SURGERY

Clerkship director: Roger P. Tatum, M.D.
Web site: http://depts.washington.edu/surgstus/

REFERENCES & HELPFUL RESOURCES

1. Surgical Recall—all the basics from horses to zebras, most difficult pimpling questions are found in this book
2. “A primer for third year medical students entering their surgical clerkship”, Farhood Farjah and Lorrie Langdale
4. Access to any surgical text for more in-depth reference

• A NOTE ON TERMINOLOGY: A surgical procedure is referred to as an “operation,” NOT a “surgery.” “A surgery” is a British term referring to a place where surgery is performed. Surgeons perform operations, the performance of operations is called surgery, and “a surgery” is a place. Got it? Don’t call an appendectomy “a surgery,” it’s an operation! It would be appropriate to say “this patient just had surgery” but NOT “this patient just had a surgery.”

WARD TIPS

• Wear comfortable shoes! Wear scrubs on non-clinic days, and nice clothes in clinic.
• Check surgery schedule for next day, read up on anatomy and basics of procedure. There is so much that they can pimp you on but 3rd years are supposed to know basic anatomy and pathophysiology. You will be unable to prepare for every case—pick one or two and know them cold then just go over the basics of the others. Surgical recall does a pretty good job of giving the bare bones facts. There will be certain operations that you will see all of the time (depending on location) like inguinal hernia repairs, lap choles, exploratory laparotomies (at HMC), so tailor your studying to your environment. If you’ve seen a case 4-5 times you’d better know the anatomy, pathophysiology, and oddball minutia cold.
• Pre-round and give yourself enough time to formulate a daily assessment and plan before rounds (review plan with intern if you get the chance), and have most of the note finished before rounds (may change plan after discussing with seniors on rounds). Follow-up on patient labs, pathology, x-ray, etc. Most importantly know everything about your patients.
• Be prepared to do dressing changes for team patients on a.m. rounds. When you enter a room where the patient has a wound that needs to be looked at (after you have cleared it with the intern) take the dressing down and have the new dressing ready to be put on. Dressing changes are your job! Have your pockets filled with dressing materials so you don’t have to fumble through the room looking for supplies while the team is trying to get through rounds.
• Dressing material to carry: Bandage shears, 2-3 ABDs, Lots of 4X4s, a drain dressing or two, and tape, +/- other material depending on the service.
• Eat when you can, sleep as much as you can, and try to study every night. Carry something to study in your coat in case of a rare moment of downtime.
• The floors all have small supply closets with crackers and other snacks—always a nice place to stock up just in case.
• Make sure your pager is loud enough to wake you up, if not consider clipping it to the chest of your scrubs when napping on call, or buying a louder pager.
• The intern will love you if you learn to help keep the Cores list (http://cores.medical.washington.edu at UW and HMC) up to date with current patient census and information. It will also help you remember the patients and stay up on what is going on with the service.

OR TIPS
• Introduce yourself to the scrub nurses, s/he will hand you the instruments you need, and keep you from doing anything really stupid. Be friendly and ask if you should write your name down for them.
• Pay attention to the operation, if you know what is going on and make an effort to help (retract etc.) you will get to do a lot more.
• Practice suturing and tying, if you do these well when given the opportunity the surgeons will notice and let you do more.
• Always try to use the restroom prior to starting a long case.
• Pull your gloves and gown prior to scrubbing, sometimes the nurses will do this for you but always check.
• Help when you can, but also stay out of the way.
• Have fun. The OR time is the best part of the surgical rotation

SAMPLE NOTES
Daily Progress Note (Post-Op check follows same format)
MS3 PN, Gen Surg B
ID: 37 yo male S/P ex lap, HD#3, POD#2, Ceftaz Day #1
S: Pain, ambulation, flatus, BM, appetite and diet, breathing and pertinent information unique to respective surgery.
O: Vitals, I&Os including breakdown of volumes. UOP should average at least 30cc/hr.
   JP/drains – note amount of fluid, color.
PE: Don’t forget to describe wounds
   Labs
   Imaging
A/P: Address all significant issues and what you want to do about them
Plan should always include:
1. Diet plan
2. Pain (controlled w/ PCA, change to po, etc.)
3. Volume status (IVF, vitals, urine)
4. Discharge plan (best guess when and what needs to happen to get there)
5. Any specific problems

Brief Operative Note
Pre-Op Dx
Post-Op Dx – same (same as above or explain difference based on operative finding)
Procedure
Surgeons, Assistants
Anesthesia – GET (general endotracheal), LMA, MAC, local, etc
EBL – ask anesthesia
Fluids – ask anesthesia
Drains – list what drains were put in
Findings – list significant findings
Specimens – list tissue sent to path
Complications – usually none... if there is a complication, ask the surgeon what you should write here or let resident write this section
Disposition – condition of patient i.e. patient taken to recovery room in stable condition

**BLOOD PRODUCTS**

Red Blood Cells: 1 unit of PRBCs raises HCT 3 points
- Indications: symptomatic anemia, large blood loss/continuing loss, low hct (< about 30) and h/o CAD

Platelets: 1 unit of platelets raises count 5,000-10,000. Given in “six packs” (six units).
- Indications: platelet count less than 20,000 (can result in spontaneous bleeding) or platelet count < 50 with bleeding or needs operation.

**SELECTED SURGERY TOPICS**

**Layers of the abdominal wall**
One of the most common pimping questions
1. Skin and subcutaneous fat
2. Camper’s (fatty) fascia
3. Scarpa’s (membranous) fascia
4. External oblique
5. Internal oblique
6. Transversus abdominus
7. Transversalis fascia
8. Peritoneum

**Acute Abdomen** = inflamed peritoneum

Sxs/signs  Rebound tenderness, involuntary guarding, motion pain (shake the bed or tap patient’s feet)
Labs  CBC with diff, Chem 7, Ca, Mg, PO4, amylase/lipase, +/- Liver tests, type and screen, UA, urine hCG
Ddx  Think in terms of quadrants and what lives in respective quadrants
RUQ  Cholecystitis, hepatitis, PUD, perforated ulcer, pleurisy/pneumonia, pancreatitis, liver tumor, gastritis, hepatic abscess, pericarditis, choledocholithiasis, cholangitis, pyelonephritis, nephrolithiasis, PE, MI, appendicitis (esp. in pregnancy)
LUQ  PUD, perforated ulcer, gastritis, splenic disease/rupture, abscess, dissecting aortic aneurysm, pyelonephritis, nephrolithiasis, strangulated hiatal hernia, Boerhaave’s syndrome, Mallory-Weiss tear, pneumonia, PE, MI, pleurisy
LLQ  Diverticulitis, sigmoid volvulus, perforated colon, colon cancer, UTI, SBO, IBD, PID, ectopic pregnancy, nephrolithiasis, pyelonephritis, referred hip pain, aortic aneurysm, ovarian cyst, endometriosis, gyn tumor, ovarian torsion, Fallopian torsion
RLQ  Appendicitis, mesenteric lymphadenitis, cecal diverticulitis, Meckel’s, intussusception, cecal volvulus + LLQ causes above

Other causes to consider

Gyn causes  Ovarian cyst/torsion, PID, fibroid degeneration, ectopic pregnancy, endometriosis, tumor, tubo-ovarian abscess
Thoracic  MI, pneumonia, aortic dissection, aortic aneurysm, empyema, esophageal
rupture/tear (Boerhaave’s), pneumothorax

Scrotal
Testicular torsion, epididymitis, orchitis, inguinal hernia

Diffuse
Uremia, porphyria, diffuse peritonitis, gastroenteritis, IBD, DKA, early appendicitis, SBO, sickle cell crisis, ischemic mesentery, lead poisoning, pancreatitis

Appendicitis

Cause:
Obstruction of appendiceal lumen by lymphoid hyperplasia, fecalith, etc., (i.e., a closed loop obstruction). Continued secretion into its lumen results in increased pressure in appendix. When lumen pressure = perfusion pressure, wall becomes ischemic, and eventually ruptures spilling bacterial and fecal matter into abdominal cavity.

Complic.
Perforation, peritonitis, bowel obstruction

Early sxs
Periumbilical pain (referred and poorly localized) that then migrates and presents as RLQ pain once peritoneal inflammation occurs, anorexia, nausea, vomiting (Pain almost always before N/V)

Signs
Involuntary guarding, rebound tenderness, fever, obturator sign, psoas sign, Rovsig’s sign (pain at on opposite side when abdomen is palpated)

Labs
CBC with diff, UA, pregnancy test if of childbearing age

Imaging
Dx typically clinical but may get Abd XR, U/S, or CT if diagnosis is not clear on physical exam

Rx
Appendectomy and 24hr Abx for non-perforated. Appendectomy and 5-7 days Abx for perforated appendix.

Cholelithiasis
10% of U.S. population, 50% are symptomatic

Risk Factors
Female, obesity, multiparity, oral contraceptives, biliary stasis, chronic hemolysis, cirrhosis, TPN, IBD, hyperlipidemia (fat, forty, fertile, female)

Stones
Cholesterol stones 90%, pigment stones 10%

Rx
If symptomatic = Lap Cholecystectomy

Biliary Colic
Obstruction, RUQ pain, nausea, vomiting usually after large meal, but no inflammation and resolves within few hours

Cholecystitis
= inflammation of gallbladder due to obstruction of cystic duct

Causes
Gallstones, biliary stasis (TPN, fasting)

Complic.
Abscess, perforation, choledocholithiasis (stones within the common bile duct), gallstone ileus (gall stone may erode through gall bladder, enter the small bowel and lodge itself at the ileocecal valve causing a SBO)

Sxs/signs
RUQ pain and tenderness (longer than 1-2 hours), fever, nausea, vomiting, Murphy’s sign, right subcapular pain (referred)

Imaging
U/S shows thickened gallbladder wall, gallstones, pericholecystic fluid, (all of above are non-specific signs) one of most important and specific signs is the sonographic Murphy’s sign (when positive is almost always cholecystitis)

Rx
IVF, Abx, cholecystectomy (often within 72 hours of presentation)
For pain control use Demerol vs. morphine as morphine induces spasm of sphincter of Oddi

Cholangitis
= bacterial infection of biliary tract (true surgical emergency)
Charcot’s triad = fever/chills, jaundice, RUQ pain
Reynold’s pentad = Charcot’s + altered mental status and shock
Rx  IVF, Abx, and surgical decompression

**Hernia**

**Causes**
Increased intraabdominal pressure, obesity, pregnancy, ascites, patent processus vaginalis.

**Complic.**
Incarceration (unable to reduce), strangulation (compromised blood supply), SBO (#1 cause of SBO in children and adults with no prior Hx of surgery). Note: the smaller the defect in the fascia the more likely the herniated bowel is to strangulate.

**Types**
Most common are indirect inguinal > direct inguinal > femoral

*Indirect inguinal*: lateral to Hesselbach’s triangle, through internal ring of inguinal canal, most common hernia in men and women.

*Direct inguinal*: within Hesselbach’s triangle

*Femoral*: beneath inguinal ligament down femoral canal and medial to Femoral vessels. More likely to incarcerate than inguinal hernias

**Rx**
Herniorrhaphy (open or laparoscopic), emergent or elective depending on complications. Often use mesh.

**Acute Pancreatitis**

**Causes**
Alcohol, gallstones, idiopathic, hypercalcemia, trauma, hyperlipidemia, ERCP (iatrogenic), cardio-pulmonary bypass, familial, drugs

**Complic.**
Pseudocyst, abscess, necrosis, ARDS, Sepsis, hypocalcemia, DIC, splenic vein thrombosis, shock and multi-organ failure

**Sxs/signs**
Epigastric pain radiating to back, nausea, vomiting, abd. tenderness, guarding, decreased bowel sounds, fever, dehydration, shock. Look for Cullen’s (periumbilical) or Turner’s (flank) signs that indicate retroperitoneal hemorrhage

**Findings**
Increased amylase, lipase, WBC, LFTs, and glucose. Decreased Hct and calcium. Pseudocyst, phlegmon, abscess, necrosis on CT. Gallstones on CT, U/S.

**Rx**
Supportive therapy: fluid resuscitation, meperidine (Demerol) for pain, NPO, NGT if needed for protracted nausea and vomiting. Surgical debridement and abx for infected necrotizing pancreatitis. CT-guided drainage and abx for pancreatic abscess.

<table>
<thead>
<tr>
<th>Ranson's Criteria (predicts mortality)</th>
<th>PROGNOSIS</th>
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<tbody>
<tr>
<td><strong>Initially (at dx)</strong></td>
<td><strong>After 48 hrs</strong></td>
</tr>
<tr>
<td>Age &gt;55</td>
<td>Base Deficit &gt;4</td>
</tr>
<tr>
<td>WBC &gt;16,000</td>
<td>BUN increase &gt; 5</td>
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<tr>
<td>Glucose &gt;200</td>
<td>Serum Ca &lt;8</td>
</tr>
<tr>
<td>LDH &gt;350</td>
<td>Hct decrease &gt;10%</td>
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<tr>
<td>AST &gt;250</td>
<td>Fluid sequestration &gt;6L</td>
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<table>
<thead>
<tr>
<th># of criteria</th>
<th>Mortality</th>
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<tbody>
<tr>
<td>0-2</td>
<td>&lt;5%</td>
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<tr>
<td>3-4</td>
<td>~15%</td>
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<tr>
<td>5-6</td>
<td>~40%</td>
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<tr>
<td>7-8</td>
<td>~100%</td>
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(Am J Gastroent 77:633;1982)

**Chronic Pancreatitis** = fibrosis, calcification due to chronic inflammation

**Causes**
Alcohol, idiopathic, hypercalcemia, hyperlipidemia, familial, trauma, iatrogenic, gallstones, cystic fibrosis.

**Complic.**
Diabetes, steatorrhea, malnutrition, splenic vein thrombosis

**Sxs/signs**
Epigastric pain, weight loss, steatorrhea, diabetes

**Ddx**
PUD, pancreatic cancer, angina, AAA
Imaging
May see calcification of pancreas on AXR, CT.
May see duct dilation/stenosis on ERCP (chain of lakes)

Rx
Insulin, pancreatic enzyme replacement, pain meds, stop alcohol.
Surgery indicated for severe, refractory pain (many options including Peustow procedure, distal pancreatectomy, total pancreatectomy, others)

Pancreatic Cancer
RFs
Chronic pancreatitis, smoking, DM, FHx

Sx
Dull epigastric pain radiating to back, may be worse w/eating; weight loss, Anorexia, ± jaundice, steatorrhea if tumor occludes bile duct

PE
may be unremarkable; ± abd mass, ascites, nontender palpable gallbladder, supraclavicular nodes

Dx
Labs: elevated bili, alk phos, CA 19-9 transabdominal U/S
CT abdomen w/ and w/o contrast -> if see mass, will need surgical C/S
Endoscopic U/S with FNA
ERCP/MRCP to r/o cholangitis and chronic pancreatitis

Tx
Resect tumors without mets that don't invade SMA/SMV, portal vein etc.
Procedure is typically Whipple; also total pancreatectomy, and others.

Small Bowel Obstruction = mechanical obstruction of intraluminal contents
Causes
Adhesions = #1, hernia (# 1 in kids and in adults with no hx of abd surgery), tumor, intussusception, gallstone ileus, Meckel’s diverticulum, abscess, bowel wall hematoma, radiation enteritis, Crohn’s disease

Complic.
Bowel strangulation, necrosis

Sxs/signs
Abd. pain, cramping, nausea, vomiting, high-pitched bowel sounds
If strangulated bowel -> fever, severe pain, hematemesis, shock, abdominal free air, peritoneal signs, acidosis

Ddx
Paralytic ileus (common in post-op pts.), electrolyte imbalance (hypokalemia is most common)

Types
Complete (no colon gas), incomplete (some colon gas)

Rx
NGT, IVF, Foley cath, and close observation for incomplete. Laparotomy for complete SBO.

Large bowel obstruction:
Almost always requires an operation, less common than SBO
Ddx: Colon Cancer, obstipation, volvulus.

Volvulus, cecal = twisting of cecum on itself and mesentery, usu. axial twist
Causes
Idiopathic poor fixation of R colon, many have H/O abd surgery

Sxs/signs
Acute abd pain, colicky RLQ pain, progresses to constant pain with vomiting, abd distention, obstipation

Dx/Imaging
AXR shows dilated colon with large air-fluid level in RLQ. “Coffee bean” sign = apex aiming toward LUQ
Colonoscopy or gastrografin contrast study if AXR non-diagnostic

Rx
Emergent surgery. Cecopexy if cecum is viable, R colectomy with ileostomy and mucus fistula if cecum infarcted

Volvulus, sigmoid (more common than cecal)
RiskFx: High residue diet, pregnancy, constipation, laxative abuse, think elderly persons in nursing homes and other chronically institutionalized persons

Complic.: Obstruction, necrosis, perforation of colon

Sxs/signs: Acute abd. pain, progressive distention, anorexia, cramps, nausea, vomiting, obstipation. Signs of strangulation include hemorrhagic mucosa on sigmoidoscopy, bloody fluid in rectum, peritoneal signs, fever, and hypovolemia. Signs of necrotic bowel include free air, pneumatosis

Imaging: See distended loop of sigmoid colon on AXR. "omega sign" = loop pointing towards RUQ

Dx: Sigmoidoscopy or CT with gastrografin enema

Tx: Sigmoidoscopic reduction successful in 80%. Enema study can also reduce. 40% recurrence after nonoperative reduction, so do elective sigmoid resection even if successful in reducing.

**Peripheral vascular disease**

If patient has PVD, likely also has other vascular disease (CAD, carotid disease, or AAA)

Risks: SMOKING is the biggest

S/Sx: Claudication, chronically cold extremity, decreased pulses, muscle atrophy

Work-up: ABIs – ratio of measured BP in ankle and arm (brachial). Normal ABI > .9. Abnormal if <.9, indicates peripheral vascular disease. ABIs < 0.4 indicate severe ischemia (resting pain) and contraindication to bypass. Angiogram needed if bypass planned.

Rx: Smoking cessation, exercise for mild disease, anti-platelet therapy. Revascularization procedures if medical therapy fails.

**Fever Work-Up (6W’s)**

Wind: Pneumonia, atelectasis (especially 1-2 days post-op)

Water: UTI (especially if Foley present)

Wound: 5-7 days (abd abscess will wall off after 5-7 days)

Walk: DVT, PE

Wonder drugs: Drug fever especially if on prolonged Abx or new med

Whole Blood: Transfusion rxn

**Fistula formation** Things that keep fistulas open (FRIENDS)

- Foreign body
- Radiation
- (Granulomatous) Inflammation
- Epithelialization
- Neoplasm
- Distal Obstruction
- Steroids

**Wound Healing** (From Essentials for Students: Plastic and Reconstructive Surgery, 1998)

*Substrate/Inflammatory Phase, Days 1-4*

- Redness, heat, swelling, pain, loss of function. Leukocyte margination, venule dilation, lymphatic blockade, neutrophil chemotaxis, phagocytosis. Removal of clot, debris, bacteria. Lasts 1-4 days in primary intention. Healing continues until wound is closed in secondary and tertiary intention healing

*Proliferative Phase, Days 4-42*

- Synthesis of collagen from fibroblasts, rapid gain of tensile strength
Remodeling Phase, 3 wks onward  
Maturation by cross-linking of collagen, leads to flattening of scar. Dynamic, ongoing process, 9 months in adults.

Primary Intention Healing  
Closure by direct approximation, flap, skin graft

Secondary Intention Healing (spontaneous healing)  
Wound left open, maintained in inflammatory phase. Closure depends of contraction and epithelialization. Contraction due to force of myofibroblasts. Epithelialization occurs from margin to center, ~1mm/day.

Tertiary intention healing  
Delayed wound closure, intentional interruption of healing begun as secondary intention. Performed when wound not infected and granulation tissue present.

Factors influencing wound healing

<table>
<thead>
<tr>
<th>Tissue trauma</th>
<th>Malnutrition</th>
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<tr>
<td>Hematoma</td>
<td>Steroids</td>
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<tr>
<td>Blood supply</td>
<td>Chemotherapy</td>
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<tr>
<td>Temperature</td>
<td>Chronic illness</td>
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<tr>
<td>Infection</td>
<td>Technique/suturing</td>
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Skin Graft = skin separated from its bed, transplanted to another area; receives new blood supply

Spilt thickness

Epidermis + part of dermis. Donor site heals in 7-10 days  
Thin graft has better take  
Thick graft is more durable and has less contraction

Full Thickness

Epidermis + all of dermis. Slower vascularization.  
Donor site has full thickness skin loss, which must be closed by primary intention or split thickness skin graft. Used for fingers, face.

Graft survival

| 1 to 48 hrs | Serum imbibition, diffusion of nutrients |
| 48hr to 4d  | Inosculation, capillary ingrowth |
| 5d->        | Revascularization |

Factors contributing to graft loss

Hematoma / seroma forms under graft  
Shearing forces or traumatic tissue handling  
Decreased vascularity of recipient bed  
Infection / colonization  
Traumatic tissue handling

Skin Flaps = tissue transferred from one site to another with its own vascular supply. Used to replace tissue loss due to trauma or surgery, bring in better blood supply, improve sensation, and for reconstruction

Random flap

2 types: rotation and advanced. Limited length-to-width ratio (1.5-2.1 to 1). Blood supply is from dermal and subdermal plexus.

Axial Flap (arterial flap)
Peninsular vs. island. Greater length possible, blood supply is by artery and accompanying vein.

Musculocutaneous flap
Consists of skin, subQ, and muscle tissue (well-vascularized). Blood supply from vessels in muscle.

<table>
<thead>
<tr>
<th>Reconstructive Ladder</th>
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<tr>
<td>Direct Closure</td>
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<tr>
<td>Graft</td>
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<tr>
<td>Local Flap</td>
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<tr>
<td>Distant Flap</td>
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<td>Free Flap</td>
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**Essential Medications for Surgery Rotation** (6 Ps)

PRNs
- Tylenol 650 PO/PR Q4-6H PRN don’t exceed 4 g/24 hours
- Reglan 10 mg PO/IV QID (take 30 min prior to meals and at bedtime)
- Zofran 8 mg PO/IV Q8H PRN
- Ambien 5-10 mg PO QHS
- Benadryl 25-50 mg PO/IV Q4-6 H PRN

Pain
- Morphine 2.5-5 mg IV q2-3H PRN
- Demerol 25-50 mg IV q3-4 H PRN
- Dilaudid 1-4 mg IV q4-6H PRN
- Percocet (oxycodone) 325/5 mg (or other combos) 1-2 PO Q4-6H PRN
- Vicodin (hydrocodone 500/5 or other combo) 1-2 tabs PO Q4-6 H PRN

Prophylaxis (GI and DVT)
- Protonix 40 mg PO/IV QD
- Heparin 5000 U SQ q 8-12H

Poop
- Docusate 100-200 mg PO BID

Parasites (antibiotics) (prophylaxis antibiotic doses are the only ones included here)
- Ancef (Kefzol) 1g IV Q6H
- Unasyn 1.5-3g IV Q6H
- Zosyn 3.375 g IV Q6H
- Metronidazole 500 mg PO QID
- Cefoxitin 1-2 g IV Q6-8 H

Pre-Op Medications Don’t forget to restart pre-op medications as appropriate!