feasible, then chemoxrt as nigro protocol
  + If there is residual disease at 6 months they need APR, or if it worsens
  + Inguinal nodes get a full dissection
  + Metastatic disease just gets chemo for SCC
* **Anal and rectal abscess**
  + If the abscess is large place a malecot and suture it to the skin
  + CT may help delineate a supralevator abscess
  + Intersphincteric abscess should be drained transrectally
* **Thrombosed hemorrhoids**
  + I&D (not hemorrhoidectomy) if it occurs in the first day or two, this can be done under local anesthesia injected into the dermis overlying the hemorrhoid, only do in the office if you are 100% certain, otherwise go to the OR and make sure you don’t have an incarcerated internal hemorrhoid that would otherwise need excision. Make sure to take an ellipse of skin when doing the I&D

**Section 6: Breast**

* **Palpable breast mass**
  + History
    - Hormonal supplements
    - Family history
    - Prior breast lesions
    - Age of onset and cessation of menses
    - Smoking
  + PE
    - Examine breasts in sitting and supine positions
    - Palpate axilla, supraclavicular, infraclavicular, cervical LN basins
  + If there is a concerning finding, even if a screening mammo has not been obtained, go ahead and order a diagnostic mammo
  + Younger women need an US
  + If you can’t find the lesion get additional imaging modalities, i.e. MRI
  + If US and Mammo are discordant, get an MRI
  + Send patients to genetic counseling if there is an indication
  + If they have palpable axillary nodes, those need an FNA
  + Ask Radiology to place a clip at the time of biopsy!!!
  + If initial IHC for HER2 is equivocal send it for FISH analysis
  + If you are concerned about metastasis, get the following (confirm this,...\_
    - Bone scan (skeletal scintigraphy)
    - CT CAP
    - PET scan
  + If patient’s have nodes disease initially, they need an ALND
  + For SLN Bx, use two methods of identification, blue dye and nuclear tracer (Tech99, can be injected no more than 24 hours prior to surgery)
  + Tumors in upper breast get curvilinear incisions, lower breast get radial incisiosn
  + Mark specimen and place clips in resection cavity and use Intraoperative mammo to identify any close margins
  + If you can’t identify a SLN, then you have to do lvl 1-2 ALND
  + Chemo is given before radiation.
  + Get a f/u mammo at 6 months after surgery with an Exam to establish a new baseline, then get annual ones
* **Suspicious mammographic abnormality**
  + BIRADS CLASSIFICATION
    - 0 inconclusive
    - 1 negative
    - 2 benign
    - 3 probably benign, short term follow up
    - 4 suspicious, get tissue
    - 5 highly suspicious
    - 6 biopsy proven malignancy
  + Evaluate whether the biopsy and mammo are concordant
  + If you can’t see your clip on the mammo during surgery, get shave margins, but don’t do much else. You’ll deform the breast
  + Dont’ use blue dye if a patient is pregant
* **Ductal carcinoma in situ**
  + For exam do breast, axilla, supra/infra clavicular and cervical nodes
  + Place a clip during the CNB
  + DCIS with microinvasion should be treated as invasive disease
  + Hormone positive disease patients can get risk reduction from 5 years of tamoxifen or anastrozole
  + Make sure to mark the specimen and place clips in the excision site
  + Lesions greater than 4 cm should get SLN Bx and those that are palpable or have comedonecrosis, or if you are doing a mastectomy
* **Lobular carcinoma in situ**
  + Make sure a clip is let in place where they get the CNB
  + LCIS mandates an excisional biopsy
  + If the CNB doesn’t work, is discordant with imaging, or has other issues just do an excisional biopsy
  + You do not need negative margins for an excisional biopsy with LCIS
  + Two types of LCIS
    - Classic
    - Pleomorphic - higher risk
  + Managment options for LCIS
    - These patients do not get radiation
    - Observation and surveillance, annual exam/mammo
    - Risk reduction hormones Tamoxifen or raloxifen but both place patients at increased risk of DVT, menopausal symptoms, and uterine cancer
    - Bilateral mastectomy, if you choose this, you do not need to do SLN Bx
  + The Gail model can be used to estimate an individual’s breast cancer risk
* **Early stage breast cancer**
  + Defined as stage 0-2, so up to T2, N1)
  + Make sure to get a history of any prior radiation to the breast
  + Perform breast exam in both upright and supine positions
  + Look at all nodal basins including axillary, supra-infraclavicular and cervical
  + Options for biopsy include stereotactic CNB or US gudied biopsy, make sure they leave a clip
  + Lymph nodes in question can be sampled using FNA
  + Workup
    - H&P
    - Diagnostic mammo and breast ultrasound, MRI if needed
    - CNB and path review
    - Genetic counseling if applicable
      * Multiples relatives with breast/ovarian cancer
      * < 35 or pregnant
      * Any family member with both breast and ovarian cancer, or bilateral breast cancer
      * Male breast cancer in the family
      * Known BRCA ½ in the family
      * Triple negative and < 60 years old
    - Labs: CBC, CMP, alkphos
    - Staging is selective as far as additional scans
      * Bone scan, if localized bone pain or elevated alk phos, or nodal disease
      * Abdominal and pelvic CT if abnormal abdominal pain or elevated LFTs, or nodal disease
      * Chest CT only if unexplained pulmonary symptoms, or nodal disease
      * PET scan if nodes are involved
  + BRCA patients surveillance
    - 18 - month breast exams
    - 25 - annual MRI and PE
    - 30 - mammos and ovarian screen annual
  + Do lumpectomy with I125 radioactive tracer
  + Do SLN Bx with radiocolloint tracer T99m and blue dye
  + Isosulfan blue is teratogenic and should not be used in pregnancy
  + Place clips in the cavity
* **Advanced breast cancer**
  + Should be called “locally advanced breast cancer”
  + T3 is up to 4 cm
  + T4 is involving the surrounding tissues (chest wall or skin) and inflammatory breast cancer
  + Also includes N2-3
  + Defined as not metastatic disease
  + This is stage 2b and 3
  + All these patients get staged with bone scan, CT cap, and pet scan
  + In larger tumors, clips should be placed in the center of the lesion
  + In cases of hormonal sensitive tumors, endocrine therapy may be used instead of chemotherapy
  + Patients with nodal disease prior to surgery, even if it completely resolves with chemo, get an ALND!!!
  + Bords of dissection for a mastectomy include sternum, clavicle, IMF, and latissiumus dorsi
  + Adjuvant therapy can start about 4-6 weeks after surgery
  + If patients had hormone positive tumors they get endocrine therapy for about 5 years
  + Radiation follows chemotherapy
  + Adjuvant chemo consists of ACT adriamycin, cytoxan, and taxotere and carboplatin
* **Inflammatory breast cancer**
  + This is not a true infectious process so it is not associated with fevers, pain, or leukocytosis
  + Get a punch biopsy of the skin and FNA of any suspicious nodes
  + This is a T4d lesion
  + This typically progress rapidly, so this is not a solitary nodule that was ignored for a while and now is involving the skin
  + More than 50% of patients have nodal involvement at the time of diagnosis
  + Do a skin punch biopsy in addition to a CNB so you can get receptor status, specifically HER2
  + All these patients need neoadjuvant chemo, then surgery ONLY if they had a good response to therapy with resolution of erythema, then radiation, then hormonal therapy if indicated
  + Surgery for this includes MRM, so total mastectomy with lvl 1-2 nodes will level 3 if there is obvious nodal disease present
  + You don’t do a SLN Bx in these patients
  + They get delayed reconstruction if any reconstruction at all
  + Nat chemo is anthracycline + taxane
* **Breast cancer during pregnancy**
  + Mammo is safe with appropriate shielding
  + Also get an ultrasound
  + MRI is NOT SAFE DURING PREGNANCY, contrast and prone positioning
  + Get a biopsy and place a clip
  + Get an axillary US and FNA any abnormal lymph nodes
  + Staging for pregnant patients is a chest xray and liver US
  + Patients in first trimester should delay surgery until second trimester. If they have nodes involved at the time of diagnosis, they need an ALND, if they don’t, then you do a SLN biopsy with just the T99m as blue dye is teratogenic, if that is positive then you do the ALND. Nodal disease will need chemo first. If they are diagnosed during the third trimester you would prefer to delay surgery until after delivery to prevent premature contractions/birth
  + Trastuzumab is contraindicated in pregnancy
  + Don’t give chemo around the time of birth to prevent immunosuppression in the perioperative period
  + Staging CT scans are deferred until after delivery
  + Blue dye is BAD FOR BABY
* **Breast reconstruction**

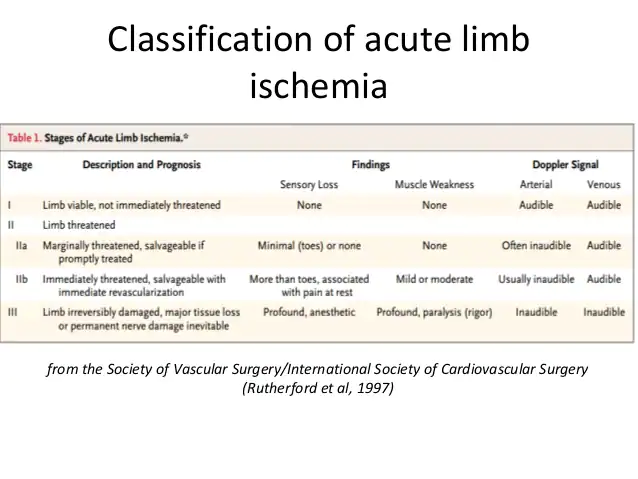
**Section 7: Endocrine**

* **Palpable thyroid nodule**
  + Identify risk factors for malignancy including history of radiation and family history
  + Assess for mass effect symptoms, dysphagia, cough, hoarseness, or airway compressive symptoms
  + Check TSH, if elevated, then check anti-TPO, if it’s suppressed, then check TSH-receptor antibody to look for graves disease. Thyroid scintigraphy can distinguish between graves and a toxic nodule or multinodular toxic goiter.
  + Get an US to see if it meets criteria for FNA, results may be as follows
    - Non diagnostic > repeat FNA
    - Benign > repeat US in 1 12 months
    - Atypica or follicular lesion of undeterminied significance molecular testing, repeat FNAB, or diagnostic lobe
    - Follicular neoplasms > diagnostic lobe or molecular testing
    - Suspicious malignancy > lobectomy or total thyroidectomy
    - Malignant > lobectomy or total thyroidectomy
  + If you repeat a FNA, wait a least a month to allow the inflammation to settle
  + If a repeat FNA is not diagnostic, proceed with diagnostic lobectomy
  + Doing a lobe may help prevent hypothyroidism or hypoparathyroidism, injury to the other nerve, and lifelong medication supplementation
  + Patients with a history of radiation, a positive family history, multinodular goiter, and those already on thyroid supplementation should just get a total thyroidectomy at the get go
  + Procedure
    - Beach chair position with neck extended
    - Transverse cervical incision
    - Divide platysma and create subplatysmal flaps
    - Divide the strap muscles
    - Confirm that IONM is working by checking the vagus nerve signal
    - Dissect strap muscles off the thyroid
    - Divide the middle thyroid vein
    - Take down upper pole first close to the thyroid gland and preserve the SLN and RLN nerves and parathyroids
    - Then take down the inferior lobe
    - Recheck by vagus nerve signal
    - Get hemostasis
    - Approximate strap muscles
    - Close in layers
    - If you inadvertently remove or devascularize a parathyroid, reimplant it in muscle
  + Look for abnormal lymph nodes also and send those for frozen, if they are positive in the central neck, then you need to do a central neck dissection as well
  + Make sure to also resect the pyramidal lobe if doing a total
  + Upper parathyroid glands are posterior and lateral to the RLN whereas the lower glands are medial and anterior to it
  + All patients who have undergone a total thyroid will require replacement with amounts varying depending on the indication
  + RAI is given to well differentiated thyroid cancers that are high risk including gross residual disease, metastatic disease, or nodal involvement. You also need to suppress TSH to less than 0.1 mU. Check serum thyroglobulin levels every 6 months also if they underwent a total thyroidectomy
* **Papillary thyroid carcinoma**
  + Bethesda classification
    - 1 - non diagnostic > repeat FNA
    - 2 - benign > US in 12 months
    - 3 - FLUS
    - 4 - follicular neoplasm
    - 5 - suspicious for neoplasm > surgery
    - 6 - malignant > surgery
  + Thyroid scintigraphy scan or uptake scan is only indicated if the TSH is suppressed to differentiate between graves, hot nodule, or toxic MNG
  + You need a neck US to evaluate the central and lateral neck lymph node compartments
  + If you see a node on that US, get an FNA and also send it for thyroglobulin
  + Level 6 (central neck dissection) includes removing all the tissue from carotid to carotid and from the hyoid bone to the innominate vein including the cervical thymus
  + Nodal involvement mandates a total thyroidectomy and dissection of that neck compartment
  + Only patients with tumors less than 1 cm, age < 45, and normal contralateral lobe with PTC should have a hemithyroidectomy, potentially!
  + In patients with nodal disease on one side of neck, you would also still do a central neck dissection, need to confirm this!\*\*\*
  + Treatment of hypocalcemia after surgery
    - Calcium carbonate 1500 mg po qid for mild symptoms
    - If worse, then add calcitriol 1 mcg daily
    - If they have more severe symptoms like muscle cramping give them IV calcium gluconate
* **Medullary thyroid cancer**
  + Get family history and evaluate for mass effect symptoms
  + Check for pheo
  + Get calcitonin, neck us, and fna, also CEA and basic labs
  + Get ret protooncogene and check PTH, urine VMA and metenephrines
  + If the tumor markers are high (calcitonin > 500) or there is nodal disease, get triple phase contrasted CT cap and a bone scan
  + MTC arises from parafollicular c cells which make calcitonin and can secrete CEA
  + If patient is ret protoncogene + then all first degree family members need to be tested as well
  + For patients with no LN involvement or distant metastasis, then a total thyroid with central neck dissection is adequate
  + If patient has lateral neck node involvement they need MRND of levels 2-5
  + Lateral neck dissection (levels 2-5)
    - Dissect the anterior triangle (2-4)
    - Retract submandibular gland superiorly and skeletonize the digastric and omohyoid muscles to define the superior aspect of dissection
    - Expose the IJ and ligate the lateral branches to define the medial aspect of dissection
    - Retract the SCM laterally and dissect tissue deep to that takin care to preserve the spinal accessory nerve.
    - Then dissect out level 5 nodes posterior to SCM
    - Identify and protect the spinal accessory nerve and skeletonize the posterior SCM down to the trapezius muscle to define the lateral border of dissection. Then proceed inferiorly to the clavicle to define the inferior border of resection. Then remove all this tissue en bloc.
    - If doing this on the left make sure to identify and protect the thoracic duct
    - If you injure the thoracic duct intraop suture ligate it with permanent suture or clip it
    - Bilateral RLN injury with airway compromise is treated with an emergent tracheostomy
    - If they develop a chyle leak, institute a fat free diet, antibiotics, and application of a pressure dressing. If it doesn’t resolve you either surgical go in or have IR take a stab at it
    - Post op surveillance after surgery for MTC includes neck us and exam every 3 months with calcitonin and CEA, if the calcitonin becomes increased, get a neck US, if it’s really high (>150) then stage them again with CT cap with triple phase IV contrast and bone scan + US
    - For patients with known ret proto-oncogene mutation, they need prophylactic thyroidectomy. For those with ATA-HST or MEN 2B they are at higher risk and need it out at 5 years of age at the latest and earlier is acceptable. For those with ATA-MOD they should start annual surveillance with PE, US, and calcitonin at the age of 5. Those patients get prophylactic thyroidectomy in childhood or early adulthood. If calcitonin becomes elevated at all (>40) go ahead and proceed also
    - RAI doesn’t work for these tumors
    - Need to determine recs for carriers who need surgery and at what age?\*\*\*
* **Primary hyperparathyroidism**
  + Get history of kidney stones, bone pain, difficulty concentrating, polyuria, or polydipsia, see how high calcium is, get labs and PTH, eval for prior kidney dysfunction, also get urinary calcium
  + See if they are on lithium, that would require 3.5 gland excision
  + See if they have ever had a dexa scan
  + Indications for surgery in primary HPT - BASK in Calcium
    - Symptomatic (neurocognitive symptoms)
    - Age < 50?
    - Serum calcium > 1 above normal
    - Bones (bones)
      * T score < -2.5
      * Previous fragility features or vertebral fractures
    - Renal involvement (kidney)
      * Kidney stones
      * 24 hr urinary calcium > 400
      * GFR < 60
    - Can’t or won’t get proper observation
  + Get a CMP to eval the albumin, as calcium is bound to it and may need correcting
  + 24 hour urinary calcium will be low in FHH (<100), if patients are vit D deficient, they can recheck the urinary calcium if it’s low and vit d was low to rule out FHH
  + Imaging should only be obtained after you have a biochemical diagnosis
  + For imaging, get an US and sestamibi scan, combine this with SPECT scan or 4D CT.
  + Get two imaging studies that are concordant for a solitary nodule before doing a targeted dissection
  + Surgery for targeted parathyroid
    - Get PTH prior to incision
    - Position beach chair with neck extended
    - Set up IONM
    - Use US to confirm target
    - Make kocher incision
    - Dissect through platysma and raise subplatysmal flaps
    - Dissect through straps
    - Divide the middle thyroid vein
    - Identify the RLN Identify the abnormal parathyroid glands
    - Excise the abnormal gland
    - Wait ten minutes before drawing a PTH level
    - Close
  + In four gland hyperplasia, you should either leave 30 mg of tissue or explant it into the arm or neck
  + For a parathyroid cancer taken the parathyroid and ipsilateral thyroid en block with any other tissue involved
  + Places to look for missing glands
    - Superior is missing
      * Retroesophageal space
      * Carotid sheath
    - Inferior
      * Thymus
      * Thyroid
    - If you are concerned about having too many glands
      * Check thymus
  + Check serum calcium 6 months after surgery to confirm cure
  + If going back in for surgery do a DL
* **Persistent and recurrent primary hyperparathyroidism**
  + Sometimes HCTZ may cause elevated calcium
  + Patients with MEN 2 often have four gland hyperplasia and need 3.5 gland excision
  + Don’t go digging for a preoperative HPT case unless you have it localized using two imaging modalities
  + Send specimen for frozen if doing reoperative surgery
  + Discharge patients with Vit D and calcium supplementation
* **Incidental adrenal mass**
  + Workup focuses on assessing risk of malignancy and identifying if it’s functional
  + Get an adrenal protocol CT scan of the abdomen/pelvis with IV contrast
  + Benign findings (low HUs and high washout)
    - < 10 HUs
    - > 60% washout
  + Malignancy risk factors
    - > 4 cm
    - Irregular margins
    - Heterogeneity
    - Hyperdensity
    - Invasion
    - Lymphadenopathy
    - Metastasis
  + Even if the mass is large, you need to see if it’s functional as this will alter your preoperative management
  + Functional tumors and workup
    - Cortisol secreting: 24 hr urine cortisol, serum ACTH, or lose dose dexamethasone test 1 mg at 11 pm, measure serum cortisol at 8 am (must be greater than 1.8), MN salivary cortisol x3, give ketoconazole, stress does at time of surgery
    - Aldosterone secreting: Serum renin and aldosterone ratio, get adrenal venous sampling to identify side, PAC:PRA ratio > 30 is consistent, give spironolactone and have them stay hydrated,
    - Pheo: urinary metanephrines and catecholamines, alpha block with doxazosin for 2 weeks, have art/cvc/nitro/esmolol available, dc alpha blocker after surgery
    - Hormones: DHEAS
  + Open surgery is reserved for tumors > 8 cm
  + Coordinate with anesthesia when you are ready to clip the vein
* **Adrenocortical carcinoma**
  + Mitotane is the chemo agent of choice
  + These need open surgery, even if it’s less than 8 cm but predicted suspicion is high
  + Be careful not to violate the capsule or have tumor spillage, take a surrounding bit of fat on the tumor
  + If you can’t get it out they need adjuvant chemoradiation therapy
  + Do this through a subcostal incision and ensure I have enough access
  + Right adrenalectomy
    - Mobilize the right liver and perform kocher maneuver
    - Retract liver superiorly and kidney inferiorly
    - Mobilize the adrenal gland from retroperitoneal fat
    - Ligate and divide the adrenal vein
    - Remove specimen
  + Left adrenalectomy
    - Enter the lesser sac through gastrocolic omentum
    - Incise the peritoneum along inferior border of pancreas
    - Retract pancreatic body superiorly and kidney inferiorly
    - Mobilize the left adrenal gland from RP
    - Ligate and divide the adrenal vein and remove specimen
  + Patients are treated with mitotane for at least 2 years if it is indicated at all
  + Positive margins needs radiation therapy
  + Surveillance includes ct every 3 months
* **Cortisol-secreting adrenal tumor**
  + Rule out exogenous source like steroids
  + This can look similar to Cushing’s disease where you have ACTH-dependent cortisol secretion from a pituitary lesion
  + Screening tests for hypercortisolism include
    - Three MN salivary cortisol measurement
    - Low dose dexamethasone suppression test 1 mg at 11 pm and measure cortisol at 8 am
    - 24 hour urine cortisol
  + Low or undetectable ACTH levels are c/w adrenal nodule
  + First see if the cortisol is high at all, if it is, then get the ACTH to see if it’s either adrenal based or ectopic/pituitary (HIGH ACTH)
  + Get adrenal protocol CT which is triple contrast with 1 mm slices
  + These patients need stress dose steroids and a taper
  + If you want to test to see if they are appropriately making their own cortisol, get a cosyntropin test
  + It can take years for patients to get back to being biochemically normal where they won’t require supplementation
* **Primary aldosteronism**
  + Discontinue antihypertensives 4-6 weeks in advance of testing if possible and instead you can do alpha blockers or amiloride
  + Get an adrenal protocol CT
  + Get selective venous sampling of the adrenal veins to confirm laterality
  + Often a/w hypokalemia
  + PAC:RAA > 20 is also suggestive
  + Patients with bilateral disease do not get surgery as the risk of addisons disease afterwards is too high compared to medical management
  + Adrenal venous sampling dictates which gland you remove, never remove both
  + Make sure these patients are tanked up before surgery
  + They also need their potassium corrected and they should be on spironolactone
  + These patients may have rebound hyperkalemia after surgery
  + They should have their levels checked 3 months after surgery
* **Pheochromocytoma**
  + Get biochemical diagnosis first, then image with ct scan with adrenal protocol, HU usually are 40-50 with delayed washout
  + Get a MIBG scan to confirm functionality if you are concerned it’s malignancy or recurrent
  + Calcium channel blockers are another option for htn management preop
  + Make sure they are tanked up from a fluid standpoint as they intravascularly dry
  + Have central line, art line, and nitroprusside/esmolol/phenylephrine gtts available
  + Double clip the adrenal vein and let anesthesia know
  + You have to mobilize the pancreas to do the left adrenal
  + Levels need to be checked every 3 months for the first year, then annually
  + CT is adequate for localization
* **Pancreatic neuroendocrine tumor**
  + Insulinoma, gastrinoma, VIPoma, somatostatinoma, glucagonoma
  + Biology is reflected in Ki67 index intermediate grade is 2-30
  + Gastrinoma is the most common one, then insulinoma, glucagonomam, VIP, SS
  + Once you have the mass identified it goes on to localization and staging in preparation for surgery
  + Get a pancreas protocol CT, triple phase 1 mm cuts
  + You can also get an octreotide scan to further evaluate where the tumors might be
  + Check an insulin and C peptide level when patients are symptomatic
  + Can also use EUS to identify them
  + You can enucleate them if they are small, otherwise you need a formal resection
  + For VIPoma patients, preadmit them, given them octreotide and resuscitate them prior to taking them to surgery
  + Hepatic artery embolization may also be an option for metastatic disease
* **Gastrinoma**
  + a/w MEN 1
  + Aka zollinger ellis syndrome
  + Due to mutation on 11q13 (menin-1)
  + For MEN1 patients, gastrinoma is the most common pancreatic tumor
  + Any patient with PUD that is refractory, recurrent, atypical, requires surgery, or occurs in abscense of H. Pylori should be worked up for gastrinoma/ZES
  + Workup
    - Fasting serum gastrin (>100 pg/mL is abnormal), make sure patients are off PPI therapy for two weeks prior, instead you can put them on H2 blocker and discontinue that 2 days prior to test
    - Levels greater than 1000 are diagnostic, however 100-1000 needs to have the secretin stim test
    - Get a CT with IV/PO with 5 mm cuts
    - Get a DOTA tate scan
    - Send them to genetic counseling
  + All gastrinomas need to be worked up for MEN 1
    - Get PTH level and calcium level
  + Treatment
    - First principle is to control symptoms medically, start with PPI 40 mg BID, you can titrate up to 80 BID until the basal acid output is less than 15 mEq per hour
    - Then localize the tumor, most are in the gastrinoma triangle
    - Treat any associated parathyroid disease first using a 3.5 gland excision
    - In MEN patient’s they often have multiple tumors so surger is of less utility, in those patients you only do surgery if it’s at least 2 cm in size (>2 cm is a/w liver met), goal of surgery is to reduce risk of liver mets and control symptoms
    - For tumors in the head of the pancreas, just enucleate those, and those in the body and tail get a distal pancreatectomy.
    - Do NOT do a whipple for a gastrinoma, unless you have a good reason to (i.e multiple ones in head, bulky, obstruction, etc)
    - You have to know if they have MEN before deciding what operation is appropriate for what patient
  + Surgery (whipple)
    - Bilateral subcostal incision and abdominal exploration to rule out mets
    - Mobilize the right colon and kocherize the duodenum
    - Open the lesser sac, assess for resectability, and clear off the anterior surface of the SMV
    - Perform cholecystectomy, portal dissection and ligate the GDA after performing a test clamp
    - Divide the proximal jejunum, duodenum, pancreas, and bile duct
    - Dissect uncinate process from the SMV/SMA
    - Send frozen section of the margins on the bile duct and pancreatic duct
    - Reconstruct with end to side PJ and HJ and perform retrocolic loop gastrojejunostomy
    - Place drains and close

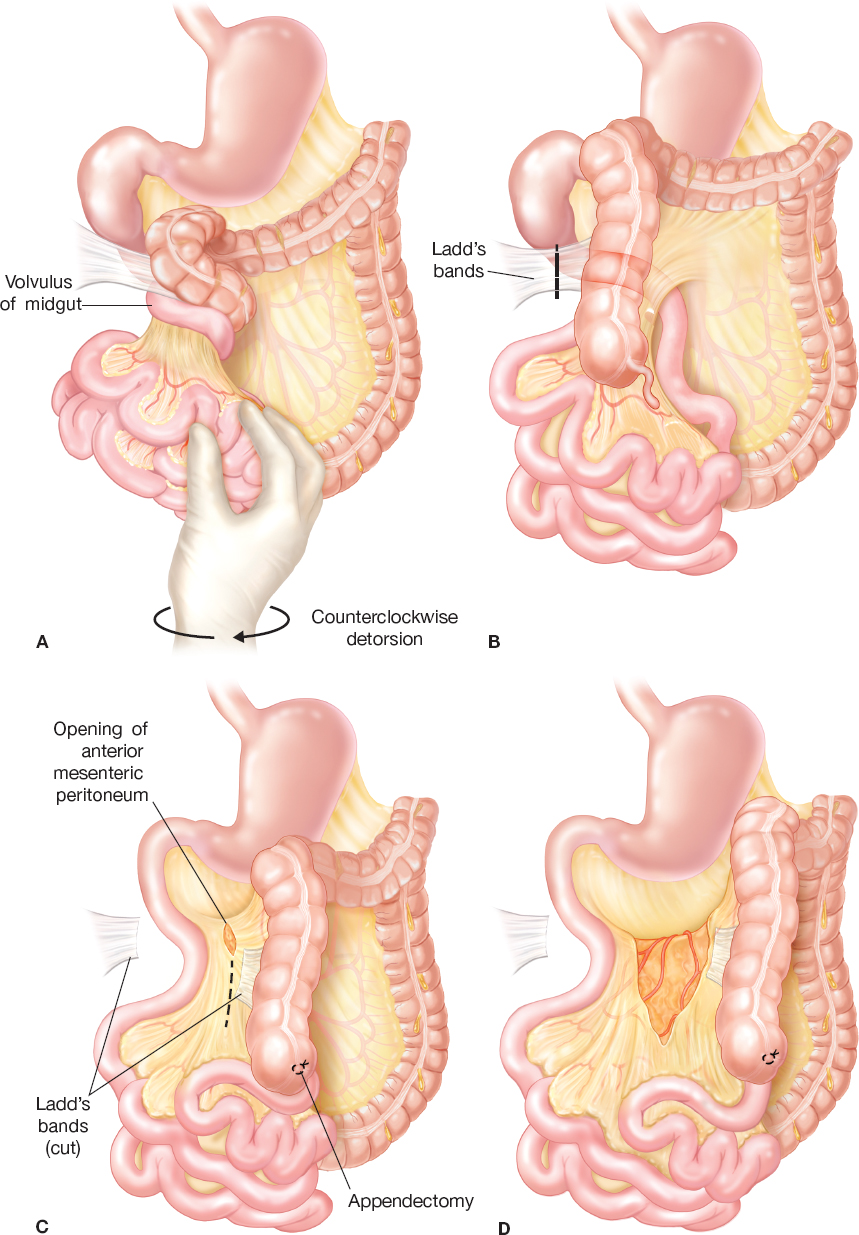
**Section 8: Thoracic**

* **Esophageal cancer**
  + High grade barrett’s is an indication for endoscopic or surgical intervention
  + These patients need
    - Barium esophogram
    - EGD with biopsy and/or brushings.
  + Check for lymphadenopathy on exam
  + Get CT CAP and a PET scan
  + Get EUS to identify depth of tumor, do FNA of abnormal LNs
  + T1b invades submucosa
  + T2 invades muscularis propria
  + Patients with stage 2 disease get neoadjuvant chemoradiation first
  + If they are poor surgical candidates, you can consider EMR
  + Workup needs to include PFTs (single lung ventilation), smoking cessation.
  + Surgery
    - Abdominal portion
      * Divide short gastric vessels and mobilize stomach
      * Divide left gastric
      * Kocherize duodenum and protect right gastric and GE artery
      * Place feeding jejunostomy
      * Mobilize the distal 5-10 cm of esophagus
      * Tubularize the stomach using sequential staple loads
      * Perform pyloromyotomy
    - Cervical
      * 7 cm incision along anterior border of SCM
      * Retract the carotid sheath laterally and the thyroid and trachea anteriorly
      * Ligate the inferior thyroid artery
      * Encircle the esophagus with a penrose drain
    - Go to the chest and mobilize the esophagus and get a prenrose around it
    - Clip thoracic duct
    - Mediastinal lymph node sampling, excise abnormal LNs
    - Divide the cervical esophagus and bring specimen out through cervical incision, divide stomach 5 cm distal to GEJ and hand off specimen for routine pathology
    - Perform 2 layers end to end hand sewn anastomosis
    - Place a drain in the neck, CT and blake in chest
    - Make sure patients have epidural placed prior to surgery
* **Esophageal perforation**
  + Get xrays to look first, then gastrograffin swallow, if that’s negative do dilute barium esophogram
  + For best case scenarios, those being early diagnosis, stable patient, no contributing factors that still need correcting, minimal symptoms, small contained leak, those can be managed with IV Abx, NPO, Chest tubes, parenteral nutrition
  + Anything other than that probably should get surgery
  + If you go in the steps are to
    - Mobilize the esophagus
    - Debride necrotic esophagus to bleeding tissue and perform myotomy to expose the entire mucosal injury
    - Repair in two layers
    - Buttress repair with intercostal tissue
    - Perform a leak test
    - Place NG tube across stenosis
    - Consider feeding tube placement
  + You can also stent the perforation
  + For unstable patients, exclude the perforation and divert them
  + Don’t forget about t tubes
* **Achalasia**
  + EGD
  + Manometry
  + Botox and dilation are options outside of surgery
  + Per oral endoscopic myotomy (POEM) is also another option, those patients may be those who are poor operative candidates. They have higher rates of GERD after since you don’t do a fundo with that
  + You should do a partial fundoplication to reduce risk of GERD afterwards
  + Patients who have an extremely redundant and tortuous esophagus need an esophagectomy, their disease is too severe
  + Do a leak test at the end of your heller myotomy
  + Surgery
    - Place ngt prior to induction and CLD for two days prior
    - Dissect the anterior esophagus bluntly from hiatus
    - Expose the GEJ protect vagal nerves
    - Divide the longitudinal fingers for 6 com on exophagus and 3 cm on stomach, use EGD to confirm location of GEJ
    - Do a leak test
    - Perform a dor fundoplication by suturing the fundus to the crus to the myotomy musclw
* **Solitary pulmonary nodule**
  + Review previous imaging for interval change
  + Get a CT chest, CMP, CBC
  + Nodules greater than 1 cm or those greater than 8 mm with high risk patient get PET CT, if pet avid it gets excised
  + Stage patients for lung cancer with EBUS, if that’s not enough then get mediastinoscopy
  + Screening is indicated with yearly low dose CT if they have a 30 pack year history and are about 60 years old
* **Spontaneous pneumothorax**
  + Those who need surgery are those at higher risk for recurrence, that being those with bilateral PTX, pilots, divers, lack of access to health care
  + Poor operative candidates can just get doxycycline instilled into their chest tube and then call it good
  + If going to surgery, place staple loads across the lung apex
  + For surgery
    - Double lumen endotracheal tube, confirm via bronch the position
    - Lateral decubitus jacknife position
    - Use reinforced staple loads, use scratch pad to mechanically debride the pleura
    - Put 500 mg doxycycline in 50 mL of sterile saline into the chest and let sit for four hours

**Section 9: Vascular**

* **Pulsatile abdominal mass**
  + Workup with CT abd/pelvis with IV contrast
  + 3 cm is cutoff for a AAA definition
  + Some patients with AAAs have distal disease, but most patients with distal aneursyms of the lower extremities need to be evaluated for AAA
  + EVAR is the preferred route of repair for those that can be done electively, however the loss of early morbidity equilibrates out and outcomes are equivalent at 2 years between open vs evar
  + EVAR candidates
    - The aneurysm neck must be at least 15 mm long with diameter less than 32 mm with less than 60\* of angulation (remember 15-30-60).
    - Also the iliacs must be 6-8 mm in diameter (again this fits, use 7-15-30-60 as a rule for EVAR
    - You can occlude one of the Int Iliac arteries but not both with a graft
  + EVAR grafts should be oversized by 10-20%
  + Procedure for EVAR
    - Prep widely from NAC to groin
    - Cut down on both CFAs
    - Heparinize the patient
    - Insert wires, then sheaths
    - Perform aortogram
    - Perform balloon angioplasty at all fixation sites and graft joints
    - Shoot a completion angiogram to rule out endoleak and confirm patency
    - Then remove wires and sheaths, close the arteriotomies and confirm distal flow
  + Types of endoleaks
    - Type 1a - failure to seal proximally - treated with angioplasty or graft extension
    - Type 1b - failure to seal distally at iliac landing zones
    - Type 2 - Continued flow into aneurysm sac (lumbar artery) - These vessels can be coiled
    - Type 3 - leak at junction of graft portions - deploy another graft over that and angioplasty
    - Type 4 - Small holes in grafts
    - Type 5 - Seroma or hygroma
  + Postoperative surveillance include CT at 1 and 12 months after EVAR, then annually
  + In patients who can’t get an EVAR, they need an open repair
  + For an open repair
    - Confirm distal pulses and mark those
    - Widely prep
    - Midline incision or RP exposure if they have a hostile abdomen
    - Reflect small bowel to the rightand transverse colon superiorly and place retractor
    - Mobilize the ligament of treitz and dissect the duodenum off of the aorta and dissect up to the left renal vein
    - Expose the infra-renal aorta and expose the common ilac arteries, divide left renal vein if needed
    - Heparinize them with goal ACT > 250 and give manitol and lasix
    - Clamp iliac arteries distally, then aorta proximally
    - Open aneurysm sac longitudinally opposite the IMA and aortic thrombus is removed
    - Oversew all lumbar arteries
    - Use a rifampin soaked dacron graft and sew it in proximally then distally with monofilament suture 3-0 Prolene proximal and 5-0 distal
    - The IMA can be ligated if there is good back bleeding, if it’s poor, then reimplant it back on the graft at the end of the case
    - Then re-establish blood flow to the legs and coordinate with anesthesia
    - Then reverse the heparin
    - Close the aneurysm sac over the graft
    - Close the abdomen and check distal pulses and inspect lower extremities, if you don’t have good pulses then you need to do an embolectomy before leaving the OR, if the embolus is in the toe, you can’t do much about that, just give antiplatelets afterwards
    - If you find a colon cancer during surgery continue fixing the aneurysm then let them heal and then address the colon cancer
    - Watch them in the ICU for 1-2 days
* **Ruptured abdominal aortic aneurysm (Charles)**
  + If the patient is stable, get a CTA to determine if they are an EVAR candidate
  + Minimize fluids, shoot for permissive hypotension
  + Type and cross
  + First step once you get in is to get proximal control using either your fingers or a sponge stick on the supraceliac aorta at the level of the diaphragm. Do this by dividing the gastrohepatic ligament and the left crus of the diaphragm and bluntly dissect through the crus and around the aorta to place a clamp. Then rotate the 3/4th portion of duodenum to the right to expose the perirenal aorta for clamping. Omit the heparin, but lasix and mannitol may still be given to protect the kidneys with cross clamping. Dissect the iliac arteries and clamp those next. If possible use a tube graft to reduce the length of anastomosis. Sew it in proximally with 3-0 Prolene, then distally as well. Leave the RP hematoma alone. Have a low threshold to leave the abdomen open. If you do it via EVAR, do bilateral femoral artery cut downs and then heparinize. Place your wires and sheath and then do an aortogram before starting. Do a completion aortogram as well. Reverse the heparin with protamine. Keep in mind that a REBOA may also be used to occlude the aorta
  + Mild cases of sigmoid ischemic may be treated with resuscitation and antibiotics, another issue is abdominal compartment syndrome
* **Lifestyle-limiting claudication**
  + Critical limb ischemia = pain at rest
  + Consider venous disease in your differential in addition to sciatica and diabetic neuropathy
  + Exam should include full pulse exam and ABIs
  + Doppler waveforms and toe pressures are useful in delineating the severity of disease in bad diabetics
  + All patients should be on a aspirin and a statin
  + Cilostazol can be used for symptoms but can’t be used for patients with CHF
  + Screen all of these patients for CAD and CVD
  + Intervention is warranted if lifestyle modification and medications don’t help enough or if it is still lifestyle limiting.
  + Get arterial imaging including a CTA before attempting any intervention
  + TASC A and B lesions are easily amenable to percutaneous intervention
  + TASC C and D lesions are more difficult through endovascular means and open surgery should be considered (15 cm or more)
  + To do you EV repair start with a 4 french sheath, then shoot your angiogram to determine if you can do something, then use a 6 french sheat for your angioplasty +/- stent
  + If doing open surgery, get vein mapping and get cardiac risk stratification, needs to be 3 mm or greater in diameter
  + For an open repair, prep abdomen and lower extremities including the contralateral groin. Most use the CFA as the inflow site. First get down and dissect out and get proximal and distal control. Your cut down should extend ⅓ of the way above the inguinal ligament and ⅔ below it. The most common site for distal anastomosis is the infrageniculate popliteal artery, to expose it make a longitudinal incision 1 cm posterior to teh posterior border of the tibia. Open the superficial posterior compartment fascia and retract the gastroc posteriorly. Then dissect off the anterior attachments of the soleus and you will see the popliteal artery medial to the vein and tibial nerve. If it’s suitable for a bypass, then harvest your vein. Once you have your tunnel created, then heparinize the patient. Do the distal anastomosis first then the proximal then confirm patency with duplex US and doppler
  + 81 mg ASA is given to all patients after intervention and they need a dose preop
  + All patients who get a infra-inguinal stent get plavix for 1 month also
  + If the graft is thought to be at high risk for clotting off, then consider therapeutic AC indefinitely
* **Tissue loss from arterial insufficiency**
  + These are patients with wounds often on their feet or toes that are due to arterial insufficiency. They need optimal wound care, revascularization, and offloading.
  + Get ABIs
  + Evaluate for other potential sources of embolic phenomenon
  + Start these patients on antibiotics, keep the feet warm
  + Get arterial duplex and characterize the blockage(s)
  + More severe disease and lower risk favor open repair
  + Again, TASC criteria apply here
  + Perform an endarterectomy when you also do an open bypass
  + Prosthetic conduit is preferred for femoral to above-knee popliteal bypass with autogenous graft is not available
  + Perform the proximal anastomosis first, heparinize before clamping 100 units/kg
  + Make sure you do your tunneling first before heparinizign
  + Place atraumatic clamps proximally and distally.
  + Incise donor artery, spatulate the vein and perform end to side anastomosis with 5-0 prolene for the femoral and 6-0 Prolene at the popliteal anastomosis.
  + Get completion angiogram or duplex and check pulses
  + All patients get DAPT for life after a lower extremity bypass
  + Unless the wound is huge or infected, revasc it first and see what happens
* **Acute limb ischemia**
  + When evaluating them for ALI, start by heparinizing them and administering fluid
  + Next, determine the viability of the limb, if it’s viable, then determine if there is an embolus or not based off of H/P. If there is an embolus, then do an embolectomy, if it’s more likely a thrombus, do an endovascular intervention. If those don’t work consider surgical bypass. Dead legs get amputated
  + If the patient can feel or move the limb then it’s not dead, then you have a chance at fixing it
  + 
  + Stage one ALI has normal motor and neural function
  + Stage two ALI has abnormal sensation +/- some motor deficits
  + Stage three ALI has no sensation or movement
  + For open embolectomy
    - Longitudinal incision in the groin
    - Heparinize to goal ACT of 250, place vessel loops proximally and distally
    - Transverse arteriotomy (if healthy) longitudinal (if not healthy)
    - Perform embolectomy using 2-5 F fogarty catheter to remove all clot
    - Flush the arteriotomy with heparinized saline and close it using 5-0 Prolene
  + If the etiology is uncertain, getting a CTA and arteriography with thrombolysis or catheter-assisted extraction is likely the best option.
  + If these patients have mental status changes, get head CT to evaluate for intra-cranial emboli/stroke
  + If considering thrombolytics, get an ECHO to rule out a cardiac thrombus which would cause problems in that situation
  + Trend CK and CPK in lower extremity ischemia
  + Don’t forget about fasciotomies
  + Make sure they don’t have a cardiac reason for forming a thrombus like an MI, consider also a PFO and a DVT so duplex the legs, get EKG and troponins
  + Get a completion angio at the end of the case and check the pulses to confirm patency
  + Pass the fogarty until it comes back clean twice
  + Make sure to communicate with anesthesia when you reperfuse the leg
  + Make sure you get all the clot out from the upstream side first, always path a catheter proximally first
* **Asymptomatic carotid artery stenosis**
  + Get a carotid duplex as the first part of the workup
  + You need to know what the PSV and EDV peaks are in the ICA and the ICA/CCA velocity ratio.
  + Make sure these people are on baby aspirin, statin, and beta blocker, get an EKG and cxr before
  + Could also consider getting a CTA for operative planning and stenosis eval
  + CEA is recommended in asymptomatic patients with stenosis of 60-99%
    - Surgery indicated if
      * Asymptomatic + low risk > 60%  
        Asymptomatic + high risk > 75%
      * Symptomatic + low risk > 50%
      * Symptomatic + high risk > 70
      * Low risk is defined as a surgical complication risk of less then 3%.
      * - PSV of 125 = 50% stenosis (5\*5 = 25, S looks like a 5).
      * - EDV of 100 = 70% or ICA:CC velocity is 4:1 or more (high grade), ratio has more Os
      * - EDV of 140 = 80% stenosis
    - ****
    - ****
  + Do this under general anesthesia with EEG monitoring
  + If it’s really high then consider getting OMFS to sublux the mandible in which case they would also need nasotracheal intubation
  + If patient has had prior contralateral CEA repair, then you need a DL
  + Position supine with head turned away
  + Ensure you have a radial arterial line
  + Place shoulder roll
  + Ensuring EEG is working
  + Incise anterior to SCM, divide platysma and retract SCM laterally
  + I would then ligate and divide the facial vein
  + Identify and protect the vagus and hypoglossal nerves
  + Dissect out the carotid artery and encircle CCA/ECA/ICA with vessel loops
  + Heparinize the patient and do a test clamp of the ECA/ICA
  + Routinely shunt
  + Clamp in order of ICE, internal, common, then external
  + Clamp the CCA proximally and make a longitudinal arteriotomy starting on the CCA and extending it onto the ICA until I reached the end of the plaque
  + Remove and plaque
  + Inspect intimal flaps and place tacking sutures if needed then close the arteriotomy using a bovine pericardial patch and a 6-0 Prolene in a running fashion. Prior to completely closing this I would back bleed the ECA and ICA and then forward bleed the CCA. I would also flush the vessels with heparinized saline prior to completing the closure on the artery.
  + I would then release the clamp on the ECA first to ensure the patch doesn’t leak, then I would release the CCA clamp to flush any remaining debris into the ECA, then after a few heartbeats I would finally remove the ICA clamp
  + Reverse heparin with protamine at the end of the case
  + I would leave a drain
  + Check neurological status before leaving the OR
  + I would give this patients aspirin post op and observe them overnight in ICU, plavix is not routinely used
  + Do frequent hemodynamic monitoring and neurologic checks overnight
  + Drian comes out day one
  + Any new neurological change warrants emergent take back for exploration
  + See them back in 2 weeks for a post op check then in 3 months with a repeat duplex and then get yearly duplex after that bilaterally
* **Symptomatic carotid artery stenosis**
  + Patients with symptomatic carotid stenosis should be on DAPT prior to surgery and a statin
  + Once patients have returned to their baseline after a TIA, then wait two week before getting surgery
  + In patients with crescendo TIA or evolving stroke, those need urgent revascularization and intervention STAT
  + If you place a shunt, secure it with Rommel tourniquets and ensure there is flow using a doppler
  + If they become bradycardic during the case while manipulating the carotid bulb, just inject 1% of lidocaine into the carotid bifurcation adventitia
  + Reverse heparin with protamine at the end of the case
* **Diabetic foot infection**
  + Look for fluctuance that warrants immediate drainage
  + Ensure you get plain xrays of the foot
  + Get a complete vascular exam
  + Get ABIs and TcPO2, may need toe pressure or PVRs
  + Toe pressure < 30 won’t allow for healing
  + In the absence of deep infection or necrosis, minor infections can be managed with local wound care and antibiotics, relieve pressure
  + You can’t do angio in the setting of active infection
  + To perform a lower extremity bypass
    - Identify the greater saphenous vein and harvest with full length leg incision
    - Obtain proximal and distal control fo the anastomotic sites
    - Create tunnels for the bypass
    - Dilate the vein with heparinized saline and check for holes that require repair
    - Systemically heparinize patient
    - Perform proximal anastomosis, tunnel vein and confirm pulsatile flow
    - Perform distal anastomosis
    - Reverse heparin with protamine
    - Close incisions and confirm patency of pulses or signals
  + When there is extensive tissue loss precluding a functional foot, non healing wounds despite patent grafts and for control of sepsis, amputation is necessary
  + In the setting of acute sepsis, just do a guillotine amputation
  + Vein diameter greater than 3 is sufficiency for a bypass
  + If the sites are to calcified then review angiogram for different target
  + Post op surveillance, get US every 3 months for a year, then every 6 months for a year, then yearly
* **Acute mesenteric ischemia**
  + May be due to a few etiologies
    - Embolus
    - NOMI
    - Venous thrombosis
    - Thrombosis
  + Surgery for embolic disease is as follows
    - Midline incision
    - Flip colon up and small bowel right
    - Incise the ligament of treitz and expose the SMA
    - Obtaine proximal and distal control
    - Heparinize the patient (should have already been heparinized)
    - Perform transverse arteriotomy and pass a 5 French foley catheter proximally and distally to remove clot.
    - Ensure all clot is removed prior to closing the arteriotomy with interrupted 5-0 Prolene sutures
    - If there is no inflow then it’s likely thrombosis
    - Check for patency
    - If not patient, I would repeat the embolectomy, if that still fails, then I would perform SMA bypass
    - For SMA bypass, harvest the saphenous vein and perform the distal anastomosis first and then I would perform the proximal anastomosis on either the infra-renal aorta or iliac depending on the vascular disease present on the CTA. If you choose the iliacs, choose the right common iliac and make it a gentle C curve to ensure to twisting or kinking
    - Assess bowel viability, resect if needed, plan for second look if there are any concerns, wait up to 30 minutes if needed
  + These patients should be on a aspirin and statin at least
* **Chronic mesenteric ischemia**
  + Endovascular repair is the treatment of choice and new standard of care with open repair reserved as a backup.
  + Basically heparinize, then get access, feed your wires up, do an angiograph, get a wire across the lesion, insert a stent then perform balloon angioplasty. Then give aspirin afterwards
  + One method for open repair is to do a left medial visceral rotation to expose the abdominal aorta from the hiatus to the iliac bifurcation. The supraceliac aorta, infrarenal aorta, celiac, sma, and left renal arteries are controlled with vessel loops. The patient is then heparinized and vessels clamped. A trap door incision is then made by making transverse incision above the celiac and below sma on the aorta and then connecting them on the left side. You then flip all this up, perform endarterectomy and then sew it back down.
  + Another option for surgery is a bypass. You can do a bypass from the surpaceliac artery to the sma +/- celiac artery using a tubed or bifurcated graft. You first get control of the supraceliac aorta and expose the SMA. Then create a tunnel behind the pancreas connecting both regions. You then heparinize them and place a side biting aortic clamp proximally before sewing in that region, you then do the distal anastomosis.
  + Used ringed PTFE graft for these types of bypass
* **Deep venous thrombosis**
  + Eval using a duplex
  + Eliquis is now first line therapy for patients with a new DVT, unless they have cancer, then lovenox is preferred
  + Patients should be treated for at least 3 months
  + You can consider referral also for catheter directed thrombolysis, monitor fibrinogen levels
  + For may thurner syndrome, you can stent that
  + Look for modifiable risk factors or anatomic (may-thurner) that can be treated
  + In patients that cant be anticoagulated, place an IVC filter
  + Catheter directed thrombolysis, get a catheter just above it and infuse tpa overnight, if that fails, then open surgery may be needed
  + Open surgery
    - Expose femoral vein through groin incision. Get proximal and distal control and make venotomy, then used a 5 French venough thrombectomy catheter and pass it distally and proximally to remove as much clost as possible. Then close that primarily with a 5-0 prolene, get a completion duplex to confirm patency. Place a drain, compression wrap the leg
  + If patients have excessive bleeding, make sure to check for DIC or HITT
* **Need for hemodialysis access**
  + Patients with GFR < 30 should be referred for dialysis access. Venous graft needs 6 months prior and prosthetic should be 3-6 weeks prior
  + Get non invasive imaging and perform an allens test to determine workup for fistula
  + Evaluate for any prior axillary surgery or reason to have a limb alert on that arm
  + Criteria for suitability for vessels
    - Vein
      * >/= 3 mm diameter
      * Absence of central stenosis
    - Artery
      * >/= 2 mm
      * No inflow stenosis (difference > 15 mmHg between brachial artery pressures)
  + Order of preference is radiocephalic > radiobasilic > brachiocephalic > brachiobasilic > prosthetic forearm > prosthetic upper arm
  + Perform surgery on non dialysis days
  + Mark the veins on the skin using ultrasound
  + For a brachiocephalic
    - Incise over antecubital crease. Dissect the cephlic vein free for 3 cm supriorly and inferiorly by creating skin flaps. Suture ligate side branches
    - Incise the bicipital aponeurosis and expose the brachial artery. Dissect 2-3 cm of artery free. Divide the vein and ligate distally, distent the vein with an olive-tipped catheter and repair all defects, spatulate the end. Advminister 5,000 Units of Heparin IV prior to placing vascular clamps on the artery proximally and distally. Then make an arteriotomy using an 11 blade and potz scissors. Then perform the anastomosis using 6-0 prolene after flushing the vein with heparinized saline. Confirm patency of the fistula. If patients have diminsed arterial pulses or signals in hand, it’s impossible to know if it’s due to vasospasm or significant steal so they need close observation after surgery. Then close incision in layers.
  + Fistula that is ready for use and rule of 6s
    - 6 mm in diameter
    - 6 mm depth below skin
    - 600 mL/minute
  + It’s ok to remove a cuffed tunneled catheter when the fistula is consistently working
  + Cuffed tunneled catheters should not be placed on the same side as anticipated fistula access

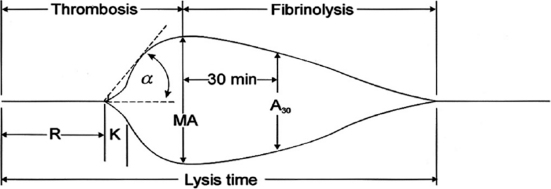
**Section 10: Pediatric**

* **Emesis in an infant**
  + Examine volume status, fontanelle
  + Is there bile or not?
  + Non bilious vomiting differential
    - Formula intolerance
    - GERD
    - Pyloric stenosis
    - Pylorospasm
    - Duodenal web
    - Gastric volvulus
    - Gastroparesis
  + Characterize the emesis, forceful, projectile
  + Pyloric stenosis
    - Pylorus size needs to be 3 mm by 15 mm and one should determine if fluid passes through
    - Correct volume status and electrolyte abnormalities
    - All these patients get a 20 mg/kg bolus of NS and titrate UOP to 1.5 ml/kg/h for maintenance fluids use d5 ½ ns at 1.5x maintenance rate.
    - NGT is not necessary as they won’t typically vomit so long as they are kept NPO
    - Have an OG placed at the time of surgery
    - Incise the pyloric serosa 2 mm proximal to the pyloric vein and extend it on to the gastric antrum
    - Use a blunt instrument to divide the remaining circular fibers until the mucosa bulges through and the two sides of the muscle move independently
    - Test for a leak by filling stomach with air
    - If the child has recurrent symptoms, the myotomy was inadequate and they will require reoperation
    - If you have a full thickness perforation, then close with interrupted absorbable sutures and cover it with omentum. Leave the NGT in for 24 hours afterwards to ensure gastric decompression.
    - If you get in and the pylorus looks normal, try to pass a tube through it or do an on table contrast study to confirm patency, this may be just be pylorospasm
    - Vomiting is common after surgery, start slow and low volume about 6 hours after surgery using pedialyte then transition to breast milk
    - Patient’s who continue to have significant emesis one week after surgery likely have an incomplete myotomy
    - Incomplete myotomy usually occurs on the gastric side and perforations occur on the distal side
* **Malrotation and midgut volvulus**
  + Differential for bilious emesis
    - Malrotation and midgut volvulus
    - Duodenal atresia/stenosis/web
    - Annular pancreas
    - Jejunal atresia
    - Meconium plus/ileus
  + SMV to the left of the SMA or anterior to it is concerning for malrotation
  + Patients with convincing history and unstable should just go to the OR
  + For patients with asymptomatic malrotation, onl operatie on them if they are under 20 otherwise the risk outweighs the benefit
  + Ladd’s procedure
    - Reduce the volvulus by twisting bowel counter clockwise, then take down Ladd’s bands, score the anterior small bowel mesentery, take the appendix, do not try to fix any tissues together, place bowel in a nonrotate configuration with the colon on the left and small bowel on the right
    - 
  + Get an UGI if they are stable, the DJJ should be at the level of the pylorus, left of midline, and posterior
  + Do this surgery through a supraumbilical horizontal incision in infants, otherwise through a midline incision in children and adults
* **Neuroblastoma**
  + This is the most common extracranial solid tumor in children.
  + MIBG scan is used to evaluate for bone marrow, bone, or metastasis
  + CT/US abdomen are useful
  + You need to get a bone marrow biopsy to stage them with either excision or CNB
  + Check urinary levels of VMA/HVA
  + During resction
    - Subadventitial dissection
    - No spillage
    - Get 6-9 lymph nodes
    - These may regress spontaneously
* **Palpable abdominal mass in a toddler**
  + Most are either neuroblastoma, nephroblastoma (wilms) or hepatoblastoma
  + Start by getting an ultrasound and if there are solid or mixed component to it then get a CT scan with IV and PO contrast
  + Also get a chest CT if concerned for malignancy in addition to a doppler US of the IVF and renal vein
  + For Wilms tumor if there is clot in the veins or it is going to require removal of other organs, give them chemotherapy first
  + Whole lung radiation is used for patients with any mets from wilm’s
  + Do not rupture a wilms tumor, if you do they need abdominal radiation
  + Do not biopsy a wilms tumor, just resect it
  + To resect a wilms
    - Mobilize colon (and kocherize duo if necessary)
    - Get vascular control, take artery first
    - Resect it without rupturing it
    - Take ureter low in pelvis
    - Obtain aortocaval lymph node sampling
* **Hepatoblastoma**
  + The most common malignant tumor of young children
  + Get liver US /- CT/MRI and CXR +/- CT chest
  + Labs include AFP BHCG and a urinalysis
  + AFP is often elevated in hepatoblastomas
  + If the tumor is unresectable or they have metastatic disease, get a biopsy and start neoadjuvant therapy
  + Through a right subcostal incision, perform an anatomic liver resection after assessing for resectability in the OR
  + Children with unresectable tumors without metastasis are candidates for liver txp
* **Intussusception**
  + Asymptomatic patients can be observed as they are transiet intussicieptions
  + Start with abdominal US
  + Presents with current jelly stools and intermittent abdominal pain and obstruction
  + Get an upright CXR to look for pneumoperitoneum
  + Air contrast enema involves placeemnt of a rectal tube for insufflation up to 120 mm Hg while under fluoroscopy (normal blood pressure), this can be repeated up to three times prior to proceeding to surgery. Patients who get reduced need to be observed for probably one overnight stay.
* **Necrotizing enterocolitis**
  + Classic findings include
    - Abdominal wall erythema and crepitus
    - Pneumatosis intestinalis
    - Fixed loops of bowel
    - Portal venous gas
  + Get abdominal radiographs in the supine and decubitus positions
  + NEC can be managed medically so long as they don’t have surgical indications
    - Bowel decompression and bowel rest
    - IV antibiotics
    - Parenteral feeding
    - Serial radiographs
  + NEC can lead to strictures and short gut
  + If after resumption of feeds they are noted to have a stricture, you may need to resect that
  + Resections are typically managed by formation of an ostomy
* **Rectal bleeding in a young child**
  + Get a meckel’s scan (Tc 99m)
  + Rule of 2s
    - 2% of people
    - 2 feet from ileocecal valve
    - 2 inches in length
    - Usually shows up by 2 years of age
    - Two types of heterotopic mucosa
  + Intestinal obstruction is the most common way that meckel’s presents (30% obstructive 27% hemorrhagic)
  + Make sure to place an NGT
  + Take the appendix out if you go in for a meckels
  + Make sure you inspect the mucosa of the ileum to confirm there is not a residual ulcer before you put it back to together
* **Omphalocele**
  + These patients need to be worked up for congenital syndromes etc
  + CXR
  + ECHO
  + Renal US
  + Skeletal radiographs
  + VACTERL
  + Most have an additional anomaly
  + Place patients on D10 ¼ NS running at 150 ml/kg/day.
  + They are at risk for hypothermia and dehydration
  + Also check their sugars frequently until you rule out bechwith wideman syndrome
  + If the sac ruptures, place a sterile silo in the OR
  + They need genetic referrals and karyotype analysis
  + During surgery
    - Reduce the contents
    - Suture ligate the umbilical vessels and urachus
  + Silastic silos are sutured to the fascia and sequential tightening of the silo every 2-3 days
  + Another option is paint and wait which basically involves putting silvadene on it to let it fibrose and form a contractile capsule that will slowly reduce over time, this can take up to a year, and patients will have a ventral hernia that will require repair
  + After reduction patients may develop GERD or inguinal hernias etc
  + When you go in to fix it, don’t forget to fix the malrotation
  + If transferring or patient is sick place lower body in a bag to prevent dehydration
* **Gastroschisis**
  + These babies may also have intestinal atresia, so if they are obstructed consider that
  + If transferring or patient is sick place lower body in a bag to prevent dehydration
  + Defect is usually to the right of the midline
  + Place an NGT
  + Don't’ operate on atresia and gastroschisis at the same time, temporize them with TPN for a month, then consider going back in
  + If you go in to reduce the bowel, watch for peak pressures on the vent and tidal volumes. Undermine skin if needed. If you can’t close all the fascia, it’s acceptable do also just close what you can then close the skin
  + You can milk out intestinal fluid before reducing to help reduce volume in the abdomen
* **Tracheoesophageal fistula**
  + These patients often have an NG that is coiled in the proximal esophagus and gas present distally in the guts
  + If someone perforates the esophagus near the CP muscle, just place a NGT into the stomach to decompress and put them on abx, it will get better
  + You need to delineate some of the anatomic details
    - What side of the chest is the aorta on
    - What is the exact anatomy of the trachea, esophagus, and their connections
    - Rule out other anomalies (VACTERL)
  + If the arch is in the right chest, then you need to do a left thoracotomy to fix it
  + Surgical repair
    - First thing is to give them a G tube and assess the gap length
    - If gap is > 3 vertebral bodies, repair is delayed
      * They may require spit fistula and a conduit in that case
    - Generally is done through a right posterolateral thoracotomy
    - Enter chest through fourth intercostal space using a muscle sparing technique
    - Have anesthesia push on NG and then place a suture incorporating the pouch and NG tube. Do a posterolateral thoracotomy and stay extrapleural. First divide the azygous vein to expose the fistula, then divide fistula near the trachea, then mobilize the proximal esophagus maximmaly, then the distal if needed. Can do circular myotomies proximally or to tubularize the proximal pouch, then perform an 8 stitch anastomosis using absorbable suture. First place the posterior 5, then feed the NG down, then place the last three, place chest tubes.
    - Babies are resilient, if the esohpageal anastomosis leaks, but put them on abx, continue chest tubes and make NPO, study it weekly until it resolves
    - These can be operated on right after birth

**Section 11: Skin and soft tissue**

* **Melanoma**
  + SLN Bx is indicated for lesions > 0.8 mm in depth with worrisome features, or for all > 1 mm in depth
  + Use dual method for SLN identification (radiotracer and blue dye)
  + Margins
    - In Situ 0.5 cm
    - < 1 mm is 1 cm margin
    - 1-2 is 2 cm margin but 1 is acceptable in aesthetically sensitive areas
    - >2 mm deep is 2 cm margin
  + Send all nodes for routine pathology
  + Staging is indicated for Stage ¾ melanoma
  + Staging
    - CT CAP with PET scan
    - Brain MRI
  + In patients with positive nodes on SLN Bx, you can also just do surveillance instead of completion lymph node dissection as doing so only improved DFS
  + Immunotherapy
    - Nivolumab
    - Dabrafenib and trametinib if BRAF+
    - Pembrolizumab
  + For patients with early stage disease they are just followed with serial exams, and imaging only if you are concerned about a metastatic site potentially
* **Melanoma presenting with regional lymph node involvement**
  + Metastatic lymph nodes can be investigated using FNA
  + Patients with clinically present lymph nodes need completion axillary dissection
  + All these patients need a metastatic workup
  + Staging labs include CBC, CMP, LDH
  + For patients with palpable axillary disease they need all three levels excised
  + For patients with palpable groin disease consider superficial and deep inguinal node dissections. Some may reserve a deep dissection for those with a positive Cloquet’s node or three or more nodes
  + Inguinal LN dissection
    - Supine with leg in frog-leg
    - Oblique S shaped incision starting medial to ASIS and coursing to 2 cm below the apex of femoral triangle
    - Raise flaps to the sartorius muscle, medial to the adductor longus, and superiorly to a line from the pubis to ASIS
    - Excise all the lymph nodes in that area superficial to the femoral vessels and external oblique.
    - Deep dissection can be performed by dividing the inguinal ligament
    - Peritoneum and ureter are retracted medially to expose the iliac fossa. The nodes are dissected off the common and external iliac vessels. Obturator nodes are dissected off the posterior surface of the external iliac vein.
    - Place a drain and mobilize sartorius to cover the exposed femoral vessels
    - Leave a superficial drain also
    - Patients with higher risk features can be referred for adjuvant radiation
    - Consider these patients for adjuvant therapy
* **Merkel cell carcinoma**
  + This is a neuroendocrine carcinoma
  + They have small blue cells on pathology
  + They occur in older patients
  + Patients with clinically positive nodal disease need staged
    - CT CAP, PET
  + If size is greater than 2 cm get 2 cm margins, otherwise 1 cm is ok
  + ALL PATIENTS GET A SLN BIOPSY! With a WLE
  + Do the SLN bx with T99m radiotracer
  + Give adjuvant radiation therapy to tumors more than 2 cm in size
  + Chemo is only indicated for unresectable disease, there isn’t much data here
  + Immunotherapy may be a better option
* **Non melanoma skin cancer**
  + Get a 5-10 mm margin
  + Ones on the face or sensitive areas can be excised with Mohs
  + SLN Bx is not warranted unless they have palpable nodes
  + Do adjuvant radiation if they have high risk features like neural invasion
* **Extremity mass (sarcoma)**
  + Get an MRI, or CT if that is unavailable
  + Diagnose with core needle biopsy with access site through a planned areas of excision
  + Orient any surgical incision for a biopsy longitudinal to the extremity
  + For staging
    - Size >/< 5 cm
    - Low grade vs high
    - Mets vs no mets
    - All patients get CT chest
      * Nodal involvement may be seen with few subtypes including epithelioid and clear cell sarcoma
  + Patients with positive margins need either re-excision or radiation
  + Some may benefit from chemo
  + If surgery would render the extremity non functional than amputation is preferred
  + Try to get at least a 1 cm margin on these
  + If margins are going to be threatened, try neoadjuvant radiation therarpy
  + Discuss in MTB and refer to a sarcoma center
  + Place metallic clips in the surgical bed for radiation planning
* **Retroperitoneal sarcoma**
  + Workup includes
    - AFP, BHCG, LDH, CT CAP
    - Get a CNB
    - Do resections en block with intra-abdominal structures
  + Sarcomas involving critical vascular structures, those with peritoneal implants, or those at the base of the mesentery, or involving spinal cord are considered unresectable
  + You don’t radiate RP sarcomas due to risk of adjacent structures
  + Place metal clips in surgical bed

**Section 12: Trauma**

* **Hemostatic resuscitation**
  + Always enable spinal precautions in a trauma patient
  + If you intubate someone, then confirm breath sounds and end tidal CO2
  + Always get a CXR and pelvis XR
  + Just start MTP if you are concerned about bleeding
  + ACT measures time to initiation of clot, if high treat with FFP
  + Use permissive hypotension as an approach to resuscitation using balanced transfusion ratio of 1:1:1
  + TEG
    - R is time to initial clot formation, if long treat with FFP
    - K time is time needed to reach clot strength, if low give FFP or cryo if alpha is abnormal
    - Alpha angle - rate of clot formation - can speed up wit Cryo and platelets if the mA is low
    - mA is strength of the clot, give platelets if low and cryo if alpha angle is off
    - Lysis is time to reduction, if it drops off too quick give TXA or amino-caproic acid
    - 
* **Emergency department thoracotomy**
  + EDT is indicated in penetrating injury if less than 15 minutes and cardiac motion on US, or if less than 10 minutes with blunt trauma with some cardiac motion.
  + If patients are in asystole, they are not candidates for EDT
    - Benefits
      * Save their live
      * They could be an organ donor
    - Risks
      * Low likelihood of survival
      * Risk to staff
      * Resource utilization
  + Steps to ED thoracotomy
    - Elevate left arm over head
    - Incise from sternum to the bed in 4th intercostal space cut the intercostal tissue protecting the neurovascular structure below the adjacent rib and then place my feneschetto retractor with the crossbar pointed towards the bed
    - Retract lung away from heat and incise pericardium anterior and parallel to the phrenic nerve then inspect the heart
    - Evaluate the lung for bleeding and cross clamp the hilum if there is bleeding
    - Cross clamp the aorta (first structure anterior to the spine) by incising the inferior pulmonary ligament and bluntly dissecting around the aorta before placing a vascular clamp around it taking care not to clamp the esophagus
  + If you do an EDT and there is a massive right hemothorax after placement of a right sided chest tube, convert to a clamshell thoracotomy, use scissors or a bone cutter to get through the sternum and ligate the internal mammary arteries
  + If you have a cardiac injury
    - If near coronary vessel use horizontal mattress sutures going under the vessel
    - Use pledgets if there is tissue loss
    - Place a foley or insert a finger or staple it
    - For atrial injuries consider a vascular clamp
    - Distal coronary vessel injuries should just be ligated
  + If needed for pulmonary bleeding you can twist the lung around the hilum after incising the inferior pulmonary ligament
  + Perform manual cardiac massage and have defibrillator sticks ready
  + Inject 1 mg epi directly into the ventricle, give sodium bicarbonate was well
  + If you defibrillate, set it to 50 J .
  + If these patients make it to and out of the OR get an echo to evaluate for any additional injuries
* **Penetrating chest injury**
  + Need to rule out tension pneumothorax, tamponade, and ongoing blood loss
  + Patients with traumatic arrest get bilateral chest tubes, every time
  + When placing a chest tube make sure to do a finger sweep
  + Greater than 1.5 L of initial output means straight to OR from CT or greater than 250/hour for three hours
  + If patients suddenly crash in the ED, consider EDT
  + Left sided thoracic outlet injuries can be treated by a trap door incision which is an anterolateral thoracotomy extending through the sternum and taken lateral at the level of the clavicle
    - This can expose the left common carotid and subclavian arteries
  + Approach to left subclavian injury is anterolateral thoracotomy in the 3rd intercostal space and supraclavicular exposure for definitive control
  + If you need access to both sides of the chest, do a clamshell thoracotomy
  + The only thing that can’t be accessed via clamshell thoracotomy are the upper mediastinal vessels which can be accessed by just doing a sternotomy on top of that
  + Key steps for REBOA
    - Get femoral access and insert 8 French sheath over a wire using a femoral cutdown
    - Insert balloon through the sheath and position in aortic zone 1 (between left subclavian and celiac artery) for abdominal bleeding or in zone 3 (lowest renal artery to bifurcation) for pelvic bleeding
  + Parenchymal lung bleeding
    - Tractotomy with linear staples, oversew with 2-0 vicryls
  + Intercostal bleeding
    - Circumferential suture around the tib, absorbably suture
    - Ligate both ends of bleeding
  + Hilar bleeding from lung
    - Hold respirations
    - Place satinsky clamp
    - Can also twist the lung
    - Pneumonectomy is last ditch effort
* **Stab wound to the neck**
  + Hard signs of vascular injury mean bypass imaging and go to OR
    - shock/hypotension
    - Active hemorrhage
    - Expanding or pulsatile hematoma
    - Neurological deficit
    - Subcutaneous emphysema
    - Respiratory distress or airway compromise
    - Air leaking through the neck wound
  + If you are going to get imaging get:
    - CTA neck
    - CXR
    - Barium esophagogram
    - EGD
    - Bronchoscopy
  + Basically if they have hard signs of injury you just go to the OR, if not then work it up with CTA and endoscopy of trachea and esophagus
  + Zone 2 neck exploration
    - Position arms tucked neck extended and rotate to other side
    - Incise anterior border of SCM
    - Open carotid sheath and divide facial and middle thyroid vein to expose the carotid and jugular
    - Mobilize esophagus and place penrose to rotate circumferentially
    - Palpate and visualize larynx and trachea
    - Perform EGD and bronch
  + All internal and common carotid injuries should be repaired even in the setting of neural deficits, consider heparinizing them if you can and you don’t have to shunt as they are often young otherwise healthy people. You can ligate the IJ and carotid without second thought but try to repair if you can. If you have bleeding from vertebral arteries use bone wax or a fogarty balloon, then transfer to IR for embolization
  + If you repair the esophagus put some interposed tissue over the repair, especially if there are other injuries nearby (i.e. omohyoid or SCM), place a drain if there is any injury. Get a esophogram before instituting a diet.
  + For tracheal injuries they can usually be just repaired with absorbable 3-0 vicryls in an interrupted fashion. Also place some tissue over the repair. Trachs are placed distal to severe crush injuries, major tracheal injuries and tears that are >1/3rd the circumference or when prolonged ventilatory support is anticipated, otherwise you don’t have to routinely place a trach.
  + For zone 3 injuries endovascular therapy may be of benefit
* **Burns**
  + Fluid resuscitation is 2 x TBSA x wt (kg) with half of that given over first 8 hours. Then titrate IVF rate to UOP
  + All burn patients with suspected inhalational injury get an ABG and CO level drawn, and do a bronch to wash out the airways
  + Use lung protective ventilationo techniques (6 mL/kg TV)
  + Ways to clear airway of mucous
    - IPV
    - NAC
    - Humidified O2
    - Hypertonic saline
    - Inhaled heparin
    - Albuterol
  + If you have bad CO poisoning, consider HBO it reduced the T1/2 ot 20 minutes
  + Treatment for cyanide poisoning is IV hydroxocobalamin
  + First degree burns just need moisturizer and pain relief
  + Second degree burns
    - Treat with topical antimicrobials
    - Excision is better early for 2nd/3rd degree burns
    - Tangential vs fascial excision
    - Epi soaked laps
  + Cadaveric versus autograft
  + Use fibrin glue prior to application of skin grafts
  + If grafts cover a joint, place an immobilizer for 48 hours
  + Remember nutrition
* **Blunt abdominal trauma from MVC**
  + Follow ABCDEs of trauma
  + Don’t forget to use IR
* **Damage control laparotomy**
  + Use permissive hypotension
  + Active MTP
  + Pack all four quadrants and inspect, if still bleeding suspect arterial and get proximal aortic control. If arterial liver bleeding is suspected, send the to IR afterwards
  + Methods to manage splenic bleeding
    - Direct suture repair
    - Topical hemostatic agents
    - Mobilize spleen and wrapped in polyglactin mesh
    - Splenectomy
  + Trauma ex lap
    - Prep chin to knees
    - Xiphopubic incision
    - Pack all four quadrants and evacuate all blood
    - Remove packs starting with area of least concern
    - Reassess physiologic status of the patient
  + If you suspect pelvic bleed, don’t extend incision below umbilicus
  + Communicate with anesthesia regarding any arterial clamping
  + In a bleeding kidney with expanding hematoma or unstable patient you can try to repair it but have low threshold for nephrectomy
  + For massive arterial destructive injuries you can shunt them with tubes and tie both ends with silk sutures. You don’t have to anticoagulant the patient and the shunt can be left in for 48 hours
  + You can safely ligate the IIA, Celiac artery, and IMA without much issue
  + If you injure the bifurcation of aorta, you may need a dacron graftm as that’s difficult to shunt
  + You can also ligate or shunt most venous injuries
  + For patients with major arterial damage have low threshold to do 4 compartment lower extremity fasciotomies
  + Make sure to get proximal control before exploring hematomas
  + If the distal panc is torn up, do a distal panc
  + If the proximal panc is destroyed, place drains
  + Intra-peritoneal bladder injuries can just be sewn up in layers and a foley placed
  + Divert ureteral injuries
  + You can close abdomen just using towel clips
* **The abdominal compartment syndrome and management of the open abdomen**
  + PE is not that helpful in diagnosing this, go with bladder pressures
  + Normal bladder pressure is less than 12, greater than 20 is concerning
  + You can go back in and do big recon on a hernia once the STSG you placed has separated from the underlying bowel
  + In patients with shock don’t forget to think about abdominal compartment syndrome
* **Complex liver injury**
  + Grade 1-3 liver injuries almost never need surgery, grade 4-5 need it up to 10% of time and progress to hemodynamic instability due to bleeding
  + Active extrav in a stable patients goes to IR
  + These patients should be monitored in an ICU
  + Maneuvers to deal with liver bleeding
  + Pack, push, pringle, total vascular isolation (take down falciform and triangular ligament to visualize and compress the supra-hepatic IVC then compress the infrahepatic IVC at the inferior aspect of the liver (supra-renal) you should probably kocherize the duodenum to see it
  + You can also plug some omentum into the laceration and suture with chromic suture on a big blunt needle
  + If someone develops hemobilia just have them go to IR as it’s diagnostic and therapeutic
  + Leave drains, watch for bile leaks
* **Duodenal injury**
  + Have a low threshold for placement of a J tube at the time of repair
  + Cattel-Braasch involves moving everything over to the left
  + Place a feeding tube if you try to repair the duodenum and leave drains
* **Pancreatic and duodenal trauma**
  + May result in negative fast, but shouldn’t preclude operative exploration
  + Pancreatic injuries are managed based on whether or not you think the main pancreatic duct is involved. If it is you will need to resect, if not, then just management with drain will likely do.
  + You can do an intraoperative pancreatogram to evaluate the duct
  + Perform a kocher/cattel brasch maneuver to expose it all and enter the lesser sac
  + Get MRCP or ERCP to evaluate the duct as well
* **Pelvic fracture**
  + Nothing to add here

**Section 13: Critical care**

* **Airway emergency**
  + Mallampati 4,I need to see more, only soft palate
  + RSI
    - Rocuronium or Succinylcholine 1 mg/kg
    - Etomidate 0.3 mg/kg
    - 100 of roc and 30 of etomidate
  + If you can’t tube them, bag them, then bag and reattempt, if that fails, try an LMA and intubate through that, if that doesn’t work, then surgical airway is indicated
* **Cardiovascular failure**
  + Disorders of compartment pressure
    - Abdominal compartment syndrome
    - Tension pneumothorax
    - Tension hemothorax
    - Pericardial tamponade
  + Disorders of intravascular volume
    - Bleeding
    - Capillary leak
    - Sepsis
  + Disorder of cardiac mechanics
    - PE
    - MI
    - Dysrhythmia
  + Septic
  + Cardiogenic
  + Obstructive
  + Distributive
  + Neurogenic
  + Door to drug is 30 min and door to balloon is 90 minutes
  + VV ecmo is used when the pump works but the lungs dont, here you have a cannula in the IJ and femoral (could also use a carotid or subclavian)
  + VA ecmo is used when both the heart and lungs are shot
  + Cannula in the RA/IVC and Femoral artery
  + Heparin is given prior to cannulation
* **Acute kidney injury**
  + Take out offending medications
  + Ensure normotension
  + Rule out abdominal compartment syndrome
  + Place foley
  + Get RP US if needed
  + Check a CK
  + Labs include basics plus urine microscopy and ua and urine electrolytes
  + Could also check a fena for feurea
  + Have a low threshold to place a foley
  + You can try some lasix maybe 60-80 mg a few times if they are oliguric but they are likely going to need RRT
* **Adrenal insufficiency**
  + A random cortisol level in the setting of stress is greater than 18
  + You can also use the Cosyntropin test and look at the delta 9 which is the difference at 30 and 60 minutes in cortisol levels. The cortisol level normally should increase by at least test at either of those time intervals otherwise they are adrenal suppression
  + AI may show up as hypotension, hyponatremia, hyperkalemia, fevers, tachycardia, weakness, and inability to wean from the ventilator
* **Acute respiratory distress syndrome**
  + Defined as bilateral pulmonary infiltrates presenting within 1 week of an insult with P/F ratio < 300 on at least 5 of PEEP that is otherwise not explained by another cause
  + Get an echo to rule out heart failure as well as EKG
  + Lung protective ventilation, keep it at 6 ml/kg for TV
  + If you prone patients, it should be for at least 12 hours per day
  + Paralytics are for severe disease and should be used for 48 hours
  + Inhaled Nitric oxide is an adjunct to help vasodilate and improve oxygenation
  + Prostacyclinis also a vasodilator that can help
  + Epoprostinol (velitri) can be used also
  + Be conservative with IVFs
* **Ventilator-associated pneumonia**
  + Really can only be present if patient has been intubated for 48 hours
  + Workup would include a BAL and aspirate
  + Treat for 10 days
  + Diagnostic criteria
    - Cultures
      * Endotracheal aspirate > 10^5 CFU/mL
      * BAL > 10^4 CFU/g
      * Protected specimen brush 10^3
    - Other
      * Purulent respiratory secretions with >25 neutrophils and < 10 squams per LPF + an organism that is identified on culture
      * Initial aspirate from pleural cavity growing something
  + Treatment should be based on local antibiograms
  + You should cover staph and pseudomonas
* **Sepsis and septic shock**
  + qSOFA
    - AMS
    - SBP<100
    - RR>22
    - If two or more are present, treat as sepsis
  + Bolus with 30 mL/kg of crystalloid
  + Goal CVP of 10 and MAP > 65 with UOP >0.5 ml/kg/hr
  + Make sure to get a lactate
  + Give antibiotics and get blood cultures
  + Levo then vaso
  + If they are still hypotensive after initial resuscitaiton, measure CVP and lactate and ScvO2 (want this greater than 70%)
  + CVP is not an accurate measure of volume status in patients who are ventilated or those with pre-existing ventricular issues
  + Pulse pressure variation, straight leg test, and bedside ultrasound can assess intravascular volume as well
* **Abdominal compartment syndrome**
  + Normal intra-abdominal pressure is 5. Hypertension is anything greater than 12, abdominal compartment syndrome starts when that’s over 20 if a/w new organ dysfunction
  + Management
    - NG
    - Rectal tube
    - Sedate
    - Paralytics
    - Diuresis
    - Foley
    - Laparotomy
    - Drains
  + Custom wound VAC for closure
    - Attempt to put omentum on bowel
    - Place large sterile plastic drape and place it deep to fascia
    - Place gauze, then NG tube or JP drains on that
    - Place blue towels on top
    - Place Ioban
  + How to measure bladder pressure
    - Insert 18 gauge IV catheter into the foley catheter and remove the needle
    - Attach IV to pressure tubing and monitor
    - Clap distal to access port
    - Instill 25 mL of saline in bladder
    - Measure pressure at the end of exhalation
* **Nutritional support in the critically ill patient**
  + none

**Section 14: Transplant**

* **Acute liver failure**
* **Varicela bleeding and portal HTN**
  + Use vaso first as a pressor for these patients
  + If they can’t stop the bleeding via endoscopy send them to IR for TIPS
* **ESRD**

**Section 15: Head and neck**

* **Melanoma of the head and neck**
  + Metastatic workup includes
    - CT neck and CAP, brain MRI, LDD, and PET scan
* **Head and neck cancer**