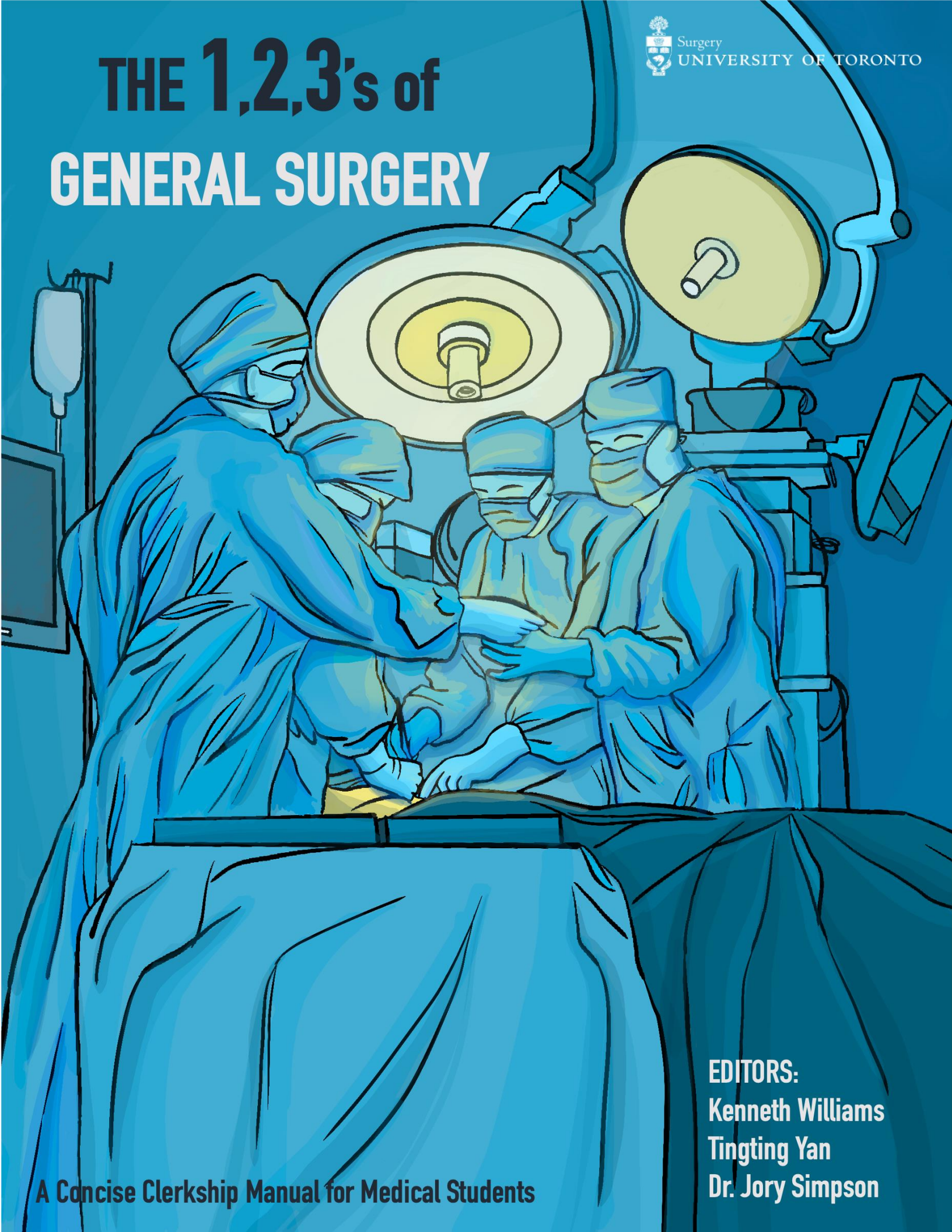
Surgery
UNIVERSITY OF TORONTO

THE 1,2,3's of GENERAL SURGERY



A Concise Clerkship Manual for Medical Students

EDITORS:
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Preamble

Welcome to your General Surgery Experience!

It is our pleasure to provide you with the 123's of General Surgery: A Concise Clerkship Manual for Medical Students. This manual has been created by medical students for medical students but extensively reviewed by established General Surgery physicians with whom you will be working during your core rotation.

This manual will outline the key issues, controversies, and current practice for each topic in a concise manner.

During your General Surgery rotation, you will see a wide range of patients from stable to critically ill, across all spectrums of ages and socioeconomic statuses. You will have a unique opportunity to participate in the diagnosis and management of first presentations of common and rare medical problems, participate in resuscitation of those who are acutely unwell as well as begin to become more comfortable with the management of your more ill and undifferentiated patients. This manual is meant to assist on your shifts, to be a guide for your exam studying, and be a future resource. The contents within have been tailored based on what previous medical students have been exposed to and/or tested on.

We thank all the authors and chapter editors who have contributed their time and expertise. We are fortunate to have contributions from so many leaders in our community.

Special thanks to our student editors (Kenneth Williams and Tingting Yan) for their ongoing commitment to Undergraduate General Surgery Training at the University of Toronto. Cover art was generously created by Sabrina Wang.

Enjoy your core General Surgery Rotation!

Sincerely,

_____

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1) Course Objectives

a) Surgery in the Geriatric Patient
   i) Develop an Approach to the Surgical Geriatric Patient

b) Presenting Complaints:
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      (1) Abdominal Mass (MMC 2)
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      (5) Breast Masses & Enlargement (MCC 10-1)
      (6) GI Blood (MMC 6)
      (7) Neck Mass (MCC 63)

c) Diagnoses:
   i) Goal: Be able to create & communicate management plans for:
      (1) Acute Abdomen (including Perforated Viscus)
      (2) Biliary Tree Disorders: Biliary Colic, Cholecystitis, Cholangitis
      (3) Pancreatitis
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      (7) Trauma 1o & 2o survey
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References

1) University of Toronto Surgery Clerkship Manual 2019-2020 Appendix E - Surgical Documentation

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2) Surgery in the Geriatric Populations

a) Definition of a Geriatric Patient: An individual that is >65y

b) Special Considerations in the Geriatric Population

i) **Issues that impact risk of complications & increase length of stay.**

(1) Loss of functional reserve / frailty = increased susceptibility to anesthesia & complications.

(a) Frailty: Most important negative indicator of surgical outcomes.

(2) Polypharmacy

(3) Cognitive decline

(4) Multiple Comorbidities (CVD, Renal Disease, Metabolic disease)

(5) Altered pharmacokinetics/dynamics:

(a) Will commonly need to titrate down dosage for geriatric patients.

(b) Avoid: Anticholinergics, antihistamines, benzodiazepine, high dose opioids, NSAIDs (bleeds & renal issues).

(c) Use:

(i) Nausea/vomiting: Ondansetron, domperidone (check QTc).

(ii) Insomnia: Melatonin, non-pharmacologic interventions.

(iii) Delirium: 1st line - Behavioral interventions - reorientation, mobilizations, physical therapy.

(iv) Pain: Acetaminophen, low dose opioids (add bowel regimen), peripheral nerve blocks.

(v) Constipation: PEG, lactulose, senna.

ii) **Atypical symptom presentation**

(1) More likely to have non-specific symptoms for classic acute abdomen conditions:

(a) Typical symptoms for infections (e.g. cholecystitis): Fever, focal abdomen pain, elevated WBCs.

(b) Finding of infection in Geriatric populations: Falls, delirium, nausea/vomiting, decreased PO intake, generalized weakness.

(2) Management tip: Have a low threshold for abdomen imaging.

iii) **Complications**

(1) Overall Complications are <u>more</u> common in the geriatric population.

(2) Perioperative: Labile BP, Cardiovascular event (MI), respiratory depression, volume overload, residual anesthetic effects due to altered pharmacokinetics.

(3) Post-Operative: Dementia (EXTREMELY COMMON; 40-60% of total hip arthroplasty pts), function decline, CV events (MI), Pulmonary events (aspiration, pneumonia, atelectasis) infections, pressure wounds, constipation, urinary retention, acute kidney injury, and VTEs, increased LOS, increased mortality risk (30% in 30d).

(4) Management tip: Focus on prevention <u>and</u> immediate management of complications.

iv) **Capacity & Consent**

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(1) Due to cognitive decline, geriatric patients may not have capacity
(2) Capacity: Understanding the information provided & appreciating the risks of decision or lack of one.
(3) You need to always assess capacity in geriatric patients, identify substitute decision maker, and consider patient values.

c) Surgical Risk Assessment in Geriatric Patient
    i) A comprehensive assessment should include:
        (1) **Surgical risk assessment** = Risks specific to the operation itself.
        (2) **Patient risk assessment** = Risks associated with a patient's health status (cardiac, respiratory, etc.):
            (a) Capacity Assessment
            (b) Identification of Substitute Decision Maker
            (c) Risk tools: Revised Cardiac Risk Score, ACS NSQIP Surgical Risk Calculator

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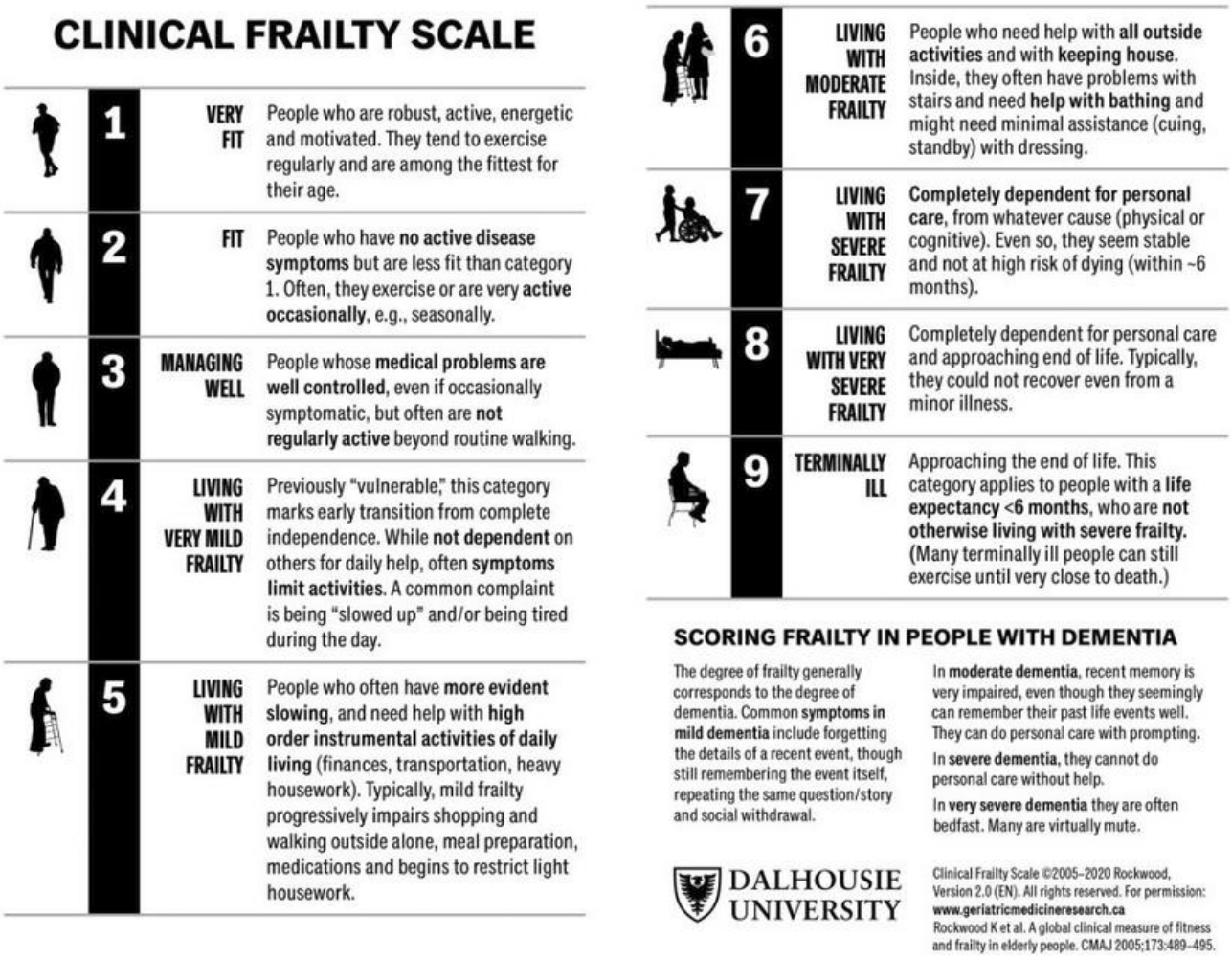
(d) Frailty: Rockwood Clinical Score (refer below)



CLINICAL FRAILTY SCALE

1	VERY FIT	People who are robust, active, energetic and motivated. They tend to exercise regularly and are among the fittest for their age.
2	FIT	People who have **no active disease symptoms** but are less fit than category 1. Often, they exercise or are very **active occasionally**, e.g., seasonally.
3	MANAGING WELL	People whose **medical problems are well controlled**, even if occasionally symptomatic, but often are **not regularly active** beyond routine walking.
4	LIVING WITH VERY MILD FRAILTY	Previously "vulnerable," this category marks early transition from complete independence. While **not dependent** on others for daily help, often **symptoms limit activities**. A common complaint is being "slowed up" and/or being tired during the day.
5	LIVING WITH MILD FRAILTY	People who often have **more evident slowing**, and need help with **high order instrumental activities of daily living** (finances, transportation, heavy housework). Typically, mild frailty progressively impairs shopping and walking outside alone, meal preparation, medications and begins to restrict light housework.
6	LIVING WITH MODERATE FRAILTY	People who need help with **all outside activities** and with **keeping house**. Inside, they often have problems with stairs and need **help with bathing** and might need minimal assistance (cuing, standby) with dressing.
7	LIVING WITH SEVERE FRAILTY	**Completely dependent for personal care**, from whatever cause (physical or cognitive). Even so, they seem stable and not at high risk of dying (within ~6 months).
8	LIVING WITH VERY SEVERE FRAILTY	Completely dependent for personal care and approaching end of life. Typically, they could not recover even from a minor illness.
9	TERMINALLY ILL	Approaching the end of life. This category applies to people with a **life expectancy <6 months**, who are **not otherwise living with severe frailty.** (Many terminally ill people can still exercise until very close to death.)

SCORING FRAILTY IN PEOPLE WITH DEMENTIA

The degree of frailty generally corresponds to the degree of dementia. Common **symptoms in mild dementia** include forgetting the details of a recent event, though still remembering the event itself, repeating the same question/story and social withdrawal.

In **moderate dementia**, recent memory is very impaired, even though they seemingly can remember their past life events well. They can do personal care with prompting.

In **severe dementia**, they cannot do personal care without help.

In **very severe dementia** they are often bedfast. Many are virtually mute.

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Clinical Frailty Scale ©2005–2020 Rockwood, Version 2.0 (EN). All rights reserved. For permission: **www.geriatricmedicineresearch.ca**

Rockwood K et al. A global clinical measure of fitness and frailty in elderly people. CMAJ 2005;173:489–495.

(e) Function assessment of preoperative function (via ADLs):
   (i) MET = metabolic equivalents
      1. 1 MET = Eating, dressing, reading, watching TV
      2. 4 METs = Climbing a few flights of stairs, heavy housework as scrubbing floors
      3. 10 METs = Strenuous activity (swimming, dancing)
   (ii) Inability to function above 4 METS = Significant increase in risk of pulmonary or CV complications.

(3) **Values assessment:** Goals of care, code status, establishing a substitute decision-maker.

(4) **Treatment options:** Review the pros & cons of intervention options and lack thereof if appropriate.

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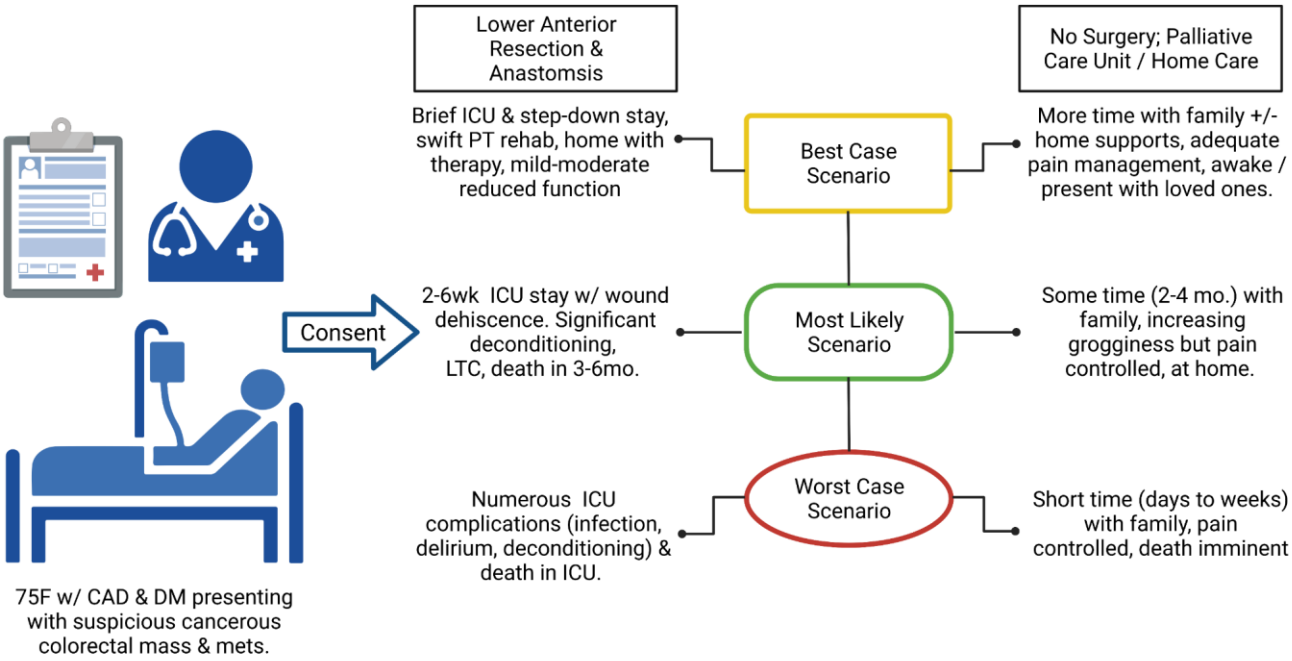
ii) **Best-Case / Worst-Case Model:** A structured method of discussing the post-operative period would look like for a specific patient based on treatment.



Example of Best/Worst Case Model with a General Surgery Case (Williams, K. BioRender (2022))

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3) General Approach to Abdominal Pain

a) <u>History:</u>

i) **O**nset, **P**osition, **Q**uality, **R**adiation, **S**everity, **T**iming, deja v**U** (has this happened before). Relation of symptoms to eating, defecation, types of food (fatty or EtOH). How has the pain changed over time if at all?

ii) **A**lleviating & **A**ggravating Factors: position, hot shower (cannabis hyperemesis).

iii) Change in bowel movements, most recent bowel movement, passing flatus.

iv) **PMHx:** Previous abdominal conditions (e.g. IBD, AAA), previous abdominal/pelvic surgeries, previous studies (CT, endoscopy, colonoscopy), medical comorbidities (epigastric pain could be an MI; CVD risk factors), STIs.

v) **Meds:** New changes and longstanding Rx's and OTCs.

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vi) **SHx:** Smoking, EtOH use, substance use (cannabis), sexual partner(s), living situation.

vii) **ROS:** B-symptoms (fever, night sweats, unintended weight loss), N/V (frequency, blood, bile), diarrhea, black/bloody stools, tolerating liquids/solids, last menstrual periods, if pregnancy (GxPx; prior complications, gestational age, ultrasound results).

b) Physical Exam:

i) **General appearance:** In distress (abdominal or respiratory).

ii) **HEENT:** Moist mucous membranes, lesions, bleeding.

iii) **CV:** Heart sounds, murmurs, peripheral pulses (or absence), pitting edema, cyanosis, clubbing.

iv) **Respiratory:** Breath sounds, wheezing/crackles, respiratory effort.

v) **Abdomen:** Bowel sounds, distention, tenderness, rebound tenderness (peritonitic sign), maximal point of pain/tenderness, +/- hernia, +/- periumbilical pulsatile mass (AAA), +/- abdominal scars, +/- ascites, +/- hemorrhoids, +/- esophageal varices.

(1) **Signs:** McBurney's point, Rovsing's sign, Murphy's sign, Cullen's / Grey Turner's sign (periumbilical / flank ecchymosis; pancreatitis).

vi) **Back:** Mildline, Paraspinal, or CVA tenderness.

vii) **GU:**

(1) External: lesions, drainage, masses, odor, testicular asymmetry/swelling.

(2) Pelvic exam (if R or LUQ pain): cervical lesions/inflammation, bleeding, discharge, foreign body, cervical motion/adnexal tenderness.

(3) Tests: Epididymal tenderness, cremasteric reflex.

viii) **Skin:** New rashes or changes (jaundice, ecchymosis, spider nevi, caput medusa).

ix) **Neuro:** Asterixis (hepatic encephalopathy).

c) Investigations:

i) **Vital Signs:** If they look toxic (i.e. "unwell") order vitals more frequently (q4-12h).

ii) **Blood work:** CBC, lytes, Creatinine, Glucose, lipase (pancreatitis), lactate (ischemia or sepsis), CRP/ESR (IBD), FIT occult bleeding.

(1) bHCG if a uterus is present.

iii) **Cardiac:** EKG & Trop x2 to rule out ACS.

iv) **Cultures:** Gonorrhea/chlamydia, stool (if diarrhea), urine, blood x2 (if toxic)

v) **Imaging:** Endoscopy/colonoscopy (bleeding or obstruction), U/S (appendicitis, gallstones/biliary tree obstruction/inflammation, ovarian/testicular torsion, ectopic pregnancy, liver lesions), Upright CXR (obstruction), CT (obstruction, pneumoperitoneum, perforation, bleeding).

vi) **Pelvic Exam**: in any individual with a uterus of reproductive who have been sexually active.

vii) **Testicular Exam:** in all males with lower abdominal pain (pain referred).

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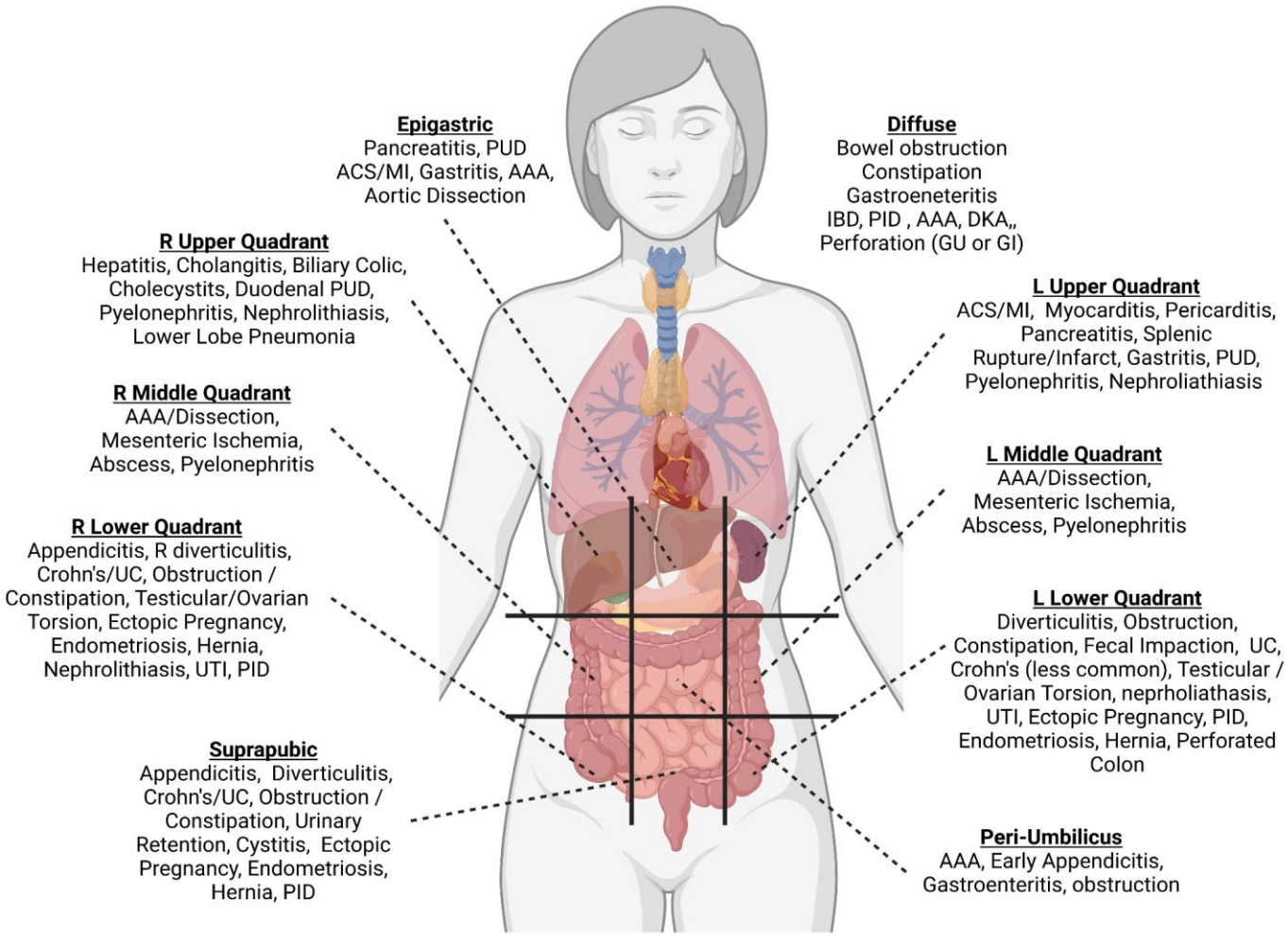
d) Clinical Pearls:
   i) Opioids in the setting of obstruction will help acutely but will worsen underlying condition, use non-opioids analgesia (acetaminophen, etc.).
   ii) Blood Supply
      (1) Above umbilicus - Celiac truck (liver, gallbladder, pancreas, stomach, proximal duodenum).
      (2) Periumbilical - SMA (small bowel, colon, testicles).
      (3) Below umbilicus - IMA (colon).



Anatomical Approach to Abdominal Pain (Williams, K. BioRender (2022))

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4) Approach to Common Upper GI & General Surgery Complaints

a) Emergent

i) **Upper GI Bleed**

(1) Definition: Bleeding proximal to the ligament of Treitz (junction between duodenum and jejunum).

(2) Anatomical Sources:

(a) Esophagus – varices, Mallory-Weiss tear, esophagitis, cancer

(b) Stomach – ulcer, gastritis, Dieulafoy's lesion, cancer

(c) Duodenum – ulcer, cancer

(3) Presentation: Hematemesis, melena, BRBPR if very brisk.

(4) Key History: Bleeding (hematemesis (Thoracic) vs coffee grounds (GI); Hx of melena; # episodes and volume), previous GI bleed, liver disease/EtOH, protracted vomiting, GERD/epigastric pain, NSAID and anticoagulant use, previous surgeries or instrumentation (e.g. gastroscopy).

(5) Physical: DRE and NG tube output.

(6) Investigations: CBC, INR/PTT, lytes incl. calcium, group & screen, gastroscopy/CT angiography, more rarely tagged RBC.

(7) Management: ABCs, 2 large-bore IVs, NPO, NG tube insertion, IV proton-pump inhibitors, consent and order transfusion if required, CBC q4hr, plan for urgent gastroscopy +/- colonoscopy. Emergent OR if hemodynamically unstable.

ii) **Esophageal Perforation**

(1) Etiology: Iatrogenic (most common; endoscope, intubation, operative); barogenic (trauma, forceful vomiting (Boerhaave's)), ingestion injury (foreign body/substance), carcinoma.

(2) Presentation: Neck/chest trauma, fever, tachycardic, hypotensive, dyspnea +/- respiratory distress. Palpable subcut. emphysema, pneumothorax, pleural effusion, and hematemesis.

(3) Investigations: CXR (pneumothorax, pneumomediastinum, subcut. emphysema, etc.), CT w/ C+, Gastrografin study (first choice if stable).

(4) Management: Supportive if contained (in mediastinum, no sepsis), NPO, Abx, IV fluids, percutaneous drainage of collections/abscess, TPN; <24 since perforation = primary closure, >24 since perforation = diversion + exclusion w/ delayed reconstruction.

(5) Complications: Sepsis, abscesses, fistula, empyema, death.

b) Elective

i) **Bariatric Surgery**

(1) Definition: A multidisciplinary team treating morbid obesity.

(2) Criteria:

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(a) BMI >40 or BMI >35 with obesity-related health problem (e.g. HTN, OSA, T2DM).
(b) Previous weight loss attempts.
(c) Psychologically and medically fit (multidisciplinary approach).
(d) Non-smoker, no substance misuse.

(3) Management: Roux-en-Y gastric bypass (RYGB), sleeve gastrectomy
(a) The mechanism by which gastric bypass causes weight loss includes restrictive and malabsorptive components.

(4) Late Complications of RYGB: marginal ulcer, internal hernia, vitamin/mineral deficiencies.

ii) **Breast Cancer (Carcinoma)**

(1) Epidemiology: 1/8 women will be diagnosed, 2nd leading cause of cancer mortality in women.

(2) Risk factors:
(a) Major: Female sex, >50y, personal/family history of cancer (breast/ovarian/prostate) or BRCA1/2, history of hyperplasia (atypical ductal/lobal hyperplasia), chest radiation.
(b) Minor: Nulliparity, >30y @ 1st pregnancy, menarche @ <12y, menopause @ >55y, HRT for >5y, ↑BMI, EtOH misuse.

(3) Presentation:
(a) Worrisome signs: Usually solitary/unilateral, non-tender variable size w/ irregular shape/borders, firm/hard, may be matted/fixed to underlying tissue.

(4) Investigations
(a) Imaging: Mammography, U/S. MRI and staging studies (CT, bone scan) in advanced disease only.
(b) Pathology: Core biopsy.

(5) Treatment: Complex based on staging and pathology. Can include breast conservation surgery/lumpectomy (BCS), mastectomy, sentinel lymph node biopsy (SLNB), axillary dissection, chemotherapy, hormone therapy, and radiotherapy. BCS + radiation is equivalent to mastectomy for survival.

(6) Screening:
(a) Average risk: Start at 50-74 (no Hx of Ca, no implants): Mammogram q2y.
(b) High risk (history of breast cancer, BRCA+, 1st-degree relative with BRCA, radiation to thoracic cancer (Hodgkin's lymphoma): Start at 30y; Mammogram + MRI annually.

iii) **Benign Breast Disease**

(1) Etiology: Fibroadenoma or fibrocystic lesions.

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(2) Common Features: Breast pain I, focal areas of nodularity or cysts often in the upper outer quadrant, frequently bilateral, mobile, varies with menstrual cycle, non-bloody nipple discharge.
(3) DDx Benign breast mass: Fibrocystic changes, fibroadenoma, abscess, lipoma, papilloma, many others.
(4) Management: reassurance, surveillance, imaging (mammogram/U/S), biopsy.

iv) **Melanoma**
(1) Yes, general surgeons do manage Melanoma hand-in-hand with Dermatologists.
(2) Epidemiology: Fair skinned and extensive sun exposure. Usually originates from benign pigmented lesions.
(3) History: Family Hx of skin cancers, sun protection (SPF 50), sun exposure, fair skin, indoor tanning, multiple dysplastic nevi.
(4) Presentation: (ABCDE) asymmetry, irregular borders, different colours, diameter > 0.5 cm, evolving.
(5) Treatment: Depend on depth (Breslow's depth is greatest indicator of prognosis)
(a) <1mmm: Require only local excision.
(b) >1mm: Require wide margins (2cm) and attention to lymph nodes (sentinel lymph node biopsy and/or remove as needed).

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5) Approach to Common Lower GI Complaints

a) Emergent - Acute Abdomen

i) **Bowel Obstruction (Small & Large Bowl)**
(1) Definition: Obstruction resulting in the build-up of fluid and gas proximally with decompression of bowel distally; increases in intraluminal and intramural pressure may result in impaired perfusion leading to intestinal ischemia.
(a) Functional - Gastroparesis (stomach), ileus (small bowel), & ogilvie (large bowel).
(i) Causes: Surgery, electrolyte issues (hypoKalemia), prolonged immobilization, medication (opioids, anesthetics, antipsychotics), psychiatric disorders (anorexia nervosa).
(b) Mechanical

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(i) Small Bowel Obstruction (SBO) Causes:
1. Intraluminal: Intussusception (overlap of bowel segments), gallstones, bezoars, foreign bodies.
2. Intramural (bowel wall): Crohn's IBD, radiation stricture, neoplasm.
3. Extramural: Adhesions from previous surgery (75% of SBO), incarcerated hernia, peritoneal carcinomatosis.

(ii) Large Bowel Obstruction (LBO) Causes:
1. Intraluminal: Constipation, foreign body
2. Intramural: Neoplasm (Adenocarinoma), diverticulitis (stricture), IBD or radiation stricture.
3. Extramural: Volvulus, adhesions, hernias.

(2) Classification:
(a) Partial Obstruction: Lumen partially occluded allowing some passage of fluid and gas.
(b) Complete Obstruction: Lumen fully occluded, preventing passage of any fluid or gas.
(c) Closed-loop Obstruction: Segment of small intestine is obstructed proximally and distally creating a loop of bowl from which fluid and gas cannot escape resulting in high risk of perforation.
(d) Causes of Obstructions: Adhesions (most common), hernias, cancers, strictures, volvulus.

(3) Risk Factors: Prior abdo/pelvic surgery, abdo/groin hernia, Hx of malignancy, prior radiation, IBD.

(4) Presentation: Colicky abdominal pain, nausea/vomiting (bilious if SBO), obstipation.

(5) Key Hx: Any previous abdominal surgeries, hernias, family or personal history of colorectal cancer, history of IBD, last BM, last flatus, most recent colonoscopy.

(6) Physical: Vitals (abnormal vital signs increase suspicion of strangulation/ischemia), abdominal distension, tenderness (focal vs diffuse), peritonitis.

(7) Investigations: CBC, lytes, lactate.
(a) Imaging:
(i) AXR: Distension of small bowel > 3cm, decompressed distal loops, paucity of air in the colon, air fluid levels.
(ii) CXR: Best (most rapid) initial imaging to r/o pneumoperitoneum
(iii) CT: Further characterizes BO, identifies transition zone, and evaluates for signs of ischemia +/- perforation.
1. Ischemic CT signs: Decreased bowel wall enhancement, mural thickening, pneumatosis, mesenteric edema/congestion/hemorrhage, free fluid, portal venous gas.

(8) Management: IV fluids, NPO, NG tube insertion (decompression), frequent re-examination.

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(a) Surgery if: 1) No resolution in 24h if complete obstruction, 2) no resolution in 48-72h if partial obstruction; 3) emergent if ischemic bowel, pneumoperitoneum, and/or peritonitis develops (lower threshold for surgery in case of bowel obstruction in “virgin” abdomen, i.e. no prior surgery).

ii) **Ischemic Bowel**

(1) Etiology:
   (a) Acute: Arterial-occlusive mesenteric ischemia (thrombosis, embolism extrinsic compression (e.g. strangulated hernia); non-occlusive ischemia (systemic hypoperfusion to preserve supply to vital organs (heart/brain); venous thrombosis (hypercoagulable state (r/o cancer), or DVT).
   (b) Chronic: atherosclerotic disease
(2) Pathophysiology: Common site - “watershed” areas (splenic flexure, left colon, sigmoid colon).
(3) Risk Factors: CVD, DLD, HTN, DVT, cancer, hernia.
(4) Presentation:
   (a) Acute: severe abdominal pain out of proportion to physical findings, vomiting, bloody diarrhea, bloating, hypotension, shock/sepsis.
   (b) Chronic: postprandial pain (mesenteric angina), fear of eating, weight loss.
(5) Investigation: CBC, lactate, CK, amylase, Liver enzymes (ALT, AST, ALP); CT (thickened bowel wall, luminal dilatation, SMA/SMV thrombus, venous gas; CT angiography (gold standard in acute ischemia).
(6) Management: IV Fluids, correct metabolic acidosis, analgesia, NPO, NG tube decompression, broad spectrum Abx, exploratory laparotomy/scopy (assess viability +/- resection of necrosis), embolectomy/thrombectomy, anticoagulation therapy, percutaneous transluminal angioplasty +/- stent.
(7) Clinical Pearls: Acute abdomen (peritonitic features) + metabolic acidosis is ischemic bowel until proven otherwise.

iii) **Lower GI bleed**

(1) Definition: Bleeding distal to the ligament of Treitz.
(2) Causes:
   (a) Small bowel – Angiodysplasia, aortoenteric fistula (ask about history of abdominal aortic aneurysm repair.
   (b) Colon – Diverticulosis, colitis (infectious, ischemic, inflammatory), angiodysplasia/arteriovenous malformations, cancer.
   (c) Anorectal – Hemorrhoids, anal fissure, rectal varices from cirrhosis, cancer.
(3) Presentation: May present with shock, hematochezia, melena, anemia.
(4) History:
   (a) Characterize bleed (blood on tissue vs blood in toilet; dark stools vs bright red blood in stool vs bright red blood par rectum (BRBPR);

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blood with bowel movement vs spontaneous bleeding; # episodes and volume).
(b) Pain vs. no pain
(c) Previous abdominal surgeries
(d) Personal or Family Hx of Colon Cancer and/or IBD
(e) Findings of most recent colonoscopy

(5) Physical: DRE and abdominal tenderness particularly important to differential.
(6) Investigations: CBC (trend Hb), MCV, Retics INR/PTT, lytes incl. calcium, group & screen, colonoscopy vs CT angiography site dependent.
(7) Management: ABCs, 2 large bore IV, NPO, (call for blood/ consent for transfusion if clinically indicated), CBC q4hr, plan for colonoscopy.
(8) Clinical Pearls: With any GI bleed, particularly with BRBPR needs to have Cancer ruled out through endoscopy/colonoscopy +/- molecular testing (CEA, etc.).

iv) **Cholelithiasis (Biliary Colic)**

(1) Definition: Intermittent blockage of gallbladder's bile duct by stones/sludge.
(2) Pathogenesis: Imbalance of cholesterol & solubilizing agents (bile salts).
(3) Risk Factors:
(a) Cholesterol-rich stones: 4Fs, Fat, Female, Fertile (multiparity, OCPs), Forties
(i) Others: Crohn's disease, impaired gallbladder emptying (starvation, TPN, DM), rapid weight loss.
(b) Pigment stones (calcium bilirubinate): Cirrhosis, chronic hemolysis, biliary stasis (strictures, dilation, infection).
(4) Protective factors: Statins (control lipids), vitamin C, coffee, exercise.
(5) Presentation: Majority are asymptomatic (incidental finding) or biliary colic (10-25%; intermittent pain (min to <6h), worse with fatty meal, radiates to R Shoulder tip, scapular pain), N/V, non-peritonitic. (+)ve Murphy's sign.
(a) Later stages: Dark urine (elevated conjugated bilirubin), clay stools, pruritus, scleral icterus.
(6) Investigations: CBC, LFTs (assess obstructive picture, elevated Bilirubin & ALP), lipase (r/o pancreatitis), U/S (gold-standard) with signs of inflammation, obstructions & localization of stones, ERCP.
(7) Management: If asymptomatic, do nothing. If symptomatic, IV fluids, analgesia (hydromorphone) & elective laparoscopic cholecystectomy.
(8) Clinical Pearls:
(a) Jaundice: Increased bilirubin production (pre-hepatic: hemolysis / hematoma), conversion (intra-hepatic: acute or chronic hepatitis

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(EtOH/Viral/Decompensated), or reduced excretion (post-hepatic: obstruction (gallstones, pancreatic CA, stricture):

(i) Increased bilirubin production: ↑ unconjugated bilirubin only
(ii) Conversion: ↑ unconjugated bilirubin & LFTs
1. Viral Hep.: AST / ALT 1000s; EtOH Hep. AST:ALT > 1,5
(iii) Obstruction: ↑ conjugated bilirubin & LFTs, ALPs, Pancreatic Enzymes

(b) Malignant vs Inflammatory
(i) Malignant: Jaundice w/ palpable, non-tender gallbladder/mass, w/o U/S stones. MRCP → ERCP (diagnostic: Biopsy); CT to stage.
(ii) Inflammatory: Jaundice w/ +/- palpable, tender gallbladder w/ U/S stones.

(c) Gallbladder polyps: The vast majority are benign (60-90%), q1y U/S to monitor if asymptomatic (low malignancy risk). If symptomatic or polyps ≥1cm or increasing by >50%/year, elective cholecystectomy.

v) **Acute Cholecystitis**

(1) Definition: Inflammation of gallbladder from bile stasis typically due to impacted gallstone, but acalculous in 5-10%. Biliary colic, in contrast, is not associated with inflammation/prolonged impaction of a gallstone.
(2) Presentation: Constant +/- progressing RUQ or epigastric pain (>6h), anorexia, nausea/vomiting, low grade fever (<38.5C). Acalculous typically in critically ill patients and is thought to be from shock-induced ischemia to the gallbladder.
(3) History: Prior Hx of biliary colic (pattern of post-prandial onset, lasting < 6 hours, +/- nausea/vomiting).
(4) Physical: Murphy's sign, palpable gallbladder in up to 1/3 of patients. R subscapular pain.
(5) Investigations: CBC, WBC (↑ & L shift), LFTs, fractionated bilirubin, U/S (98% sensitive).
(6) Findings of acute cholecystitis on U/S:
(a) Calculi in the gallbladder.
(b) Anterior gallbladder wall thickening > 3-4 mm.
(c) Pericholecystic fluid.
(d) Gallbladder distension.
(e) Hypervascularization of the gallbladder wall on Doppler.
(f) Positive sonographic Murphy's sign.
(7) Management: IV fluids, NPO, NGT analgesia, antibiotics (Cefazolin IV +/- Metronidazole);
(a) Admission for: ERCP (diagnostic + therapeutic) if CBD stones present on U/S or MRCP +/- ERCP if CBD dilated but no U/S stones.
(b) Laparoscopic cholecystectomy (Standard of Care) or open if septic.
(8) Clinical Pearls:

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(a) WBC L shift: ↑neutrophil consumption = more bands & blasts on CBC.

vi) **Choledocholithiasis**

(1) Definition: Stones in Common Bile Duct (CBD).
(2) Risk Factors: CBD stone on U/S, CBD dilation, Bilirubin >68, >55y.
(3) Presentation: Most are asymptomatic (50%), Hx of biliary colic, RUQ/Epigastric tenderness, +/- jaundice, +/- dark urine. Afebrile.
(4) Investigations: CBC, LFTs (↑AST, ALT, ALP, Tbilli), Amylase/Lipase (r/o pancreatitis.
(5) Imaging: U/S - Intra-/extra-hepatic duct dilatation; MRCP (90% sensitive; non-invasive diagnostic test).
(6) Management: ERCP (diagnostic & therapeutic (removal of stones & sphincterotomy), and elective cholecystectomy.

vii) **Ascending Cholangitis**

(1) Definition: Obstruction of common bile duct (CBD) (choledocholithiasis 60%, stricture, mass) leading to biliary stasis, bacterial overgrowth, and biliary sepsis; KEEPS bacteria most common.
(2) Presentation:
    (a) Charcot's Triad: Fever, RUQ pain, jaundice (full triad present in 70% of cases).
    (b) Reynaud's pentad: Fever, RUQ pain, jaundice, hypotension, confusion (altered LOC).
    (c) +/- Nausea and vomiting.
(3) History:
    (a) Acholic stools (no bile), tea coloured urine
    (b) Hx of gallstones, biliary colic
    (c) Hx of ulcerative colitis/primary sclerosing cholangitis (PSC)
    (d) Systemic symptoms (fever, chills, sweats)
(4) Investigations: CBC (↑ leukocytosis, L shift), blood cultures, LFTs (↑ALP, GGT, Bilirubin differential).
    (a) R/O Pancreatitis w/ Lipase.
(5) Imaging: U/S (best first test - CBD dilatation)' CT (CBD dilatation & localization of biliary stenosis; MRCP if diagnosis is unclear.
(6) Management: Early IV fluid resuscitation and broad-spectrum antibiotics, NPO, +/- NG tube; some patients may require ICU admission. Admit and plan for ERCP + sphincterotomy (treatment of choice); Percutaneous trans-hepatic cholangiogram (PTC) and drain if ERCP unavailable. Plan for cholecystectomy + T-tube drainage if previous fails. Elective Cholecystectomy if not done on admission.
(7) Clinical Pearls:

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(a) KEEPS bacteria: Klebsiella, enterococcus, E. Coli, Enterobacter, Proteus/Pseudomonas, Serratia.

viii) **Acute Pancreatitis**

(1) Definition: Obstruction of pancreatic duct by gallstones & sludge +/- infection.
(2) Etiology: Gallstones (45%), EtOH (35%)
(3) Complications: Autodigestion of pancreas (abscess/necrosis), Insulin-dependent DM, ARDS/Sepsis, splenic/mesenteric/ portal vessel thrombosis, severe hypocalcemia.
(4) Presentation: Tachycardic, tachypneic, hypotension, epigastric pain radiating to back. N/V, ileus, peritoneal signs, jaundice, fever.
    (a) Signs: Inglefinger's (pain worse supine, improved seated), Cullen's (periumbilical) & Grey Turner's (Flank) ecchymosis.
    (b) Prognosis: Ranson's/APACHE II Score
(5) History: Pain relieved with sitting forward (Ingelfinger's sign), history of gallstones or biliary colic, EtOH use, recent surgery or biliary. instrumentation (ERCP/MRCP), recent trauma.
(6) Investigations: CBC, lytes, LFT (↑ ALT (>150), AST = gallstone pancreatitis), lipase.
(7) Imaging: U/S findings of stones +/- edematous pancreas; C/AXR/CT if complications occur (gas in pseudocyst).
(8) Management: NPO, IV fluids, +/- NGT, analgesia, early TPN, only Abx if infections on imaging.
    (a) Usually no surgical management of uncomplicated, most stones often pass spontaneously (~90).
    (b) Initiate CIWA to prevent EtOH withdrawal.
    (c) ECRP/sphincterotomy if CBD stone is impacted or +cholangitis signs
    (d) All pts offered cholecystectomy during the same admission due to risk of recurrence (25-60%).
    (e) If necrotic pancreatitis - drain + I&D.
(9) Clinical Pearl:
    (a) Chronic pancreatitis is generally medically managed unless they fail medical management (++epigastric pain to back; CBD obstruction, fistula, etc.).

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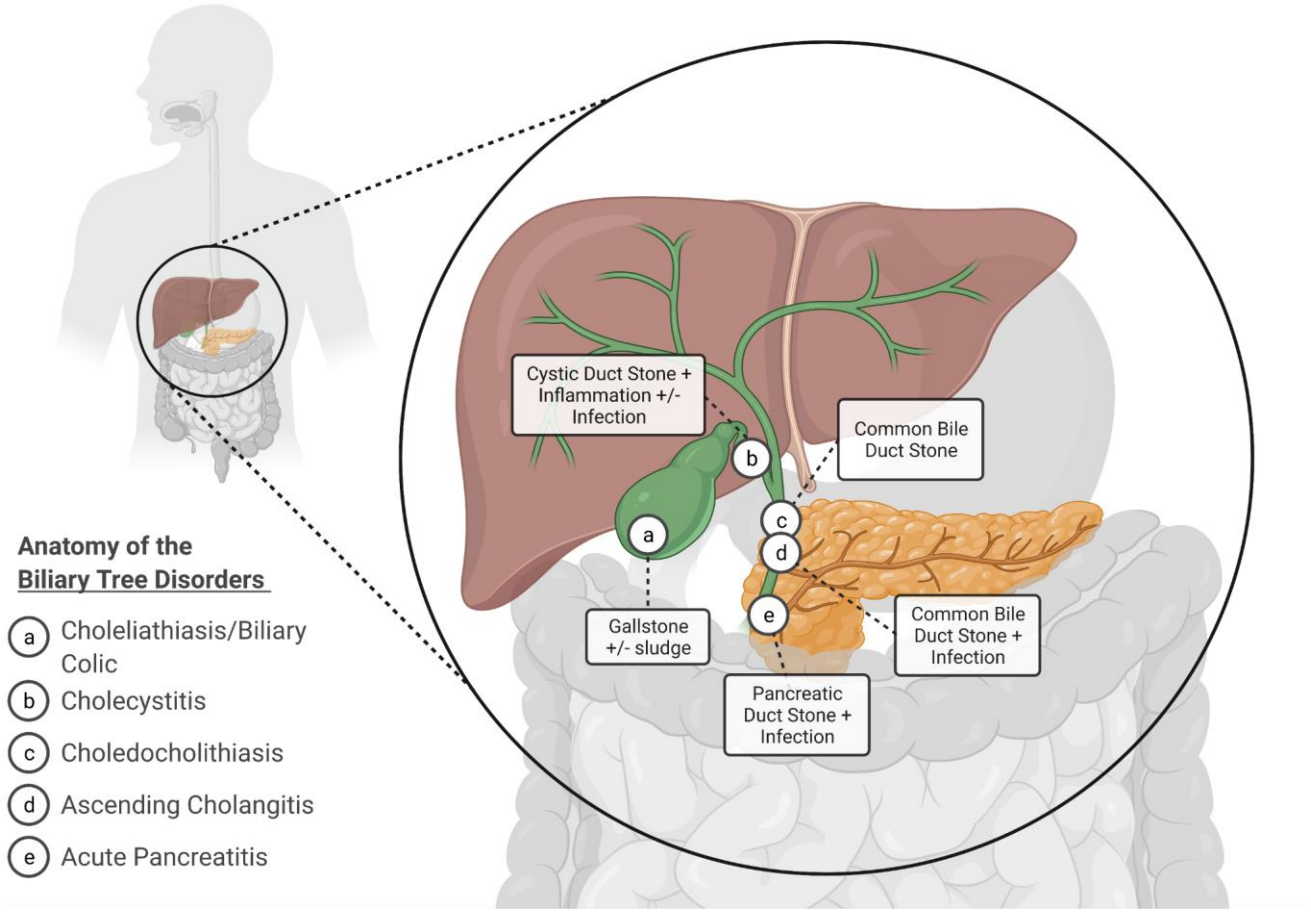

Anatomy of Biliary Tree Disorders (Williams K., BioRender (2022))

ix) **Appendicitis**

(1) Definition: Appendiceal infection thought to be caused by luminal obstruction.

(2) Causes: Lymphatic hyperplasia in kids; fecaliths, neoplasms, or unknown in adults.

(3) Presentation: Nausea/vomiting, anorexia, migratory pain to RLQ, fever

(4) History: Progression of symptoms - typically initially a constant, dull periumbilical pain, then localized pain over McBurney's point with anorexia & nausea/vomiting. Progression from visceral to parietal irritation.

(5) Signs: Tenderness at McBurney's point, Rovsing's sign, psoas sign, obturator sign.

(6) Investigations: CBC, urinalysis, beta hCG, urine analysis, U/S, CT if concern for complicated appendicitis or when U/S not feasible / inconclusive, consider U/S or MRI in pregnancy, consider colonoscopy to rule out malignancy.

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(a) Findings on U/S: Wall dilation >6-7mm, hyperemia, echogenic periappendiceal fat, periappendiceal fluid, non-compressible appendix, fecalith.

(7) Management: IV fluids, NPO, analgesia
   (a) If uncomplicated (no perforation or abscess): initial trial of antibiotics (metronidazole + ciprofloxacin).
   (b) If complicated: admit for surgery with pre-op antibiotics (cefazolin + metronidazole). IR drainage for abscesses.

(8) Clinical pearl: Antibiotics are stopped postoperatively if the appendix was not perforated. A fixed course of 4 days of antibiotics (often Amoxicillin-Clavulanate 875/125 PO BID) is otherwise generally appropriate.

x) **Diverticulitis**

(1) Definition: Inflammation of a diverticula leading to focal necrosis which may result in local perforation; 95% left sided in Western nations.

(2) Cause: erosion of wall secondary to increased intraluminal pressure or inspissated food particles.

(3) Presentation: LLQ pain, changes in bowel habits, nausea/vomiting, fever.

(4) History: age, previous colonoscopy.

(5) Physical: presence of peritonitis key to management, focal vs diffuse.

(6) Investigations: CBC, upright CXR for free air, CT (signs include presence of diverticula, fat stranding, colonic wall thickening, abscess, fistula, extraluminal air).

(7) Management: usually non-operative antibiotics, IV fluids, and analgesia in the absence of generalized peritonitis, free perforation on imaging, or failure of medical management. Patients with abscesses need follow-up colonoscopy to rule out malignancy.

xi) **Mesenteric Ischemia**

(1) Definition: Acute ischemia of bowel secondary to reduced blood flow through mesenteric vasculature.

(2) Causes:
   (a) Arterial-occlusive mesenteric ischemia: thrombus, embolus, extrinsic compression.
   (b) Non-occlusive mesenteric ischemia: vasoconstriction secondary to hypoperfusion.
   (c) Mesenteric venous thrombosis.

(3) Presentation: Deranged vital signs, sudden onset, severe abdominal pain out of proportion to exam, blood per rectum, +/- nausea/vomiting.

(4) History: Elicit history of predisposing conditions i.e. atrial fibrillation, peripheral vascular disease, atherosclerosis, DVT/PEs.

(5) Physical: Pain out of proportion to exam, peritoneal signs late in course.

(6) Investigations: CBC, lactate, CTA

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(a) CT findings consistent with ischemia: Decreased bowel wall enhancement, mural thickening, pneumatosis, mesenteric edema/ congestion/hemorrhage, free fluid, portal venous gas.

(7) Management: IV fluid resuscitation, NPO, +/- NG tube, prophylactic antibiotics, plan for exploratory laparoscopy/laparotomy or endovascular procedure (i.e. thrombectomy, stenting), consideration of prompt anticoagulation.

xii) **Perforated Viscus**

(1) Definition: perforation within the gastrointestinal tract resulting in peritonitis and gross spillage of intestinal contents.

(2) Causes:

(a) Esophagus: Boerhaave's syndrome, foreign body.

(b) Stomach/Duodenum: Peptic ulcers.

(c) Small bowel: Closed loop bowel obstruction, mesenteric ischemia.

(d) Colon: Appendicitis, diverticulitis, colitis, iatrogenic (e.g. colonoscopy)

(3) Presentation: Hemodynamic derangements (shock), severe abdominal pain, +/- nausea/ vomiting.

(4) History: Goal of identifying the underlying cause (surgical history, NSAID use, Hx of ulcers, history in keeping with SBO/appendicitis/diverticulitis, travel history, Hx of IBD, recent instrumentation).

(5) Physical: Vitals (may be septic - hypotensive & tachycardic, +/- fever) and ++ abdominal peritonitis.

(6) Investigations: CBC, lytes, lactate, blood cultures, upright CXR, CT uncommonly ordered by general surgery given management is surgical regardless and patients are typically unstable.

(7) Management: IV fluids, NG tube, broad spectrum antibiotics, NPO, volume resuscitation and correction of electrolyte derangements prior to surgery; operative management.

b) Elective

i) The elective categorization is variable depending on the patient's medical status, i.e. if hemodynamically stable or not.

ii) **Hernias**

(1) Types:

(a) Hiatal: Stomach protrudes up through diaphragm into thoracic cavity (typically reducible);

(i) Epidemiology: Most common in >50y.

(ii) Risk Factors: Age, increased abdominal pressure (obesity, pregnancy, coughing, & heavy lifting); smoking.

(iii) Presentation: Asymptomatic, GERD, +gas (eructation), cough, regurgitation, dysphagia.

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(iv) Complications: Esophagitis, peptic stricture, esophageal cancer (Barrett's or carcinoma), aspiration pneumonitis/pneumonia.
(v) Investigations: barium study, endoscopy +/- biopsy, 24h pH monitoring (GERD).
(vi) Management: Lifestyle (↓smoking/EtOH/coffee, weight loss, smaller meals), pharmaceutical (PPI, H2-antagonist, prokinetic), surgical (only if failure of medical management; laparoscopic repair & fundoplication (90% success in improving GERD).

(b) Abdominal or Ventral: defect in abdominal wall leading to protrusion of intra-abdominal contents.
(i) Epidemiology: More common in men (9:1), umbilical hernias (2-5y) typically resolve and do not require surgery.
(ii) Risk Factors: obesity, cough, pregnancy, constipation, ascites, heavy lifting, congenital abdominal abnormalities, previous hernia repair.
(iii) Presentation: Mass of variable size +/- tenderness, relieved when supine or hernia reduction, abdominal fullness, N/V, constipation, palpable impulse with coughing or straining.
(iv) Investigations: Physical w/ reducibility assessment (+analgesia), U/S +/- CT (if hernia is large, obturator, internal abdominal, femoral or patient is obese).
(v) Classification:
1. Internal: hertiation into or involving intra-abdominal structure(s).
2. External: herniation through abdominal wall.
3. Complete: hernia sac + contents protrude via defect
4. Incomplete: partial protrusion.
5. Incarcerated (Urgent!): irreducible but not vascularly compromised.
6. Strangulated (Emergent!): vascular supply compromised, risk of ischemic necrosis & perforation.
(vi) Management: Surgical repair (herniorrhaphy) ONLY to prevent strangulation or evisceration or if symptomatic (incarcerated or strangulated); if asymptomatic, surgery can be delayed.
1. Repairs are now tension free techniques (not mesh) due to risk of infection.
2. Recurrence is common (15-20%); ↑risk if elderly, Hx of recurrent hernias, smoker, obese, T2DM, DLD.

(c) Inguinal:
(i) Anatomy: Indirect (⅔; passes through deep inguinal ring); Direct (⅓; through Hesselbach's triangle); Femoral (3%, into femoral canal; below inguinal ligament).
1. Risk of strangulation: femoral >> indirect > direct

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(ii) Management: Same as Abdominal Hernias, though all require surgical repair.

iii) **Pancreatic cancer**

(1) Epidemiology: M:F 1.3:1; average age 50-70
(2) Presentation: Painless jaundice, palpable gallbladder, weight loss
(3) Risk factors: Smoking (most established modifiable risk factor), alcohol, age, DM, chronic pancreatitis
(4) Types: Pancreatic adenocarcinoma (most common), intraductal papillary mucinous neoplasm (IPMN), others. NOTE: cholangiocarcinoma (bile duct cancer) is often indistinguishable on imaging.
(5) Management:
    (a) Whipple procedure (pancreaticoduodenectomy): removal of duodenum, proximal pancreas, gallbladder, common bile duct, and distal stomach. Bile duct, pancreas, and stomach are each respectively anastomosed with jejunum.
    (b) Adjuvant chemotherapy is standard of care.
    (c) Neoadjuvant chemotherapy if the tumor is close to vital structures.
    (d) Chemotherapy/radiation if tumor is unresectable (e.g. distant mets, involvement of SMA/SMV).

iv) **Colorectal Cancer (CRC)**

(1) Epidemiology: 4th most common cancer, 2nd highest cancer mortality, 7% lifetime risk in Canadian population
(2) Risk factors: Age, genetic (FAP, HNPCC), ulcerative colitis, diet, smoking
(3) Presentation: Often asymptomatic, occult bleeding +/- anemia, abdominal pain, weight loss, bowel changes, symptoms of distant metastases
(4) Investigations: Colonoscopy (gold standard), FIT occult blood tests, CT colonography, staging CT C/A/P, CEA biomarker
(5) Key History: Past or family history of CRC or Lynch Syndrome (HNPCC), last colonoscopy timing & result.
(6) Treatment:
    (a) Colon: curative resection with wide margins based on blood supply and lymphatics (e.g. right/left hemicolectomy), adjuvant chemotherapy in stage III and some stage II, palliative chemotherapy/radiation/surgery for hemorrhage/obstruction.
    (b) Rectum: curative resection, options include local excision (rare), low anterior resection (LAR) if adequate distal margin to spare sphincter, abdominoperineal resection (APR) if inadequate distal margin. Neoadjuvant chemoradiotherapy for locally advanced rectal cancers (not colon).
(7) Screening:

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(a) Average risk (no 1st-degree relative with CRC): start at 50 with FIT q2y w/ abnormal result leading to a colonoscopy w/I 8 weeks; a flex sig every 10 years until 74.
(b) High risk (with 1st-degree relative w/ CRC): Start colonoscopy 10 years before their relative's diagnosis or at 50y.
(i) q5y if relative was diagnosed <60y
(ii) q10y if relative was diagnosed >60y

v) **Benign Perianal Disease**
(1) Pathophysiology: Secondary to thrombosed external hemorrhoid, anal fissure, and perianal abscess
(2) Types:
(a) Anal fissure: painful tear below dentate line, blood streaks on stool, classically has fear to pass gas due to pain
(i) Pathophysiology: High resting anal tone that causes local ischemia and prevents healing of acute tear, usually caused by constipation
(ii) Management: soften stool, topical calcium channel blockers, less commonly botulinum toxin or sphincterotomy.
(b) Anorectal abscess: arise from blocked anal glands, classified by anatomical relationship to the sphincter muscles
(i) Management: incision and drainage, healing by secondary intention.
(c) Anal Fistula: abnormal communication between epithelialized surfaces of rectum and perianal skin, usually originating from an abscess that has been drained
(i) Management: examination under anesthesia with seton placement or fistulotomy.
(d) Rectal prolapse: protrusion of rectal mucosa through external sphincter.
(i) Management: conservative (stool softening, manual reduction) and surgery (various approaches).

vi) **Hemorrhoids**
(1) Pathogenesis: Three venous cushions that line the anal canal — the left lateral, right anterior, and right posterior positions.
(2) Classification:
(a) Internal hemorrhoids
(i) Location: above the dentate line.
(ii) Presentation: painless bleeding, prolapse.
(iii) Subclassification:
1. Class I = no prolapse

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2. Class II = prolapse with spontaneous reduction
3. Class III = prolapse requiring manual reduction
4. Class IV = permanent prolapse

(b) External hemorrhoids:
(i) Location: located below the dentate line.
(ii) Presentation: itching, pain, bleeding, prolapse, thrombosis.

(3) Investigations: Physical exam, anoscopy, colonoscopy to rule out proximal lesion if bleeding presentation.

(4) Management: Diet high in soluble fiber (Metamucil) and water, steroid cream, Sitz bath, band ligation, hemorrhoidectomy.

(5) Clinical Pearl: Hemorrhoids is a Dx of exclusion, Colorectal Cancer must be ruled out if a patient presents with Bright Red Blood Par Rectum (BRBPR).

vii) **Inflammatory Bowel Disease**

(1) Definition: SB and LB damage secondary to sustained immune activation due to down-regulation of immune responsiveness after an infection associated with 200+ gene loci (CARD15/NOD2).

(2) Types:

(a) Crohn's Disease
(i) Risk Factors: Ethnicity (Caucasian, Ashkenazi jew), smoking.
(ii) Pathology: Segmental inflammation of any part of GI (gum-to-bum), most commonly ileum + R colon. Recurrence common post-surgery.
(iii) Presentation: Younger patient, rarely w/ rectal bleeding, large volume non-bloody, watery diarrhea w/ post-prandial/colicky pain, fever, palpable RLQ mass, and weight loss.
(iv) Complications: Strictures, fistulae, perianal disease, colon cancer (>30% if colon involved).
(v) Investigations: Colonoscopy & biopsy, CT, ↑CRP, cultures (O&P, C. diff, bacterial cultures).
(vi) Management: Lifestyle (smoking cessation), diet (fluids only during exacerbation), anti-diarrheals (loperamide), antibiotics, steroids, immunosuppressives (6-mercaptopurine, azathiprine), biologics, surgery for complications (fistulae, obstruction, abscess, perforation, bleeding) w/ risk of short bowel syndrome (poor nutrient/water absorption) & recurrence.

(b) Ulcerative Colitis
(i) Risk Factors: Age (⅔ by 30), reduced risk if smoker
(ii) Pathology: Diffuse, continuous inflammation ranging from pancolitis to just rectum (proctitis).

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(iii) Presentation: Rectal bleeding, frequent mucousy blood small volume diarrhea with post-defecation pain. Fever, anorexia, weight loss, fatigue.
(iv) Complications: Toxic megacolon, colon cancer risk increased, iron deficiency, anemia
(v) Investigations: Colonoscopy or sigmoidoscopy with mucosal biopsy, CT, cultures (stool, C. Diff)
(vi) Management: 5-ASA, steroids, immunosuppressants/biologics, surgery (curative; colectomy) if failed medical therapy (toxic megacolon, uncontrollable bleeding, cancer, unable to taper steroids).

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6) Approach to Trauma - General Surgery Perspective

a) Tips for the first time in the Trauma Bay:
   i) Tip 1: It is ok to be overwhelmed, it is loud and if it is your first time it may look like disorganized chaos, but everyone has a role to play.
   ii) Tip 2: Try to clarify your role and where you should stand in the Trauma Bay, if there are not too many staff ask to step up to the table and help with log rolling and other low stakes tasks.
   iii) Tip 3: It is ok to step out if the case is distressing for you.

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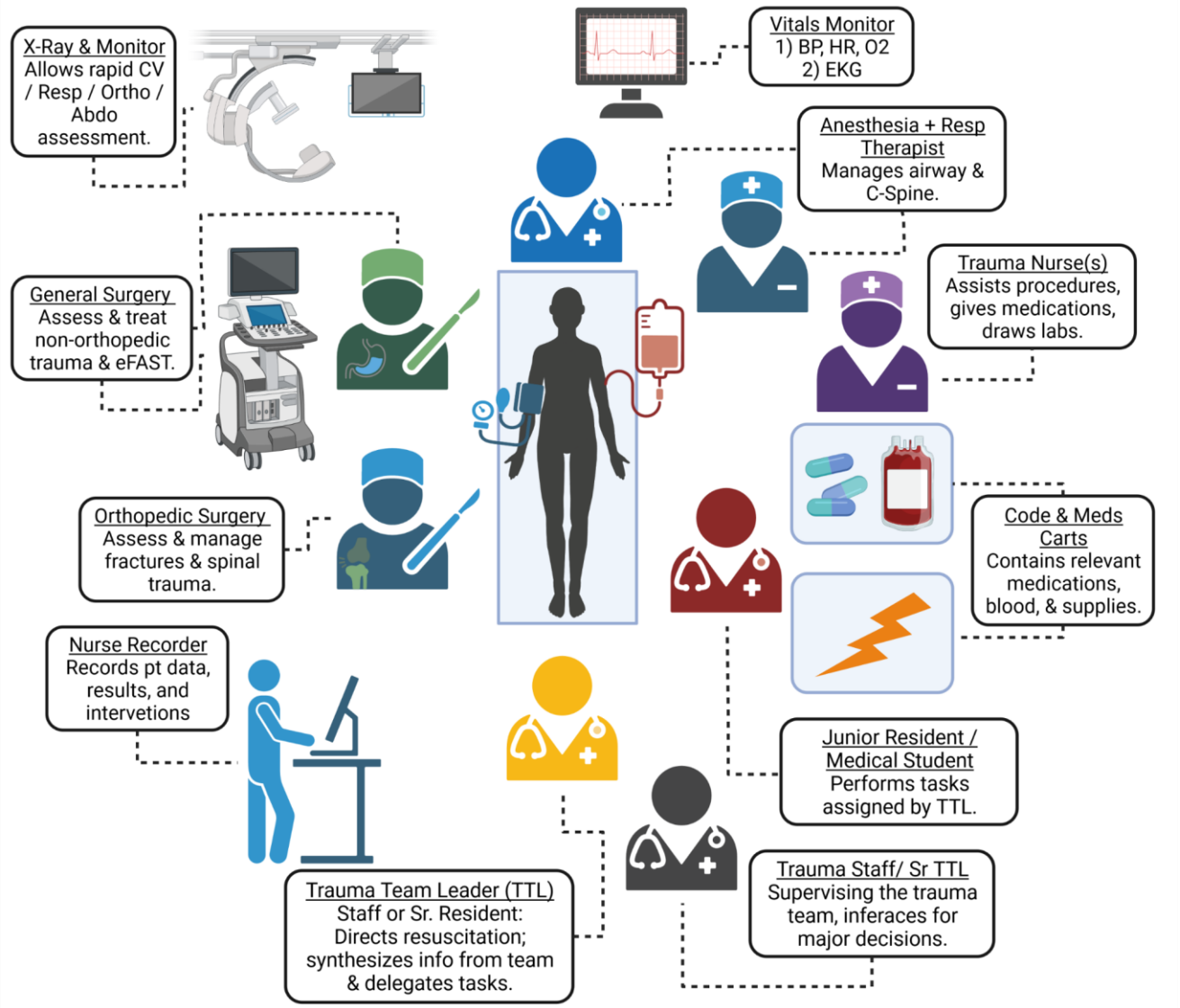

Trauma Bay Team Members & Role Overview (Williams K., BioRender (2022))

b) Primary Survey

i) The ATLS Primary Survey follows the ABCDE format. It is described as a stepwise algorithm but in reality, all of these steps happen simultaneously by the different specialties described below (may differ based on hospital):

(1) **Airway** (Anesthesia + Respiratory Therapist(s))

(a) Always assessed maintaining C-spine precautions to prevent further neurological damage.

(b) Main indication for intubation: Patient cannot protect airway.

(i) Anatomic causes:

1. Obstruction (blood, vomit, hematoma).
2. Disruption of airway (laryngeal fracture, facial fracture, transection).

(ii) Neurologic signs:

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1. Low GCS (<8)
2. High C-spine injury

(c) Traumatic intubation is performed using in-line stabilization for C-spine.

(2) **Breathing** (Anesthesia + General Surgery)

(a) Start O2 (face mask or nasal prong) then assess if additional supports needed.

(b) Auscultation, palpation, CXR +/- U/S to assess for 5 life-threatening injuries:

(i) Tension pneumothorax
(ii) Open pneumothorax
(iii) Flail chest
(iv) Massive hemothorax
(v) Cardiac tamponade

(c) Tension/open pneumothorax and hemothorax require chest tube (Thoracotomy) via “Triangle of Safety” (Refer to Guide to General Surgery Procedures/Skills Section).

(d) Tamponade requires paracentesis or pericardial window.

(e) Severe flail chest may require intubation and positive pressure ventilation to relieve work of breathing and pain.

(3) **Circulation** (General Surgery + Orthopedic Surgery)

(a) Assess the 5 high-risk locations of life-threatening bleeding:

(i) External – examine the entire body (e.g. look for penetrative entry & exit wounds).
(ii) Chest – physical exam and CXR +/- eFAST U/S.
(iii) Abdomen – physical exam and eFAST U/S.
(iv) Pelvis – pelvic stability and pelvic X-ray.
(v) Long bones – physical exam (femur(s), humerus).

(b) Direct pressure +/- tourniquet for external bleeding in extremities

(c) 2 Large Bore (14-16G) IVs and begin fluid resuscitation (1-2L of NS/RL then blood products if still hypovolemic/hypotensive).

(d) Can temporarily staple close exit and entry wounds.

(e) Splint long bone fractures.

(f) Pelvic binder for pelvic fractures.

(4) **Disability** (Anesthesia + Orthopedic Surgery)

(a) Focused neurological exam for head and spinal cord injury:

(i) GCS
(ii) Pupils
(iii) Lateralizing neurological deficits (paralysis, numbness)

(b) Traumatic brain injury is divided into severe (GCS<8), moderate (9-12), and mild (13-15).

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(c) Cushing's response to ↑ intracranial pressure (ICP): bradycardia, hypertension, irregular breathing.
(d) Overview of GCS (Total 15):
(i) **Eye opening** /4: Spontaneous (4), to sound (3), to pressure (2), non-testable (1).
(ii) **Verbal** /5: Oriented (5), confused but answers questions(4), inappropriate words (3), incomprehensible (2), non-verbal(1).
(iii) **Motor** /6: obeys commands (6), moves to pain (5), flexion w/ pain (4), abnormal flexion (decorticate; 3), extension (decerebrate; 2), no motor response (1).

(5) **Exposure** (General Surgery + Orthopedic Surgery)
(a) Must examine every part of patient's body.
(b) Remove all articles of clothing.
(c) Logroll patient to look at back for wounds, feel down entire spine to assess for pain, deformities, focal neurological deficits in perineum +/- rectal tone.
(d) Place foley, update tetanus. IV Abx, maintain body temperature.
(6) Continue to reassess ABCDEs & Urine output.

c) Secondary Survey
i) A "Head-to-Toe Assessment" starts *only* after the ABCDE primary survey, which is the goal of any injury and its significance that may have been missed during the primary survey, particularly in an unconscious or unstable patient.

ii) Secondary Survey Mnemonic: **H**as **M**y **C**ritical **C**are **A**ssessed **P**atient's **P**riorities **O**r **N**ext **M**anagement **D**ecision?
(1) **H** - Head/Skull
(2) **M** - Maxillofacial
(3) **C** - Cervical Spine
(4) **C** - Chest
(5) **A** - Abdomen
(6) **P** - Pelvis
(7) **P** - Perineum
(8) **O** - Orifices (confirm discharge, bleeding, tubes)
(9) **N** - Neurological
(10) **M** - Musculoskeletal
(11) **D** - Diagnostic Tests/Definitive Care (Surgery, Pharmacological Interventions)

d) Approach to Common Trauma Scenarios
i) **Prevention:**
(1) Public health approach: surveillance, research on risks, protective factors, interventions; programs and policy, evaluation and monitoring.

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(2) Haddon's matrix: Interaction between host (injured person), agent (what injures host), environment (physical and social context).
    (a) Pre-event = primary prevention; Event = secondary prevention; Post-event = tertiary prevention

ii) **Blunt Force Trauma**
(1) Etiology: Motor vehicle accidents, falls, crush injuries, etc.
(2) Complications: Hyperkalemia, myoglobinuria, renal failure, compartment syndrome, undiagnosed bleeding.
(3) Investigations: U/S FAST, CT, laparoscopy, angiography.
    (a) FAST for free fluid (not organ injury)
        (i) Four regions: RUQ (Morrison's pouch - liver/kidney), LUQ (Splenorenal recess - spleen/kidney), bladder, pericardium. E-FAST = extended FAST to include lungs & heart for pneumo- or hemothorax.
        (ii) Indications: Low BP (unstable pt), poor oxygenation, direct force applied to abdomen.
        (iii) Benefits: Non-invasive, portable, highly specific, rapid!
        (iv) Cons: Need to do it early, cannot see retroperitoneum or solid organ injury, subcut emphysema and obesity can make it hard.
    (b) XR for Fractures
        (i) Indications: Pain of bony structures or obvious fractures.
    (c) CT scan (non-contrast)
        (i) Indications: Stable patients only!
        (ii) Benefit: Solid organ injury, see retroperitoneum & active bleeding.
        (iii) Cons: Miss hollow organ and diaphragm injury.
(4) Management: ABCDEs, Calcium carbonate (protect the heart from ↑K+), D50W, diuretics, alkalize the urine (Bicarbonate), fasciotomy (for compartment syndrome).
    (a) Low BP + abdominal bleed or organ rupture (peritonitis): FAST + exploratory laparotomy ASAP.
    (b) Normal BP + intra-abdominal bleed: Investigate (FAST + CT) then exploratory laparotomy.

iii) **Penetrative Trauma**
(1) Etiology: Gunshot wound (GSW), knife wound, etc.
(2) Investigations: Same as Blunt Force Trauma.
(3) Management:
    (a) GSW:
        (i) If simple entry & exit with no MAJOR vessels are in the vicinity of the injury (i.e. femur) ONLY I&D + Tetanus booster is required.
        (ii) If vessel is involved: CT-Angio + Doppler studies are required to assess extent of injury.

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(iii) If peritoneal injury or obvious vascular injury w/o distant pulses & potential expanding hematoma: surgical exploration +/- removal of fragments.
(iv) If injury includes bone, nerves, and blood vessels: Needs repair (order: fracture > vascular repair > nerve repair).
1. Prophylactic fasciotomy provided due to risk of ischemia & risk of compartment syndrome.

(b) Knife:
(i) If eviscerated, peritonitic, or hemodynamically unstable: exploratory laparotomy.
(ii) If unclear if wound entered peritoneum: explore wound with finger (do not perforate peritoneum) to see if passage to peritoneum is present *and/or* FAST/CT to r/o intra-abdominal fluid.

(4) Clinical Pearls:
(a) For penetrative wounds, always look for exit wounds & other compartments due to potential for fragments causing extensive damage, e.g. if nipple to hip wound, explore abdomen.
(b) Always confirm Tetanus immunization status and give a booster if >10y since last immunization.

iv) **Chest Trauma**
(1) Typical Investigations: CBC, cardiac enzymes (troponin), lytes, U/S FAST & CXR (pelvic and others depending on mechanism), VBG/ABG, EKG (myocardial damage).
(2) Rib fracture
(a) Management: Typically, not ORIF, analgesia (local nerve block + epidural) to ensure normoventilation (natural course: hypoventilation > atelectasis > pneumonia > death).
(3) Pneumothorax
(a) Presentation: SOB, pain, ipsilateral lack of breath sounds & hyper-resonant, and no lung sliding on POCUS on ipsilateral side; tracheal deviation, hypotension, ↑JVP (tension pneumothorax).
(b) Management: CXR, needle or chest tube decompression + UWS (upper and anterior).
(4) Hemothorax
(a) Presentation: SOB, pain, some to no breath sounds, DULL to percussion due to fluid filling potential space.
(b) Management: CXR, chest tube (to drain + prevent empyema) placed as low as possible, rarely surgery.
(i) If 1500cc+ is collected on insertion (or 600cc+ in the 1st 6 h) a major vessel (intercostal artery) may be involved, requiring a video-assisted thoracotomy to control the bleeding.

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(5) Sucking chest wounds
    (a) Presentation: Obvious on exam - sucking skin flap leading to a tension pneumothorax & CV compromise.
    (b) Management: Occlusive dressing with 3 sides tapped down to allow for air to be released but not in > surgical management.
(6) Flail chest (3+ ribs fractures)
    (a) Presentation: Caved in chest appearance on inspiration; main issue underlying lung contusion (very sensitive to fluid overload).
    (b) Management: Fluid restriction + diuretics; monitor blood gasses; bilateral chest tubes if deterioration to prevent tension pneumothorax.
(7) Cardiac tamponade
    (a) Presentation: Increased CVP but deterioration of CO, +ve subxiphoid FAST exam, muffled heart sounds, and low voltage EKG tracings.
    (b) Management: Urgent paracentesis, pericardial window, open thoracotomy.
(8) Pulmonary contusion
    (a) Presentation: Shows up right away after trauma (deteriorating blood gases + white out of lungs on CXR).
    (b) Management: Fluid restriction + diuretics (due to fluid overload sensitivity); monitor blood gasses; bilateral chest tubes if deterioration to prevent tension pneumothorax.
(9) Myocardial contusion
    (a) Presentation: +/- Sternal/rib fracture(s); +ve EKG +/- ↑troponins.
    (b) Management: Complication based, i.e. treat arrhythmias with beta-blockers.
(10) Traumatic diaphragmatic rupture
    (a) Investigations: CXR (stomach +/- bowel loops in left thorax).
    (b) Management: Exploratory Laparotomy.
(11) Traumatic aortic rupture
    (a) Presentation: Usually asymptomatic until adventitial contained hematoma blows up.
        (i) Most common: Junction of the aortic arch and descending aorta.
        (ii) Increased suspicion if first rib, scapula or sternum are fractured or if there is a wide mediastinum.
    (b) Mechanism: Strong deceleration injury
    (c) Management: Transesophageal echocardiogram, spiral CT , MRI-angio, surgical repair (endovascular prosthesis where possible over open thoracotomy)
(12) Traumatic tracheal rupture or bronchus
    (a) Presentation: Shortness of breath, O2 decompensation, subcutaneous emphysema or air leak in chest tube.
    (b) Management: CXR or CT chest; fiberoptic bronchoscopy (identification + intubation) + surgical repair.

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(13) Air emboli
  (a) Suspected in the sudden death of a chest trauma patient who is intubated.
  (b) Main cause: Subclavian open to air (Supraclavicaular node biopsy, Central line insertion or disconnection).
  (c) Management: Thoracotomy + cardiac massage with left side down.
  (d) Prevention: Trendelenburg position with insertion.
(14) Fat emboli
  (a) Suspected with long bone fractures (humerus or femur), multiple fractures.
  (b) Presentation: Petechial rashes in axilla + neck, fever, tachycardia, low Plt; late stage: respiratory distress (hypoxemia + bilaterally patchy lung infiltrates on CXR), unexpected coma (MRI brain with star field pattern).
  (c) Management: Respiratory support with respirator; high threshold for irreversible damage and removal of care.

v) **Head and Neck Trauma**

(1) Neurological damage related to trauma or tumor.
  (a) Initial blow or growth = Nothing can be done beside identification.
  (b) Hematoma or space occupying lesion w/ midline shift = Surgical decompression and resection.
  (c) Increased ICP = Risk of herniation & death = Mannitol or OR for decompression.

(2) Canadian CT Head Rules for Head Injuries
  (a) High Risk (need CT ASAP):
    (i) GCS<15 at 2h after injury; suspected open or depressed skull fracture; any sign of basilar skull fracture; vomiting 2+; Age 65+.
  (b) Medium Risk (r/o clinically important brain injury):
    (i) Retrograde amnesia to event >30 mins; dangerous mechanism (pedestrian struck by motor vehicle, ejected from vehicle, fall from >3ft or >5 stairs).

(3) Head Trauma Scenarios & Management
    (i) Penetrating
      1. Management: surgical intervention + repair.
    (ii) Linear skull fracture
      1. If closed: conservative management with imaging to r/o complications.
      2. If open, comminuted or depressed: imaging, surgical debridement within 24h, anti-epileptics, empiric antibiotics.
    (iii) Basilar skull fractures

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1. Presentation: Raccoon eyes (periorbital ecchymosis), Battle's sign (retroauricular ecchymosis), rhinorrhea/otorrhea (CSF leak).
2. Management: CT head + C-spine; no nasal endotracheal tube; expectant management.

(iv) Acute epidural hematoma
1. Presentation: Unconsciousness/LOC then lucid interval then gradual coma onset with fixed dilated pupil (ipsilateral) & contralateral hemiparesis.
2. Management: CT (lens shaped hematoma, not along suture) and emergent craniotomy.

(v) Acute subdural hematoma
1. Presentation: Bigger trauma & patient sicker (no fully lucid period).
2. Management: CT (crescent-shaped along suture line)
   a. If midline shift = Craniotomy.
   b. If no deviation = Medical management of increasing ICP; elevate head, hyperventilate, avoid fluid overload, diuretics - mannitol + furosemide; ICP monitoring.
      i. Do NOT want to reduce systemic arterial pressure via diuresis as brain perfusion is directly related to systemic BP.
      ii. Sedation + hypothermia = Used to reduce O2 consumption.

(vi) Chronic subdural hematoma
1. Presentation: Shrunken brain is rattled around due to previous trauma - tears venous sinuses; gradial mention function deterioration
2. Management: Diagnostic CT; craniotomy and evacuation

(vii) Diffuse axonal injury
1. Pathology: Occurs in more severe trauma, angular motion.
2. Presentation: LOC to coma
3. Management: CT head - diffuse grey-white matter blurring + small punctate hemorrhages; no hematoma = NO surgery; preventing further damage from ICP.

(viii) Subarachnoid hemorrhage - Aneurysm related
1. Presentation: Sudden, worst headache of their life (thunderclap), nuchal (neck) rigidity, sometimes return with second worse episode (previous was sentinel).
2. Management: CT head; arteriogram to locate aneurysm; Lumbar puncture if CT is -ve but high suspicion, neurosurgical clipping or IR endovascular coiling.

(ix) Malignant intracranial hypertension

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1. Pathophysiology: Closed head injury → diffuse brain injury à generalized brain edema → high ICP → ventricles collapse, CSF pushed out → diffuse brain ischemia and worse edema → even higher ICP → brain herniation & death
2. Presentation: LOC → coma → death.
3. Management:
    a. Lower ICP: External ventricular drain, carbonic anhydrase inhibitor, osmotic diuresis (mannitol).
    b. Decrease cerebral brain volume: Normalize pCO2/pO2, increase venous outflow (head up), decrease pCO2 (hyperventilate)
    c. Relieve mass effect: Expand cranial vault - craniectomy

(x) Complications of traumatic head injuries

1. Cognitive decline secondary to cerebral damage, delirium, mood disorder.
2. Cognitive impairments
    a. Presentation: Impaired arousal and attention, learning and memory, language and communication, executive function
    b. Management: Remediation (sub tasks, cueing, overlearning) and compensation (memory book, work modification, pacing, safety dogs, family support)
3. Behavioral impairment
    a. Presentation: Apathy, agitation, disinhibition, mental inflexibility
    b. Management: Simple directions, avoid restraints and overstimulation.
4. Depression
    a. Cognitive impairments increase in depression over time
    b. Management: Refer above in addition to psychiatric assessment with SSRIs or other antidepressants.

(4) C-Spine Trauma

(a) Etiology: Blunt force head injury, risk increases with increased force and GCS <8. Most common are C2, 6, & 7, with >1 fracture.

(b) Investigations:

(i) Canadian C-Spine Imaging Rules

1. Image (XR or CT) if : Age >65y, extremity parethesias, or dangerous mechanism (fall of ≥ 3ft or 5 stairs, axial load injury, high speed MVC, bicycle collision).

(c) Clearing C-spine:

(i) Normal sensory findings, no midline spine pain, no neurological motor deficits, no distracting injuries, painless ROM of C-Spine (only test if previous findings are met).

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(ii) If any of these are +ve, immobilize, image, consult neurosurgery/orthopedics.

(d) Management: Cervical collar 2-3 months, surgical fixation if displaced or misaligned.

(5) Spinal Cord Trauma

(a) Management: ABCs, intubation (if C3-5 (diaphragm) affected), C-Spine precautions, C-Spine XR (3 view), CT/MRI, avoid hyperglycemia, hyperthermia, +/- early high dose steroids, surgical decompression (reduce edema & preserve neurologic function).

(b) Complete transection:

(i) Presentation: Nothing works (sensory or motor) below the lesion.

(c) Hemisection (Brown Sequards; very good long term prognosis)

(i) Cause: Clean-cut wound (stabbing).

(ii) Presentation: Ipsilateral paralysis and loss of proprioception + contralateral pain loss distal to injury.

(d) Anterior cord (prognosis is poor)

(i) Cause: Burst fracture of vertebral bodies.

(ii) Presentation: Loss of motor function, pain, temperature bilaterally with position and vibration sense retained.

(e) Central cord (prognosis is average)

(i) Cause: HYPER-EXTENSION injuries (e.g. rear-ended).

(ii) Presentation: Loss of motor + burning in UEs & preservation of function in LEs.

(f) Complications:

(i) Neurogenic bladder

1. Management: Intermittent catheterization, condom catheter.

(ii) Neurogenic bowel

1. Management: Diet (fluid, fibre), laxatives, suppositories, digital stimulation.

(iii) Pressure ulcers (refer to Postoperative complications section)

(6) Neck Trauma

(a) Management:

(i) Unstable: Exploratory surgery

1. Instability signs: Airway (gurgling, stridor, apnea), Vessel (expanding hematoma, pulsatile bleeding, shock, stroke), Digestive (mediastinitis).

(ii) Stable:

1. Soft signs: Airway (dysphonia, subcutaneous air), Vessels (hematoma, oozing), digestive (dysphagia) - CT angiogram +/- endoscopy / bronchoscopy.
2. No soft signs: Observe & Wait.

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vi) **SHOCK**

(1) Definition: Lack of tissue perfusion (traumatic or non-traumatic etiology) leading to tissue/multi-organ failure.

(2) Types & Management:

Cause	HR	Temp	JVP	CVP	Clinical signs	Investigations	Tx
Spinal cord	**Slow**	Warm	Low		Bradycardia, warm extremity, low JVP, neuro findings	C-spine XR (3 views), CT, MRI	Fluids and source control, phenylephrine
Sepsis (usually not acute)	Fast	Warm				Blood cultures – high WBC If not responding to Tx – suspect adrenal insufficiency	Broad spectrum Abx, pressors if unresponsive to fluids (norepinephrine), tight glycemic control
Hemorrhage	Fast	Cool	Low	Low	Tachycardia, decreased pulse pressure, cool and pale extremity, **low JVP**, evidence of bleed/hypotension Abdomen + chest à straight to the OR	Metabolic acidosis, high lactate, anemia, bleeding Physical exam + scans by location: External (Hx + P/E) Chest (CXR, CT) Abdomen (U/S, CT, angio; retroperitoneum is harder to rule out in ED) Pelvis (XR, CT, angio) Long bones (XR)	Rapid fluid resuscitation (see below) + surgical correction if ongoing
Obstructive: tamponade, PTX, PE	High	Cool	High	High	TPTX/HTPX: resp distress, hypoxemia, hypotension, less air entry, hyperresonance, trachea deviates to opposite side, **high JVP** if not hypovolemic (CXR, U/S) Pericardial tamponade: *Beck's triad*: low BP, **high JVP**; muffled heart sounds (U/S, echo, CT)		See below
Cardiogenic (rare)	Fast or slow	Cool			Findings of MI, myocardial contusion, endocardial issues	U/S, echo Locations: pericardial, myocardial, endocardial, coronary arteries	Correct electrolyte abnormalities, pain control, source management, dobutamine
Anaphyla"K"sis (vasomotor)	Fast	Warm		Low	Tachycardia, warm, swelling, wheezing, hypoxemia, hives, erythema	N/A	Epinephrine, antihistamines, steroids

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(3) Clinical Pearls:
   (a) Distributive Shock leads to systemic vasodilation; includes sepsis, toxic shock syndrome, anaphylaxis.

vii) **Trauma in Vulnerable populations**

(1) Geriatrics
   (a) Considerations: Precipitating cause, elder abuse, F>M, comorbidities, lower physiologic reserve, frailty, muscle weakness, functional impairment.
   (b) Issues: Worse outcomes, more likely to die from complications, more head/hip injuries (don't break fall with arms).
   (c) Vital Signs: High mortality from HR>90, SBP<110. Lower HR if on CV meds (beta blockers, calcium channel blockers, etc.).

(2) Paediatrics
   (a) Vital signs: Differ by age (Broselow tape).
   (b) Approach: Same ABCDE as adults, consider child abuse.
   (c) Airway: Larger head, tongue, tonsils, larynx more anterior, short trachea.
   (d) C-spine: <10 yo can have spinal cord injury without radiological abnormalities (SCIWORA).
   (e) Breathing: Lung injury without rib fracture; mediastinum is mobile.
   (f) Circulation: Blood volume ~70 cc/kg. Small blood volume change can lead to hypotension. Increased physiologic reserve à tachycardia poor skin perfusion. SBP doesn't decrease until 45% blood volume remains.
   (g) Disability: Modified GCS.
   (h) Other: Neuro injury – vomiting, seizures, diffuse brain injury.

(3) Pregnant
   (a) Issues: Preterm labor, abruptio placenta, fetomaternal hemorrhage, pregnancy loss.
   (b) Considerations: Priority = mom >> fetus, more blood volume after GA10 wks so clinical signs of shock are slow to develop, after GA12 wks higher risk to uterus, after GA18 wks supine position can compress IVC and cause hypotension, isoimmunization.
      (i) Management: Keep pregnant patient in left lateral decubitus position during trauma assessment, Monitor fetus for 4-6 h post trauma.
   (c) Screen for intimate partner violence.

viii) **Clinical Pearls of Trauma**

(1) Foley catheters should not be inserted if there is penile or pelvic trauma.
(2) (ADD Photo) In trauma situations you are trying to stave off the *Trauma Triad of Death*:

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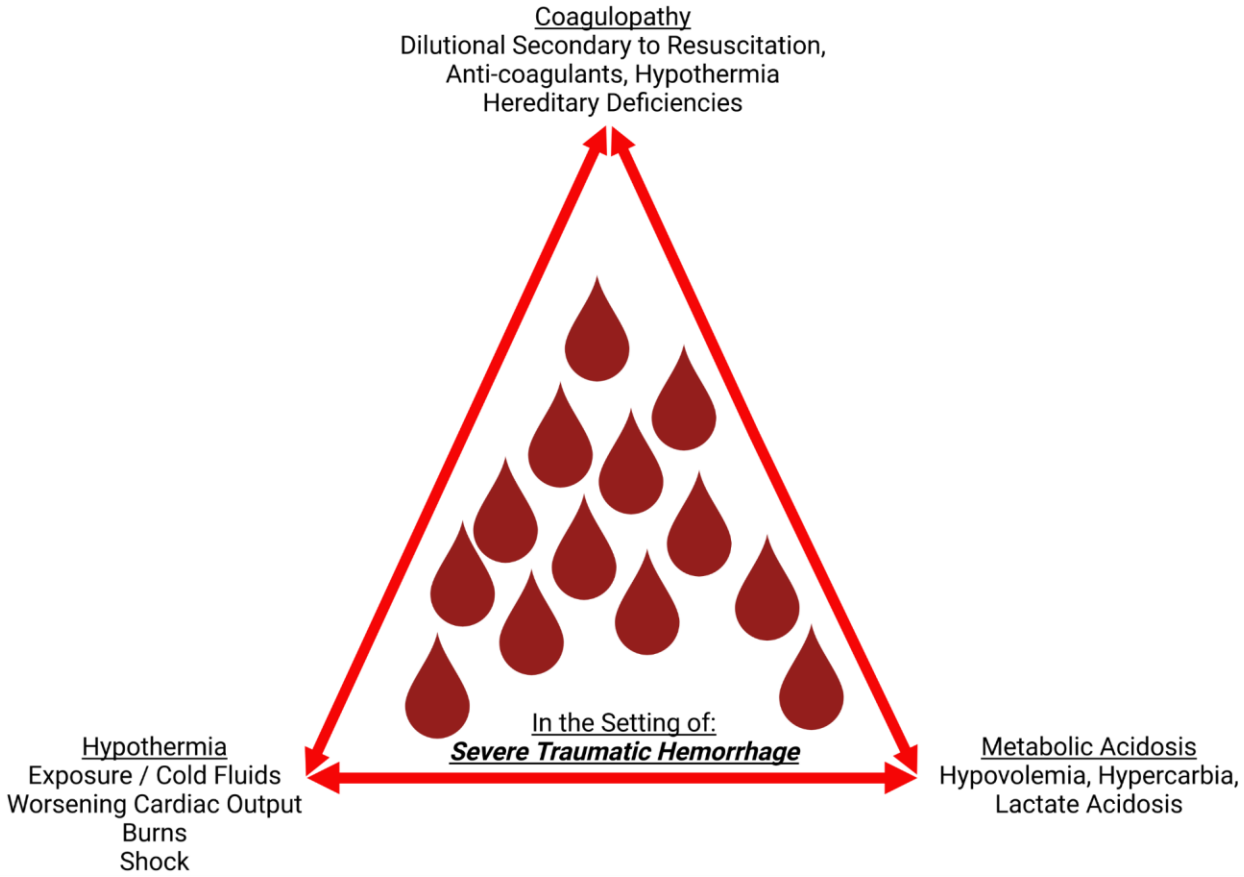
(a) Metabolic Acidosis
    (i) Etiology: Hypovolemia, hypercarpia, lactate acidosis.
    (ii) Management: IV Bicarbonate.
(b) Hypothermia
    (i) Etiology: Environmental (removal of clothing), DM/hypothyroid, Shock, cold fluids, burns, TBI.
    (ii) Management: Give warmed fluids IV, provide warmed blankets once primary survey complete.
(c) Coagulopathy
    (i) Etiology: Dilutional secondary to fluid resuscitation, DIC, factor deficiency, medications (anti-platelets/coagulation), hypothermia.
    (ii) Management: Keep patient warmed, give FFPs and plasma following 1-2L of resuscitation, give vitamin K and PCC if on warfarin.

(3) Leading causes of injury-related death:
(a) Paediatrics: Suffocation
(b) Adults: Suicide
(c) Elderly: Falls



Trauma Resuscitation's Triad of Death (Williams, K. BioRender (2022))

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7) Approach to Postoperative Complications

a) **Wound:**

i) **Poor healing**

(1) Risk Factors: Diabetes, smoking, wound infection, drugs (e.g. steroids), poor nutrition (low protein, Vit A/C, Zinc), tissue necrosis/hypoxia, excessive tension, hypothermia, obesity, male sex, immunosuppression, radiation.

(2) Prevention:

(a) Optimize risks (DM Tx, ↓ steroids, ↑ nutrition, ↓ smoking)

(b) Optimize tissue (↑ hemostasis, protect blood supply, minimize tension, prevent foreign bodies, debride necrotic tissues, ↑ sterility, normothermia).

(c) Infection prophylaxis (surgical scrub/prep, +/- clip hair), ABx <1h from incision (skin = cefazolin; GI = metronidazole).

ii) **Dehiscence**

(1) Etiology: Skin intact (early) but underlying fascia has failed due to abdominal wall tension overcoming tissue or suture strength/security.

(2) Risk Factors: Underlying surgical site infection, diabetes, ascites, emergency surgery, malignancy, etc.

(3) Presentation: POD 4-14 (mean 8), wound site pain/tenderness, dressings unusually soaked with serosanguinous drainage ("salmon coloured"), incisional bulge exacerbated by valsalva maneuvers.

(4) Management: RAPID action will prevent evisceration. Bind the abdomen & limit movement/straining (prevents ventral hernias). Surgical irrigation, debridement, repair is definitive.

iii) **Evisceration**

(1) Etiology: Later stage of wound dehiscence, skin and underlying fascia have both failed due to abdominal wall tension overcoming tissue or suture strength/security.

(2) Risk Factors: Same as dehiscence as well as delayed detection.

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(3) Presentation: POD 4-14 (mean 8) Skin and fascia separated following patient strains/coughs, bowels may be open to air.
(4) Management: EMERGENCY. Cover the bowel with sterile warm saline dressings & page the OR for emergent surgery. DO NOT attempt reduction NOR use dry dressings due to potential for perforation.

iv) **Incisional Hernia**
(1) Etiology: Late failure of fascial closure.
(2) Risk Factors: Same as dehiscence as well as COPD, pregnancy.
(3) Presentation: 6-8 wks post-op, bulging/pain at incision site aggravated by coughing or straining
(4) Management: Repair only if symptomatic, or if small due to risk of incarceration.

v) **Surgical Site Infection**
(1) Etiology: Can be superficial or deep from iatrogenic contamination or pre-existing infection.
(2) Risk Factors: Diabetes, obesity, immunosuppression, poor surgical sterility (pre-, peri-, and post-op), failure to hemostasis.
(3) Presentation: POD7-14, localized erythema, induration, warth, tenderness/pain, +/- purulent discharge, +/- fever & leukocytosis, +/- fluctuant.
(a) Necrotizing fasciitis (CANNOT MISS): out of proportional pain, ++dish-water-like discharge, pale, devitalized, & friable tissue/fascia, crepitus.
(4) Management:
(a) If just erythematous & warm (cellulitis): ABx (Cefexin) + Frequent reassessment.
(b) If fluctuant as well as (abscess): If deep: CT scan. Incision, drainage, debridement (foreign bodies, devitalized tissue) packing with sterile saline. Frequent dressing changes until granulation tissue layer is formed. Vacuum dressings can be used to reduce larger, complex wounds & prevent excessive fluid accumulation.
(c) If necrotizing fasciitis is suspected: STAT OR exploration & debridement, cultures (tissue, blood), broad-spectrum ABx (carbapenum or Pip-Tazo, and vancomycin, and clindamycin).
(d) Assess for sepsis (hypotension, fever, tachycardia).

vi) **Seroma**
(1) Etiology: Serous fluid collection. Most common with extensive soft tissue & lymph node dissection.
(2) Management: Pressure dressing, drain if symptomatic. Will typically self-resolve over time if the lymphatic system is intact.

vii) **Hematoma**

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(1) Etiology: Sanguineous fluid collection. Most common if bleeding vessels are not cauterized or clipped during the operation
(2) Management: Pressure dressing, open drainage +/- wound packing if large, STAT OR if patient exhibits HD instability.

viii) **Compression Ulcers**
(1) Etiology: Prolonged pressure on dependent areas.
(2) Risk Factors: Prolonged bed rest/immobilization, coagulopathy, abuse, physical disability.
(3) Presentation: Bed-ridden patient, ulcers @ locations where bone is near skin (sacrum, knee, & ankle). Grade depending on depth.
(4) Management: Frequent patient rolls to alleviate pressure, wound care (irrigation & debridement), +/- antibiotics if signs of infection (fever, purulent discharge, etc.).

b) **Postoperative Fever:**
i) Most Common Presentation: POD1-2, inflammatory response to surgical stress.

ii) General Approach: Hx + P/E (6Ws), wound site inspection, blood/urine cultures, CXR, +/- lactate, +/- ABG/VBG if septic.

iii) 6Ws + other cannot miss conditions:
(1) **Malignant hyperthermia**
(a) Presentation: Fever following anesthesia (halothane or succinylcholine).
(b) Management: O2, IV dantrolene (antidote), cooling blankets, U/A (watch myoglobinuria), lytes, CK (rhabdomyolysis).

(2) **Wind** (Pneumonia or Atelectasis)
(a) Presentation: Shortness of breath w/ fever, +/- unilaterality, +/- crackles, +/- wheezes
(b) Management: CXR, +/- fever workup
(i) Atelectasis (POD1): NGT decompression, incentive spirometry, deep breathing/cough.
(ii) Pneumonia (POD2-3): Respiratory cultures, empiric IV for hospital acquired pneumonia (Vancomycin + Pip/Tazo), consider intubation if not able to protect airway or low O2 saturation.

(3) **Water** (UTI)
(a) Presentation: POD3-5, fever +/- urinary symptoms (dysuria, frequency, urgency).
(b) Management: D/C foley ASAP (prevention), U/A. Urine C+S, empiric ABx (ceftriaxone).

(4) **Walking** (VTE = DVT/PE)

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(a) Presentation: POD3-7, fever, continued immobilization, unilateral leg swelling (2cm Δ between legs) erythema, +/- acute SOB and pleuritic chest pain, +/- leg pain.
(b) Management: U/S Doppler of leg, CT PE of chest, D-Dimer (if low pretest probability). Anticoagulation with LWMH +/- DOAC.
(c) Prevention: Prophylactic anticoagulation in hospital, early mobilization, compression stockings.

(5) **Wound** (Wound infection or Abscess)
(a) See above. POD3-7+

(6) **Wonder drugs**
(a) Presentation: POD7+, fever w/ new drugs or transfusion or line.
(b) Management: Drain abscesses if present via IR guidance.
(c) Prevention: Remove exposure (foley catheter, central line, drain).

(7) **Anastomotic leak**
(a) Presentation: POD4-5 following Lower Anterior Resection or hemicolectomy with bowel anastomosis. Patient febrile, tachycardia, hypotensive, localized pain & low U/O.
(b) Management: NPO, IV fluids, analgesia; vitals, CT (if stable); Emergency exploratory laparotomy & insert foley catheter.

c) **Shortness of breath:**
i) DDx (acute to chronic):
(1) Heart: MI, CHF
(2) Lungs: PE, atelectasis, pneumothorax, aspiration, pneumonia, pleural effusion, pulmonary edema
(3) Systemic: Sepsis, anaphylaxis, inadequate analgesia
ii) Presentation: SOB, RR >20, +/- O2 desaturation, accessory muscle breath, nasal flaring, hypoxia, +/- pleuritic/retrosternal chest pain.
iii) Management: ABCs, call for help, Hx + P/E
(1) Investigations: CBC, ABG/VBG, CXR, EKG/Trop x2, U/S Doppler/CT PE, +/-cultures.
(2) Treatment based on cause (e.g. pneumothorax - chest tube decompression).

d) **Chest Pain:**
i) Presentation: MI or CHF (POD2-3), retrosternal chest pain +/- radiation, SOB, exertional/positional component, +/- peripheral pitting edema; PE (POD3-7), sudden onset pleuritic chest pain, high HR, SOB, poor oxygenation, distended veins (high JVP).
ii) Management:
(1) MI: STAT EKG (ST changes), Trops x2, emergency angioplasty (PCI).
(2) CHF: STAT EKG, Trops x2, IV furosemide, inotropes, ACEi, fluid restriction.

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(3) PE: STAT EKG (Tachycardia, S1Q3T3), CT PE, LMWH/DOAC +/- warfarin.

e) **Abdomen Distention**

i) Epidemiology: Common in general surgery patients, particularly geriatric patients.

ii) Risk Factors: Previous abdominal surgery, electrolyte abnormalities (K+)

iii) **Paralytic Ileus** (small bowel peristalsis slowly or arrest)

(1) Presentation: POD1-5, no pain, distension, electrolyte changes (hypokalemia), +gas.

(2) Management: electrolyte correction, progress diet, ambulation.

iv) **Bowel Obstruction** (small or large)

(1) Refer above (Approach to Common Upper/Lower GI complaints) for more comprehensive review.

(2) Presentation: No resolution of previously suspected paralytic ileus by POD5-7, increased abdominal pain, no BM.

(3) Management: Abdo XR (air-fluid levels) +/- CT w/ C+, NPO, NG decompression, IV Fluids, IV analgesia, book the OR.

v) **Ogilvie Syndrome** (paralytic ileus-like of colon)

(1) Presentation: POD1-5, no pain, distension, immobilized eldery patient, +gas.

(2) Management: Correct lytes & hydrate, abdo XR (dilation of entire colon), colonoscopy (R/O cancer & decompress colon), insert rectal tube.

f) **Renal & Volume Status Complications**

i) **Urinary Retention**

(1) Epidemiology: Very common after general or spinal anesthesia.

(2) Risk Factors: Male, older (>65), Hx of BPH, anticholinergics (quetiapine, dimenhydrinate).

(3) Presentation: Abdominal discomfort, palpable bladder, overflow incontinence, desire to urinate.

(4) Management: Post-void residual urine volume U/S (>100cc), foley catheter, +/- in & out catheterization step down, alpha blocker for BPH (tamsulosin).

ii) **Zero Output**

(1) Etiology: Mechanical obstruction OR post-renal failure (ureters cut)

(2) Presentation: Abdominal discomfort, palpable bladder, zero U/O, +/- desire to urinate.

(3) Management: Attempt re-catheterization, consult urology.

iii) **Low Output**

(1) Etiology: Pre-Renal (hypoperfusion) vs renal (acute tubular necrosis (ATN), acute interstitial nephritis (AIN), acute glomerulonephritis).

(a) Most commonly pre-renal +/- ischemic ATN.

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(b) External fluid loss: bleeding, dehydration, diarrhea.
(c) Internal fluid loss: third-spacing due to bowel obstruction and pancreatitis.

(2) Presentation: U/O <0.5cc/kg/hr (<450 in 75kg patient in 12h), increasing Cr & BUN, +/- gross or microhematuria.

(3) Management: Consult Nephrology, NS 500cc IV bolus challenge (if dehydrated U/O will increase), if no change renal failure w/u (beyond this manual's scope).

iv) **Hypotension**

(1) Definition: BP <90/60 (MAP <65mmHg).

(2) DDx: Dehydration, bleeding, meds (steroids, diuretics), sepsis, abdominal compartment syndrome, pneumothorax, cardiogenic shock (MI, CHF, tamponade), adrenal insufficiency.

(3) Management:

(a) Acute: Resuscitate - bolus NS/RL 500-1000cc /hr until normalization; look for signs of bleeding (BRBPR, melena, hematemesis, +eFAST), look for signs of infection (fever, blood cultures, tachycardia), D/C offending meds, work up SHOCK.

(b) Maintenance: 4-2-1 rule; 4cc/kg for 1st 10kg, 2cc/kg for 2nd 10kg, 1cc/kg for remaining kg (HACK: 50cc to wt (kg)); adjust based U/O (target: 0.5-1cc/kg/hr), volume assessment (ins & outs; including drains).

g) **Electrolyte abnormalities:**

i) **HypoNatremia** (too little Na+ via dilution)

(1) Etiology: Liberal administration of sodium-free (D5W) fluids + high levels of ADH (triggered by trauma or tumor) - rapid decline in serum Na (hours).

(2) Concern: Rapid loss = cerebral edema = herniation, coma, & death

(3) Presentation: confusion, convulsions > coma + death

(4) Management:

(a) Too much ADH/Third-Spacing (CHF, Ascites): Fluid restriction diuretics.

(b) Losing too much fluids: give some Na in IV fluids (RL is best in acidotic or neutral pH; NS in alkalosis).

(c) If rapid HYPOnatremia occurs - high mortality; some use small amounts of hypertonic saline 3-5% + Na-sparing diuretics' (osmotic diuretic - mannitol); resect tumor if present.

(d) No more than 8mEq of Na+/d to prevent demyelination.

ii) **HyperNatremia** (too much Na+ via concentration)

(1) Etiology: Large loss of water (surgical damage to posterior pituitary (ADH storage)) with unrecognized diabetes insipidus (polyuria; unrecognized osmotic diuresis).

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(2) Presentation: Confusion, lethargy > coma; +/- rapid weight loss due to water loss, rapidly rising serum Na.
(3) Management: Fluid replacement w/ tonicity assessment - D51/2 or 1/3 NS (if acute increase in Na+).

iii) **HypoKalemia** (too little K+) -
(1) Etiology: SLOW - loss via the GI or urine (loop diuretics - furosemide; too much aldosterone) without replacement; FAST - in diabetic ketoacidosis Tx due to increase insulin pushing K into cells, need to monitor K+.
(2) Management: PO K-Dur (IV potassium @ 10mEq/h). EKG monitoring for QTc prolongation.

iv) **HyperKalemia** (too much K+)
(1) Etiology: Kidneys cannot excrete potassium (ESRD or aldosterone antagonists/ARBs "water pills" OR in trauma (crushing injuries, dead tissue, acidosis).
(2) Management: 50% dextrose + insulin (shift water & K into cells), removing it from the GI tract (NG Tube); IV calcium gluconate (inhibit effect on cell membrane (cardiac protection), hemodialysis if not resolved. EKG & K+ monitoring for arrhythmias.

h) Acidosis/Alkalosis:

i) **Metabolic Acidosis** (excessive production of acids)
(1) Etiology: Diabetic ketoacidosis, lactic acidosis, loss of buffers (low bicarb from GI tract), or inability to filter (i.e. renal failure).
(2) Presentation: Blood gasses: pH < 7.4, bicarb <25 w/ anion gap (Na > Cl + Bicarb by 10-15).
(3) Management: Treat underlying cause (treat diabetic ketoacidosis, replace bicarb).
(a) MONITOR K to prevent cardiac complications.

ii) **Metabolic Alkalosis** (loss of acid or excessive production of bicarb)
(1) Etiology: Loss of GI acid juice (diarrhea, vomiting. tremors etc.), excessive administration of bicarb (tumor).
(2) Presentation: pH >7.4, High bicarb (>25).
(3) Management: KCl bolus (5-10mEq/h) will allow kidneys to sort out; 2nd line: ammonium chloride or 0.1N HCl needed.

iii) **Respiratory Acidosis**
(1) Etiology: Impaired ventilation (CO_2 build up leading to lower HCO_3).
(2) Presentation: Respiratory depression (Drug/Opioid OD, anesthesia, increased ICP).
(3) Management: Improve ventilation

iv) **Respiratory Alkalosis**
(1) Etiology: Hyperventilation (low CO_2 resulting in high HCO_3 in blood).
(2) Presentation: Respiratory Acceleration, anxiety, fear, etc.

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(3) Management: Reducing ventilation (paper bag breathing).

i) Altered Mental Status

i) DDx: ARDS (hypoxia), infection, electrolyte abnormalities, hypoglycemia, delirium tremens (EtOH withdrawal), delirium (non-EtOH related)

ii) General Approach: DIMS (Drugs, Infection, metabolic, structural): Hx + P/E, vitals, CBC, lytes, Cr, lipase, lactate, ABG/VBG, U/A, U/M, Urine C+S, blood cultures, CXR, head CT.

iii) **Electrolyte & Hypoglycemia Abnormalities**

(1) Management: Order: CBC, lytes (esp. Na, Cr, Glu, metabolic panel, replete deficiencies.

iv) **Hypoxic & diffuse CXR infiltrates** (pulmonary edema or infection)

(1) Management: Call ICU/CCRT & intubate, start Tx based on Hx (CHF or infection).

v) **Delirium Tremens**

(1) Presentation: Hx or suggest Hx of EtOH misuse, acute psychosis or seizures 48-72h after admission.

(2) Management: Benzodiazepines (lorazepam), CIWA protocol activation.

vi) **Delirium**

(1) Epidemiology: Extremely common in the geriatric population (est. 40-60% of geriatric total hip arthroplasty, preventable in 30-40% of cases).

(2) Risk Factors: Age, prior cognitive impairment/delirium, functional impairment, poor nutrition, EtOH, sensory impairment (visual/auditory), severe illness (sepsis), surgery, medications (NSAIDs, opioids, anticholinergics, anticonvulsants, antidepressants, steroids).

(3) Presentation: Acute change (hr to days) in level of consciousness / cognition, temporal / fluctuating course Sx ("sundowning"), distractibility/inattention, disorganized thinking, +/- hallucinations (visual or auditory).

(4) History: Progression of symptoms (hrs to days), medication changes, recent infections, hx of EtOH/Drugs, pre-existing psychiatric conditions. NSQIP risk score.

(5) Management: Assess DIMS (drugs, infection, metabolic, structural) causes, treat underlying cause, prioritize non-pharmaceutical management (mobilize, reorientations, removal of excessive stimuli), low dose antipsychotics (haloperidol) in only severe cases.

References

1) Mizell JS., Rosen M, Chen W. Complications of abdominal surgical incisions (2021)
2) Spelman D., Baddour LM. Cellulitis and skin abscess in adults: Treatment (2021)
3) Stevens DL, et al. Necrotizing soft tissue infections (2021)
4) Online MedED: General Surgery (2021) http://www.onlinemeded.org/
5) Toronto Notes: General and Thoracic Surgery

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6) Ganti L, Kaufman M. S., Mishra N. First Aid For the Surgery Clerkship (2009): Third Edition. 17-35; 73-90. 2009.

8) Guide to the General Surgery OR & Common Procedures/Skills

a) General advice for the General Surgery (and any other OR)

i) **Before Getting into the OR:**

(1) Read about the patient and the case (incl. looking at imaging & consult notes).

(2) Introduce yourself to nursing staff and physicians (if you have not met them), confirm that you will be scrubbed in, +/- minus add your name to the board.

(3) Give the nursing staff your glove size (if you are not sure, start with a size 7 or ask the nursing staff).

(4) If it is the first case of the day, do a first thorough scrub with betadine scrub. You can scrub in with a fast drying alcohol based antiseptic for following cases. Make sure to clean up to your elbow and the webbing between your fingers.

ii) **The Fundamental OR team:**

(1) Scrub nurse: The nurse who will be scrubbed in as well who will be assisting the surgeons with equipment as well as donning surgical gown. Make sure to let them know you are a learner and they will help you with the process of donning the surgical gown.

(2) Circulating nurse: The nurse that will not be scrubbed in but will be grabbing equipment from around the OR or modifying equipment from a non-sterile area. They will also be in charge of documentation.

(3) Anesthesiologist +/- respiratory therapists: Responsible for the patients overall hemodynamic stability and minute-to-minute ABCs. They will also adjust the OR table height & angle.

(4) Surgeon + learners: Your staff +/- residents/fellows who will be performing the operation, make sure to ask them where it is best for you to stand and let them know your experience and offer to help.

b) Common General Surgery Procedures (INCLUDE DIAGRAMS)

i) **Clinical Pearls:**

(1) Most General Surgery patients will start cefazolin & metronidazole if suspected infectious or traumatic etiology to cover Gram-(+), Gram-(-), and anaerobic bacteria.

(2) All patients will get cefazolin (1-2g) immediately prior to the first incision.

ii) **Tube Thoracostomy** (Chest Tube Insertion)

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(1) Definition: Insertion of a chest tube in 4-5th intercostal space (laterally from Xiphoid process), mid-axillary line.
(2) Indications: Drain acute or chronic abnormal pleural air/fluid (large hemo/pneumothorax, large pleural effusion, empyema) with respiratory decline and ARDS
(3) Clinical pearls:
    (a) Procedures: Can include placement of permanent catheter for drainage.
    (b) Complications: malposition (below diaphragm), bleeding, infection, re-expansion pulmonary edema.
    (c) Structures to avoid: intercostal blood vessels and nerves running inferior to 4th intercostal rib, perforation of lung/heart.

iii) **Inguinal hernia repair**
(1) Indications: Symptomatic, non-reducible, incarcerated or strangulated inguinal hernia.
(2) Clinical pearls:
    (a) Goal: Prevent strangulation
    (b) Procedures: Tension-free mesh repair (plug in hernia defect + patch or patch only), non-mesh in emergent incarcerated strangulated hernia (risk of infection from ischemic bowel).
    (c) Structures to avoid: Femoral vessels, vas deferens in men, ilioinguinal nerve.

iv) **Appendectomy**
(1) Definition: Excision of appendix.
(2) Indications: Perforated or non-perforated appendicitis refractory to medical management (with U/S or CT findings), appendiceal neoplasm
(3) Clinical pearls:
    (a) Almost always laparoscopic unless the patient is hemodynamically unstable, profound in situ inflammation, or the patient cannot tolerate CO2 insufflation (bradycardia, hypercarbia).
    (b) Structures to avoid: cecum, terminal ileum, ileocecal valve, ureter, iliac artery.

v) **Cholecystectomy**
(1) Definition: Excision of gallbladder.
(2) Indications: Symptomatic cholelithiasis, cholecystitis, choledolithasis, ascending cholangitis, gallbladder cancer or polyp.
(3) Clinical pearls:
    (a) Clipping the cystic duct must be done very carefully to ensure you do not damage the remaining biliary ducts. Identify Cystohepatic triangle.
    (b) Structures to avoid: Common bile & hepatic ducts, right hepatic artery, duodenum.

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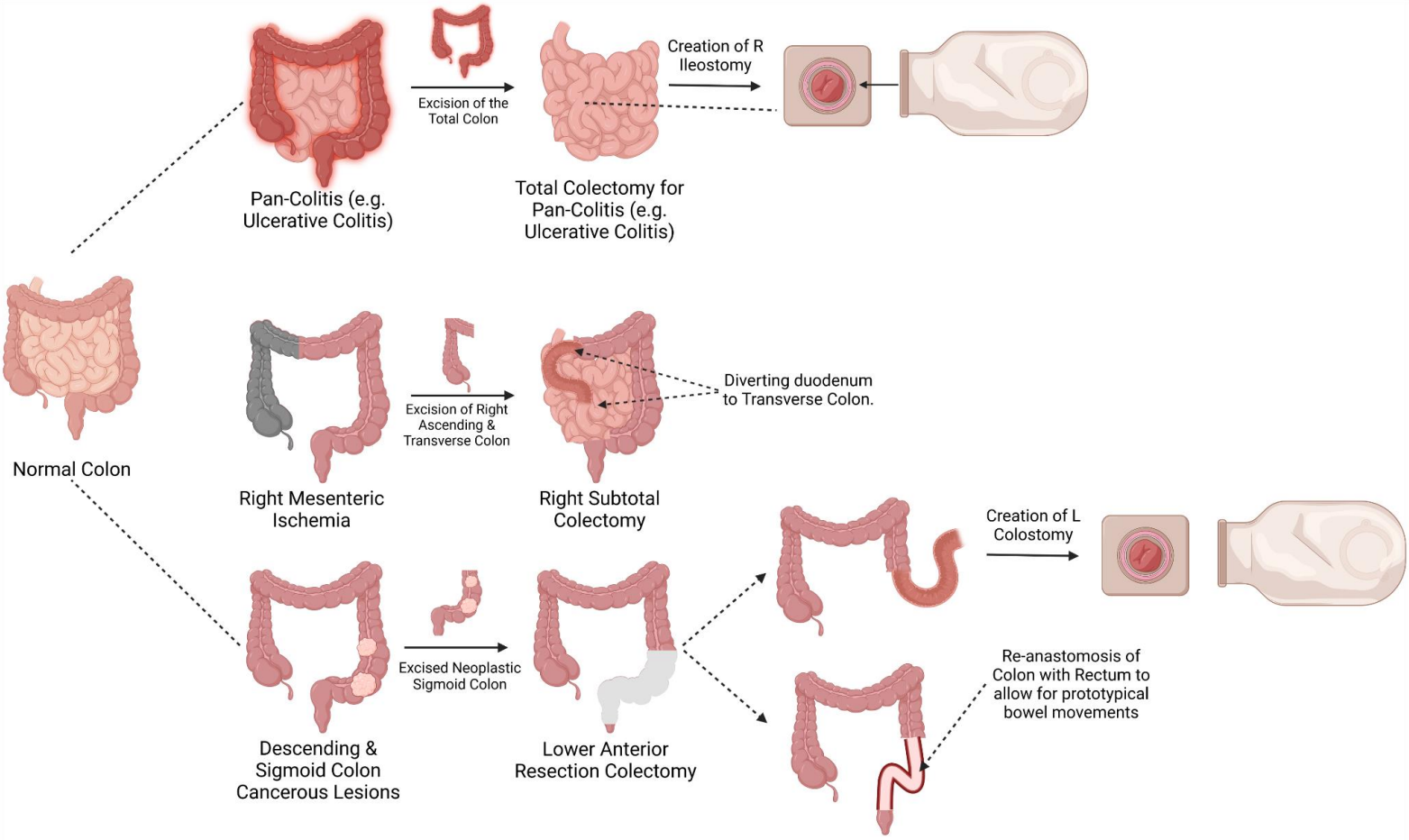
vi) **Colectomy Variants**

(1) Definition: Excision of part or all of colon. Total or Procto-colectomy - colon & rectum; Hemicolectomy - L or R colon; Subtotal colectomy - colon but rectums remains; Sigmoid colectomy - only the sigmoid colon; Lower anterior resection - sigmoid colon & part or all of rectum.

(2) Indications: Infectious (diverticulitis, toxic megacolon), inflammatory (Crohn's, Ulcerative IBD), structural (volvulus, malignancy (colon cancer), obstruction), vascular (ischemic bowel).

(3) Clinical pearls:

(a) Structures to avoid: Blood vessels (branches from SMA & IMA) & ureters.



Colectomy Surgical Variants & Management (Williams, K.J; BioRender, 2022)

vii) **Whipple (Pancreaticoduenectomy)**

(1) Definition: Complex GI reconstruction with removal of gallbladder, common bile duct, duodenum, pancreatic head, +/- distal stomach.

(2) Indications: Proximal pancreatitis, pancreatic cancer

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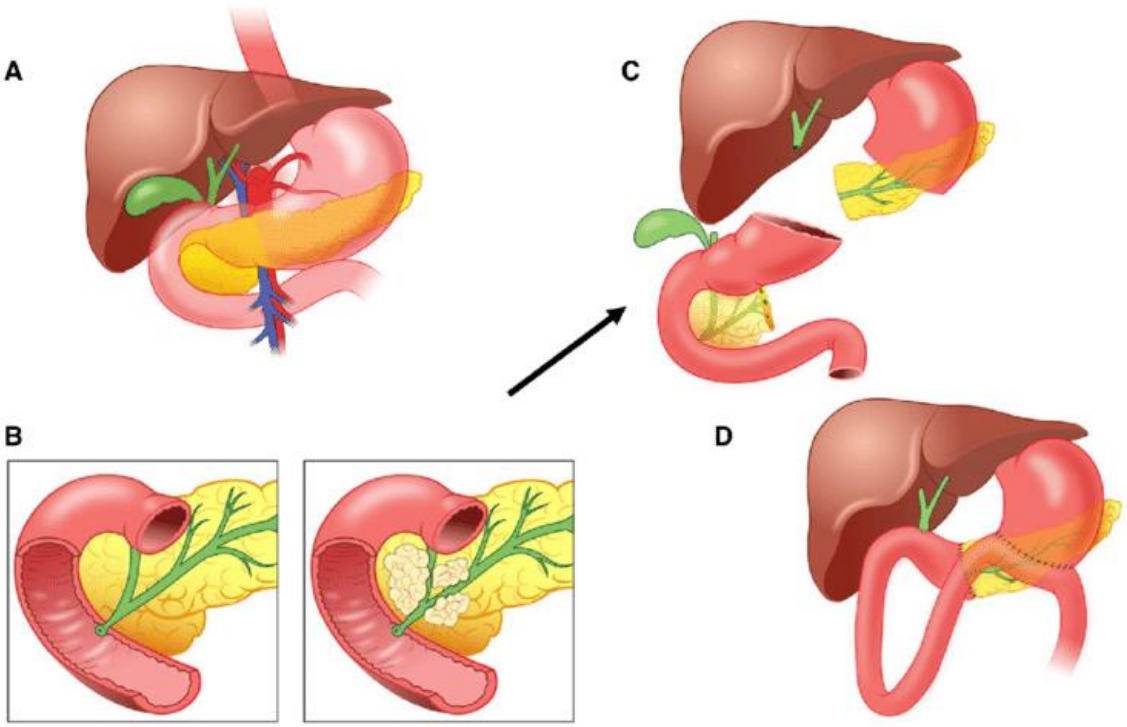
(3) Clinical pearls:

(a) Whipple is curative is pancreatic cancer is anterior with <5% mortality.

(b) Low threshold for imaging in these patients due to significant reconstruction increases risk of obstruction (biliary, gastric, jejunal)



The Whipple Procedure (Pancreaticoduenectomy). A) Normal anatomy; B) Head of pancreas (containing tumor) + proximal duodenum + +surrounding bile ducts + distal stomach + gallbladder are excised; C) Reconstruction to anastomose pancreas, CBD, & stomach to GI tract. Grossberg A., Chu L.C.H., Deig C.R. ACSJ. 375-403; 70; 5. 2020.

viii) **Bariatric Roux-en-Y Gastric Bypass** (ADD PHOTO)

(1) Definition: Creation of a small gastric pouch to restrict stomach volume. Roux limb: feeding limb; Y limb: biliary limb

(2) Indications: BMI >40 without comorbidities, BMI >35 with 1+ serious comobidity (DM, CAD, OSA, GERD); gastric cancer

(3) Clinical pearls:

(a) Roux-en-Y is the most common, most effective at reducing patient weight postop, but has higher complication rates.

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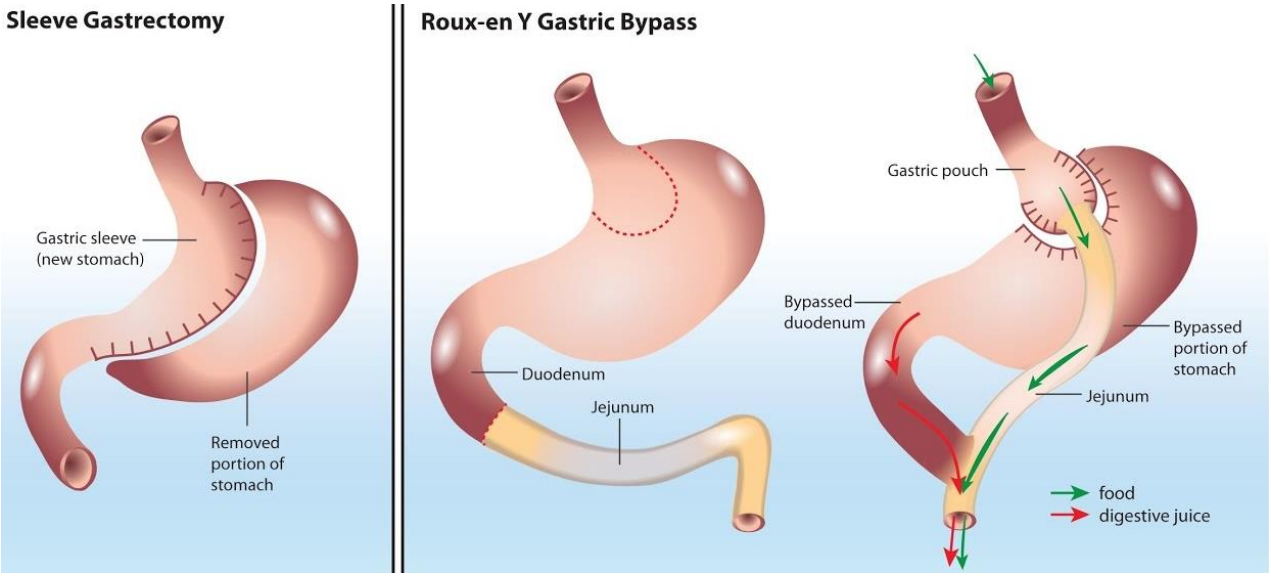
(b) Complications: adhesive SBO, gastric remnant distention, stomal stenosis, ulcers, short bowel syndrome (poor absorption), fistulas, metabolic perturbations.



Overview of Roux-en-Y Gastric Bypass Operation. University of Michigan Health System Surgical Weight Management Program (2016)

ix) **Lumpectomy**

(1) Definition: Breast conserving surgery; removal of tumor without removal of all breast tissue and skin.

(2) Indications: Non-diffusely spread benign or malignant tumors (stage I/II disease).

(3) Clinical pearls:

(a) Typically combined with radiation & SLNB if malignant etiology with margins confirmed by pathology in the OR.

(b) No survival benefit of mastectomy over lumpectomy + radiation in stage I/II breast cancer.

(c) Non-palpable and palpable masses are typically labelled with radiative seed, with SLNs identified by dye and radiolabels.

(d) Complications: local recurrence, failure of tumour-free margins, not suitable for radiation (pregnancy, previous rads).

x) **Mastectomy**

(1) Definition: Simple - removal all breast & skin; radical (rare) - removal of all breast, skin, pectoralis muscle, & axillary nodes; modified radical mastectomy - radical but pectoralis muscle is preserved.

(2) Indications: Invasive Stage III/IV breast cancer, extensive DCIS, contraindications to lumpectomy, patient choice.

(3) Clinical pearls:

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(a) Borders of Mastectomy: Superior - clavicle, Inferior - inframammary fold, Medially - sternum, Laterally - anterior border of latissimus dorsi; Deep - fascia of Pectoralis muscle.
(b) Patients are typically offered combined mastectomy + breast reconstruction.It is possible to do the reconstruction at a later time, but a dilator will need to be inserted for several weeks prior to implant insertion.

Resources:

1) TOSURG. https://www.tosurg.ca/pearls.html#operative
2) Toronto Notes, General & Thoracic Surgery (2020)
3) Ganti L, Kaufman M. S., Mishra N. First Aid For the Surgery Clerkship (2009): Third Edition. Section ii: High-Yield Facts for the Surgical Clerkship. 15-265. 2009.

9) Miscellaneous Advice - How to Survive & Excel

a) Common Challenges & Solutions

Here are some common challenges experienced by students during their surgical clerkship, and some tips and tricks to help make this a fun and successful rotation.

1. **"What exactly is my role? What are the expectations?"**
    - Ask your faculty or residents what your role is.
    - Be a student; read; prepare.
    - Beware loss of defined daily structure (compared to preclinical years).
    - Know your ward, operating room, clinic responsibilities.

2. **"How can I be a good clerk during my General Surgery Rotation"**
    - Show up to rounds, the OR, clinic on time (if you do not know where you are supposed to be email your chief resident, administrator, or staff).
    - Show interest!
        - Try to answer questions, it is OK if you do not know the answer.
        - Ask questions!
        - Come prepared, know your patients and the procedures.
        - Read around cases!
    - Offer to help in daily tasks!
    - Ask for help: make sure to let your team know if you are uncomfortable or unsure about a procedure or task.

3. **"There is not enough time to read. How do I manage knowledge overload?"**
    - Develop a reading plan.
    - Read about the next day's cases.
    - Recognize that you can't read it all.

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4. **“I am getting little or no feedback. What should I do?”**
    - You desire and deserve descriptive, specific and timely feedback but at an appropriate time.
    - It is OK to ask for feedback but make sure to ask when would be appropriate to do so.

5. **“I have no life, and I am stressed to the max!”**
    - Stress management principles: eat sensibly, exercise, self-care, find a confidant/family/friends.
    - It is OK to take personal care days! <u>You can take up to ≤ 5 clinical days during 6-8wk rotations.</u> Just let your team know with enough notice and go through the proper channels.
    - Reach out to your friends, peers, family, and OHPSA.

6. **“My notes are taking forever, how can I speed this up?”**
    - Try making a Hx template that you can copy and paste between cases.
    - Try downloading dictation software that is compatible with your hospitals EMR (Dragon Mic or Power Mic).

b) Surgery Case Presentation Template

1. **Patient ID:** Name, age, gender, pronouns, & presenting complaint.
2. **Present History:**
    - Abdominal pain
    - Type of pain**,** duration**,** onset (Sudden, rapidly vs. slowly progressive)
    - Severity, changes (Location or nature of pain)
    - Associated referred pain**,** exacerbating and relieving factors
    - Previous episodes
3. **Associated symptoms:**
    - Nausea &/or vomiting (Bilious, blood, relation to pain)
    - B-symptoms: Fever, chills, unintended weight loss
    - Alteration in bowel habits and timing
    - GI Bleeding (Hematemesis, melena, hematochezia)
    - Biliary (Jaundice, dark urine, pale stools)
    - Urinary symptoms (Dysuria, frequency, urgency)
    - Gynecologic symptoms (Discharge, Menstrual history, STDs)
    - Cardiac and respiratory symptoms
    - Tolerating Solids, Fluids, NPO since *(what time?)*
4. **Past History**
    - Relevant medical/surgical history, medications / allergies
    - Adverse anesthetic events, alcohol/ drug use
5. **Physical Exam**
    - General appearance

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- Vital signs
- Abdominal exam
    - Inspection (Scars, hernias, distention, skin changes)
    - Auscultation (Bowel sounds, bruits)
    - Percussion (Tenderness, shifting dullness, tympany) o Palpation (Tenderness, guarding, hernias, masses, DRE)
- Genitourinary, cardiovascular, respiratory exams based on Hx

6. **Investigations**
   Review all and present the abnormal and significant normal results
    - Hematology, Chemistry, Urinalysis and Pregnancy Test
    - Coagulation
    - Diagnostic Imaging
7. **Differential Diagnosis**
    - It is OK to be completely wrong!!
8. **Management plan**
    - It is OK to be completely wrong!!
    - Base it off your DDx
    - If admitting, make sure to include:
        - OR Booking (A, B, C case)
        - Diet As Tolerated (or modified), Activity As Tolerated (or modified), DVT prophylaxis (unless bleeding)
        - Antibiotics (if infectious etiology, standard: cefazolin & metronidazole)
9. **Patient concerns:** Often not stated by the patient unless prompted. "What additional concerns do you have that have not been addressed?"

c) Pre-Operative Assessment Template

1. **Preoperative risk assessment:**
    - Pulmonary (exercise tolerance, PFTs)
    - Cardiovascular (ASA class, echocardiography, Doppler)
    - Renal (BUN/Cr, Dialysis Hx)
    - Metabolic (nutritional assessment, thyroid function)

2. **Assess anesthetic risk factors:**
    - Age, urgency of intervention, emergent versus elective surgery.
    - Associated conditions: pregnancy, diabetes, COPD, valvular or ischemic heart disease, cerebral/peripheral vascular disease, renal insufficiency, etc.

3. **Discuss informed consent:**
    - This is often done by the residents and or staff. Make sure to let your supervisor know if you are not comfortable doing this at your stage.

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4. **Discuss conditions that potentially interfere with fluid and electrolyte homeostasis**:
    - Describe strategies for replacement / monitoring. Such as: bowel preparation, NPO status, NG drainage, dialysis, operative losses, etc.

5. **Identify factors that might impair coagulation or increase risk of bleeding & management.**

d) Operative Note Template

i) **Date / Time**: Use the 24 hr clock, spell out month and do not use a numeric value for the month).
ii) **Surgeon**: List all present if more than one
iii) **Assistants**: Physician or RN, Residents, Clerks
iv) **Anesthesiologist & Type of anesthesia used**: General & local, general & epidural, general (difficult airway, glidescope used or awake intubation, tracheostomy), use of ETT, LMA; conscious sedation – simple mask / NP
v) **Procedure Performed**
vi) **Ins & Outs**:
    (1) Estimated Blood Loss (EBL)
    (2) Foley Catheter Output – Clear, concentrated, colour, low output, blood tinged, no foley used
    (3) Drains - Placement site, secured by suture or its own mechanism (ie: pigtail), attached to suction (Davol), Suction initiated (JP Drain & Hemovac), OrthoPat, NG tube, Implanted drains – for use later (tenchoff) -colour, amount (evidence of clots)
    (4) Crystalloids & Colloids Provided (# of units or volume)
vii) **Specimens removed and sent to pathology or harvested**
viii) **Complications**:
    (1) Consults to Internal Medicine, Cardiac, Acute Pain Services, etc.
    (2) ICU Admission – difficult to extubate etc.
    (3) Hypertension or hypotension episodes – treatment used (vasoactive drugs – Anesthesia).
    (4) Death (expected / unexpected).
ix) **Relevant findings**:
    (1) Only required for cases where unusual pathology was encountered.
x) **Dressings**:
    (1) Type, location, use of NPWT (Negative Pressure Wound Therapy – Vac Dressing) and its settings.

e) Post-Operative Assessment Template

1. **List the conditions necessary for discharge**
    a. To home or to the unit.

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2. **Assess Analgesic Management**
    a. Compare and contrast: parenteral vs. enteral agents and describe the role of epidural and nerve blocks in pain management.
    b. Calculate the nutritional needs and describe preferred routes of administration of nutritional therapy for patients with various surgical problems.
    c. Compose nutritional orders and routine laboratory studies utilized to follow response.

3. **Complete nutritional assessment.**
    a. Be familiar with the most common forms of nutritional & deficiency disorders. Consider: protein-calorie malnutrition, chronic alcoholism, iron & B12 deficiencies, malabsorption syndromes and requirements of the morbidly obese.
    b. Discuss disease states and surgical interventions for patients at high risk for nutritional impairment.
    c. Discuss the advantages and disadvantages of nutritional support.
    d. Compare and contrast enteral vs. parenteral administration.

References:

1) University of Toronto Surgery Clerkship Manual 2019-2020 Appendix E - Surgical Documentation.

10) Additional Study Resources

- TO Surg Websites
- Toronto Notes
- UofT Surgery Operation Videos
- Teach Me Surgery
- Surgery Instrument & Hand Knot Tying
- Textbooks: Dr. Pestana's Surgery Notes, Case Files Surgery (5th edition), Acute Care Surgery, First Aid for Surgery

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