

CSGna 

# Presentation for GI Nurses Writing the CNA Exam

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Canadian Society of Gastroenterology Nurses & Associates

Société canadienne des infirmières et infirmiers en gastroentérologie et travailleurs associés

# Writing the Exam

- The CNA exam for gastroenterology is designed to test the competency of the GI nurse who has worked in the field for at least two years.
- They expect that most nurses who have been there for that length of time, will have the experience required to correctly answer the questions.
- One must keep in mind that the field of GI is a wide one. The exam does not just deal with endoscopy nursing, but questions are asked from a larger perspective.
- There are questions dealing with all age ranges; pediatric to geriatric.
- Some questions are for those in endoscopy, others are for those working in the field of Inflammatory Bowel Disease, or post operative, rehabilitation or ostomy care.
- A few questions will challenge you to think outside your normal scope of practise, and require you to answer what a physician might do.

- The exam is “criterion-referenced”.
- It measures your ability to answer questions dealing with a specific content or skills domain or list of objectives.
- There is a set of competencies that have been developed, updated, and approved by the Gastroenterology Nursing Certification Exam Committee.
- For the competencies, two assumptions were made:
  - “Patient” refers to patient and/or family as defined by the patient.
  - “environment” recognizes that GI nurses practise in a wide variety of environments including hospitals, rehabilitation, continuing care, ambulatory clinic, and the community.

- According to the committee, four goals for a gastroenterology nurse are:
  - To provide care and encourage patients to function at their optimal level of wellness and autonomy throughout the continuum of care;
  - To identify alterations in health as a result of gastrointestinal disease processes and complications;
  - To assist patients in managing gastrointestinal disease processes and in adapting to lifestyle changes that may occur; and
  - To facilitate health promotion in collaboration with patients by assessing and providing education pertaining to gastrointestinal disorder risk factors. <sup>1</sup>

- They have also clearly defined the role of the Gastroenterology nurse:
  - Uses a holistic approach to assess, plan, implement and evaluate patient care;
  - Designs a plan of care to accommodate the physical, psychological, social, cultural, and spiritual needs of the patient;
  - Provides a caring, therapeutic environment for the patient in an effort to encourage engagement in care planning;
  - Advocates for the patient to enhance the continuity of care;
  - Collaborates with the health-care team to provide coordinated, comprehensive care;
  - Acts as a role model and resource;
  - Participates in continuous quality improvement;

- Acknowledges the impact of chronic and complex disease processes on the nurse and recognizes the need for self-care;
- Practises within professional, legal and ethical standards and engages in a process of self-regulation based on these standards;
- Assumes responsibility for professional development;
- Demonstrates competence in theory-based nursing care and acknowledges a responsibility and accountability for professional practise; and
- Strives to provide evidence-based nursing care and acknowledges a responsibility to support research within the specialty area. <sup>2</sup>

Categories	Approximate weights given in the total examination
Anatomy, Physiology, and Pathophysiology	20-27%
Pharmacology	8-15%
Diagnostic Tests and Therapeutic Procedures	15-22%
Gastroenterology Emergencies	8-15%
Care of the Gastroenterology Patient	23-30%
Safety, Ethics and Research	5-12%



# Structural Variables (How the exam is designed)

- There are approximately 165 multiple choice questions, presented in one of two manners:
  - Independent: these questions stand alone.
  - Case-based: approximately four questions are based on a scenario presented at the beginning of each question, and all are about the same patient situation.
    - In the certification exam, approximately 60-75% of cases are independent, and 25-40% are case-based.

- So that your competency is assessed at each level of cognition, the questions are aimed at different levels of brain processing.
  - Knowledge/Comprehension: measures your ability to recall material and to understand what it means. This may include definitions, facts, being able to interpret data.
  - Application: measures how well you are able to apply your knowledge to new situations, or in a practical situation. This would include applying rules, theories, principals etc. in your patient's care.
  - Critical thinking: measures your ability to "judge the relevance of data, to deal with abstraction and to solve problems". This would include identifying cause and effect relationships, forming conclusions, and making judgements about patient needs.

Cognitive Ability Level	Percentage of Questions on the Exam
Knowledge/Comprehension	15-30%
Application	40-55%
Critical Thinking	25-40%

# Contextual Variables (Specifies the Nursing Context)

- Patient Culture: will involve questions about how aware you are of the culture your patient comes from, and your sensitivity and respect for their values, beliefs and practises.
- Patient Health Situation: each patient needs to be looked at in a holistic manner, and the questions will reflect patients in a wide variety of situations.
- Health care Environment: since GI nurses practise in a wide variety of settings, this will be specified only if it is needed to clarify the question, or give those writing further guidance as they answer the question.



# ANATOMY AND PHYSIOLOGY

## Esophagus

# Esophagus

- This is actually the third organ of digestion, coming after the mouth and pharynx.
- It is a hollow, muscular tube approximately 23-25 cm long, and 2-3 cm wide.
- Its function is to deliver food to the stomach.
- The wall of the esophagus are composed of three layers: the mucosa, submucosa, and muscularis. Most of the other structures in the GI tract have four layers, but the esophagus is missing the serosa.
- The cells lining the esophagus are composed of stratified squamous epithelium.
- The muscle layers of the esophagus for the first five percent are striated muscle, the next 35-40% are a combination of striated and smooth muscle, while the final 50-65% is smooth muscle only.
- The Upper Esophageal Sphincter (UES) protects food from entering the lungs and is composed of cricopharyngeal muscle.

- The Lower Esophageal Sphincter (LES) (Cardiac Sphincter) controls the passage of food into the stomach.
- It is approximately 2-4 cm, but in truth is not an anatomical marking, but a physiological sphincter.
- The esophagus is supplied by both sympathetic and parasympathetic nerves, including the Vagus nerve, which supplies the striated muscle to the upper part of the esophagus.
- When you are resting, both UES and LES are closed.
- Once you swallow, the UES opens to allow the food through, and gravity, peristalsis, and the bolus of food push the food down the esophagus. As the striated muscles contract, the LES opens up to allow the food to enter. The whole process travels at approximately 3-5 cm/sec. As the bolus passes into the stomach, the LES closes, preventing reflux.

- Food passes with the assistance of gravity, and the actual bolus of food or liquid, but most of the process is through the contraction of muscles progressing from the upper to lower esophagus called peristalsis.
- If it is initiated by a swallow, it is termed “primary peristalsis”.
- It is possible for the whole bolus not to pass the first time, and to have food/liquid remaining in the esophagus.
- The esophagus will then contract to clear it, without any swallowing movement.
- This is termed “secondary peristalsis”.



# PATHOPHYSIOLOGY

## Esophagus



# Esophageal varices

- Most often caused by portal hypertension.
- Something in the portal system, often cirrhosis, causes a blockage, resulting in a scarred liver, and the hepatic vein becoming obstructed.
- The closest place for the excess to flow into is the smaller veins in the GI system.
- The esophageal veins dilate, and may become large enough to burst, and bleed.
- This can be an emergency situation, with bright red blood pouring from their mouth, and a who is in shock. Most patients have no pain, and may not even know they have this condition until they present in an emergency.
- Varices are graded on a scale from I-IV, with grades III-IV being the most likely to bleed.
- Patients are being treated earlier, as many with liver cirrhosis are being found earlier, and the emergency treatment may be prevented in many cases.

- Those with liver disease are sent for endoscopy, and if varices are present, they are placed on medications similar to Nadolol (Corgard), a non-specific beta-blocker to lower their blood pressure, and prevent progression of the varices.
- If, on endoscopy, larger varices are noted, they may be treated with ligating devices (esophageal variceal ligation (EVL)), involving placement of bands around vessels that are large enough to create bleeding.
- A patient presenting to the emergency room with an emergency bleed needs to be treated immediately with packed red blood cells, albumin, hydration, and fresh frozen plasma.
- Prognosis for an acute bleed are poor. Approximately one third will die this hospitalization, one third in the first six weeks post bleed, and the last third in the next year.
- Traditionally, sclerotherapy was used in an acute bleed to inject a medication to stop the bleeding.
- Unfortunately, there were several complications involved including perforation, inflammation of the surrounding areas, strictures or ulcers formed, and often, they would bleed at a later date.

- Presently, the use of esophageal variceal ligation is the first choice for treatment.
- Physicians may choose to include the use of Octreotide (Sandostatin) by IV infusion to help control bleeding, and one must monitor for bradycardia and seizures during its use.
- Some facilities may not have access to emergency procedures, so prior to sending patients for further care, may place a balloon tamponade (Minnesota tube or Blakemore tube) until more assistance may be obtained. Always keep scissors at the bedside for emergency care for these patients.

- In trying to prevent long term complications, a TIPS procedure (transjugular intrahepatic portosystemic shunt) may be performed by a radiologist to shunt the blood from the portal system, bypassing the liver.
- It is important for these patients to alter their lifestyle to offer them the best chance to survive:
  - Take medications as ordered.
  - Drink 2-3 cups of coffee a day.
  - Avoid aspirin, ibuprofen, naproxen, other NSAIDS.
  - Avoid alcohol and recreational drugs.
  - Low fat diet (especially for cirrhosis from fatty liver disease).
  - Treatment for Hepatitis, if applicable.

# Strictures, webs, rings

- A stricture is a formation of fibrous tissues at the lower end of the esophagus.
- It may, or may not be circumferential.
- Causes range from acid reflux damaging the area and leaving scarring, caustic injury (acid or alkaline), or infectious processes.
- Rings and webs are thin, mostly circumferential, mucosal tissue in the esophagus.
- Distinctions are made by the type of tissue involved, and their placement.
- Webs consist of mucosa and submucosa, and are often found in the upper esophagus.
- Rings consist of mucosa and muscle, are often thicker, and are typically found in the lower esophagus.
- These patients complain of dysphagia with intermittent, or progressive symptoms.

- All of them are treated with dilation, using weighted Tungsten or mercury filled bougies (Maloney or Hurst), or graduated plastic dilators designed to be placed over a wire (American or Savary-Gilliard).
- Many patients need repeat treatments at intervals to treat their dysphagia.
- Perforation is the most common complication of dilation.
- Chest pain after dilation is not normal, and needs to be evaluated.

- A patient who is immunocompromised is also prone to bacterial infection after dilation.
- It is possible that a patient with a stricture could have a malignancy underlying it, so the first time an endoscopy is performed, biopsies or brushings should be obtained to rule out cancer as a cause of the stricture.
- Schatzki's ring is found in the lower esophagus at the gastroesophageal junction. It is often the result of acid reflux, and leads to progressive dysphagia, and even food boluses. Although it can be diagnosed by a Barium swallow, an endoscopy is performed to evaluate, and treat with dilation.
- A cervical esophageal web, along with iron deficiency anemia and middle-aged women, is known as Paterson-Kelly or Plummer-Vinson syndrome. They also need to be evaluated for postcricoid carcinoma, as this may be part of the syndrome. The web will often disappear if they are treated for their IDA.

- It is not uncommon for patients to present to the emergency department, or their physician's office reporting that they have something stuck in their esophagus.
- Most often, they have noticed a progression of trouble swallowing, but have managed on their own to deal with the symptoms. Some may have experienced food stuck before, and have been able to clear the bolus.
- Foods that seem to be most difficult to swallow include meat, bread, and rice.
- At times, they have waited to report the issue, hoping it would clear on its own, but it has not. The longer they waited, the more difficult it is to resolve the problem, as the longer it sits in the esophagus, the more edematous it becomes.
- Some patients have little symptoms, while others are unable to swallow their saliva.
- Resolving a food bolus can be a difficult situation, and an endoscopy is most often required.



- If the physician can visualize the stomach, the food may be pushed into the stomach more safely, than if it has to be brought up through the mouth. Aspiration then becomes a possible complication. The use of an overtube should be considered to prevent aspiration.
- With the walls of the esophagus already edematous, using forceps, snares, nets, baskets etc. in limited space, can result in perforation. So particular care should be given in this circumstance, and caution used during the procedure.
- Some physicians may have the patient return in a few weeks for dilation on an outpatient basis, or they may choose to dilate at that point. Perforation may again be a potential complication.
- Potentially, the physician may suspect other causes for the dysphagia like EOE, and obtain esophageal biopsies.

# Gastroesophageal reflux disease (GERD)

- In adults, and children, reflux is normal.
- Reflux is defined as gastric, or duodenal contents, flowing back into the esophagus.
- It is only treated when it becomes bothersome, or symptomatic, or has caused erosions or ulcers in the esophagus.
- Often, it is because the LES has become incompetent- there is not enough pressure to stay closed, and keep acid in the stomach. Caffeine, chocolate, mints, alcohol, smoking, are a few things that can lower the pressure in the LES.
- Less common, pyloric stenosis, or a motility disorder may give symptoms of reflux.
- Patients report heartburn, epigastric pain, regurgitation, sore throat, cough, aspiration, asthma, ear infections, dysphagia, nighttime awakening with acid in their mouths, and a host of other symptoms.
- Treatment is aimed at relieving the symptoms, mucosal healing, and preventing complications associated with reflux.

Diagnostic Test	Indication	Procedure	Positive	Negative
Barium Swallow	Demonstrate reflux	Patient swallows barium, and x-ray is taken of the esophagus.	May show inflammation.	Cannot show frequency of reflux, nor associate it with other symptoms.
			Able to evaluate swallowing, motility and anatomy.	Not reliable with children.
Esophageal Manometry	If suspicious of motility issue causing reflux.	A probe is inserted into the nose, and measurements are taken to assess muscle movement.	Will show motility issues that can contribute to reflux.	Cannot confirm reflux.
Endoscopy with biopsies	To look for esophagitis.		Biopsies can confirm Barrett's esophagus to decide what therapy is needed.	
24 hour pH Study	To prove how many episodes of reflux the patient has over 24 hours	A probe is inserted into the nose, and the patient is instructed to push buttons when he has symptoms.	Accurate representation of pH levels in the esophagus for that time span.	Some patients do not tolerate it well.
			Able to associate symptoms to reflux.	Only represents that 24 hour time frame.
				may be unable to help symptoms if non-acid reflux.
Bernstein Test	Will show the difference between cardiac and non-cardiac chest pain.	. Place lower tip of NG in low esophagus and drip Hydrochloric acid to see what symptoms they have.	If patient experiences symptoms like they have with reflux, will know it is not chest pain.	May not tolerate placement of the NG tube.
Gastric Emptying Study	Assesses how fast the stomach empties.	Eat a meal with radioactive elements, and follow it over a period of hours to see how fast it empties.	Can evaluate how long food stays in the stomach.	
Nuclear Scintiscan	Assessing aspiration.	Patient swallows radioisotope, and then it is	Will demonstrate aspiration.	<b>27</b>

- There are several things that patients may do before adding medications to control reflux, or in addition to medication for reflux:
  - Reducing the substances that weaken the LES: alcohol, tea, coffee, colas, mints, chocolate, tomatoes, and licorice.
  - Reducing weight, and wearing loose clothing.
  - Reduce, or stop smoking.
  - Elevate the head of the bed on four centimeter blocks. Extra pillows will make the problem worse, by increasing abdominal pressure.
  - Avoid food two hours before laying down, and not laying down for two hours after a large meal.
  - Reduce the size of meals, and the amount of fat in the meal.
  - Many medications are useful for GERD, including antacids, H-2 blockers, and PPI which will be discussed in a different presentation.

- Those with severe reflux, esophagitis, aspiration, that cannot be controlled in any other manner, may need anti-reflux surgery.
- A Hill and Nissen Fundoplication can be performed in both an open, or laparoscopic procedure.
- The problem of reflux can be profound for a patient with a tube feed.
- Slowing the rate of the feeds, and elevating the head of the bed on blocks may prove helpful.
- Pregnant women are limited in the amount of medication that can be offered, and heartburn is often a problem as the growing baby increases the abdominal pressure, and weakens the LES. Lifestyle changes may be enough to manage the heartburn, as the symptoms will ease after delivery.
- Infants are notorious for refluxing, but the situation often resolves itself by 18 months of age. However, there are those who fail to thrive. If the baby is gaining weight, but are not aspirating, they will likely outgrow it.
- For those with severe symptoms, changing formulas may help, as well as limiting the amount eaten, placing them in an elevated position after feeding, and quiet time for an hour after feeding.
- Metoclopramide (Reglan) may be used to increase motility, or H2 blockers to avoid damage from reflux.
- Up to 15% of infants may require a Nissen Fundoplication.

# Esophageal ulcers

- Irritation of the esophagus, if untreated, may lead to erosions, and then to ulceration, which can extend several centimeters into the esophagus.
- Severe ulcerative esophagitis can be treated with PPI's and lifestyle modifications, but at times more is required.
- Even with treatment, some patients will have refractive ulcerations.
- They may present with difficulty swallowing, heartburn, chest pain, or complain of regurgitation.
- A 24 hr pH test can give the physician information as to how much acid is in the esophagus for that time frame, and how high it rises in the esophagus.

# Barrett's Esophagus

- Esophagitis is inflammation in the esophagus, often the result of acid reflux.
- Barrett's esophagus is different. Over years, acid has caused the lining of the esophagus to change from squamous cell lining to columnar lining, more typical of the lining of the small intestine, and is often referred to as "intestinal metaplasia".
- It occurs in up to 20% of patients with chronic GERD.
- Biopsies are obtained under endoscopy if the physician is suspicious of Barrett's, and confirmed or denied by pathology.
- All patients with Barrett's should be on a PPI for life due to the high risk of progression to cancer. PPI's reduce the risk of metastatic progression by 75%.
- The Seattle Protocol suggests taking 4 biopsies for every 2 cm of Barrett's esophagus, and then, depending on the severity, repeating it every 6 months to 3 years.
- There is no rule to follow that always works.
- Barrett's can progress to low level dysplasia, then high level dysplasia, and finally, to esophageal cancer.
- In North America, the statistics say that the prevalence of adenoma carcinoma in those with Barrett's esophagus is 30-50% higher than those without it.

- If a patient has progression to low or high level dysplasia, there are a few treatment options.
- Photodynamic Therapy can be used to lessen the dysplasia. Patients are given a dose of photosensitizer, and then exposed to light rays. Complications include stricture formation, and a light sensitivity. They should stay out of the sun for 3-4 weeks.
- Argon Plasma Coagulation has been used for low to high grade dysplasia, with complications including bleeding, perforation, strictures, chest pain and fever. The biggest concern, however, is that the outer layers reverted to squamous cells, but inner layers continued to develop into adenocarcinoma, masked by normal looking cells.



- Endoscopic Mucosal Resection

- Using equipment similar to a variceal ligator, the area to be removed is suctioned into a cap, and the band applied. A snare is then used to remove the area, band included. It is suctioned into the cap, and removed. There are several bands on the cap, so more than one area may be removed at a time.
- Another method is to inject the area around the dysplasia with saline, then use a specially designed cap and snare to remove the suspicious nodule.
- Both these methods carry the risk of perforation, bleeding, infection, and leaving cells behind.

- The latest technique to treat dysplasia in the esophagus is radio frequency ablation.
- Dysplasia only exists in the mucosa of the esophagus, and RFA uses radio waves, combined with heat, to destroy the tissues of the mucosa, not damaging anything else beneath.
- If the patient remains on high dose PPI, the tissue that regrows will probably be normal squamous cells, and the Barrett's will be gone.
- Studies have demonstrated the chances of renewed adenomatous growth under the treated area are rare.
- Most patients require more than one treatment, and then close follow up for the first few years.
- Complications include chest pain, sore throat, bleeding, perforation, strictures, and dysphagia.
- An endoscopy is performed to evaluate the area, and note is taken of the length of the Barrett's, and if there are nodules present.
- Nodules are removed with EMR, and the patient brought back for another appointment in 3 months for ablation therapy.

# Esophageal cancer

- Esophageal cancer is one of the most aggressive of tumors, with a 5 year survival rate of approximately 10%.
- It is estimated that in 2015:
  - 2,200 Canadians will be diagnosed with esophageal cancer.
  - 2,100 Canadians will die from esophageal cancer.
  - 1,700 men will be diagnosed with esophageal cancer and 1,600 will die from it.
  - 500 women will be diagnosed with esophageal cancer and 460 will die from it.
- Based on 2010 estimates:
  - About 1 in 116 Canadian men is expected to develop esophageal cancer during his lifetime and 1 in 106 will die from it.
  - About 1 in 348 Canadian women is expected to develop esophageal cancer during her lifetime and 1 in 324 will die from it.

- Even more concerning, is that, while other cancer rates have fallen, thanks, in part, to better detection rates, better medications, and better efforts from many people to curb habits that contribute to cancer, esophageal cancer is on the rise.
- In 1975, most cancers of the esophagus were of the squamous type (75%), and were located in the middle of the esophagus. It was thought that alcohol and tobacco contributed to this type of cancer, and those of Asian and African descent were more at risk, from genetic factors.
- In 1975, adenocarcinomas of the esophagus accounted for 4:1,000,000 people. By 2001, those rates were 23:1,000,000, making it the fastest growing cancer in the US. This type is most often at the GE junction, and begins as Barrett's esophagus. It is possible that obesity contributes to this cancer.
- Not only has adenocarcinoma outstripped squamous cell carcinomas of the esophagus numerically, but the total rates of esophageal cancers have risen.

- Very quiet.
- First symptom is often difficulty swallowing, back pain, anorexia, weight loss, anemia, cough.
- High risk patients: over age 55, alcohol use, chewing tobacco, exposure to toxins, HPV, GERD, achalasia patients.
- 45% of patients have NO reflux symptoms.
- An endoscopy will confirm the diagnosis with biopsies, but it is often too late to act.
- An Endoscopic Ultrasound will confirm the spread, and if it is small, an EMR to remove it is possible.
- Survival rate is 3% or less.
- Surgery may be performed to remove the esophagus, or for advanced tumors, radiation or photodynamic therapy.
- An obstruction needs to be dilated, or a stent placed for palliation.

# Mallory-weiss tear

- This is a specific tear that occurs only at the GE junction, and runs in a linear direction through the GE junction.
- It occurs when the pressure in the intra-abdominal cavity is increased.
- Pushing during labour, forceful vomiting, insertion of gastroscopy during endoscopy, trauma, improper insertion of naso-gastric tube can all be culprits leading to this tear.
- A key question to ask is did you vomit first, and then vomit blood, or did you vomit blood first? The first person is more likely to have a Mallory-Weiss tear.
- It often heals on its own, with no treatment, and if there is 24-48 hr wait between the vomiting blood and the endoscopy, you may not even see anything.
- If the bleeding is severe, it can be controlled by endoscopic clips, injection of adrenalin, or thermal therapy.

# Motility disorders

- Anything that interrupts the normal function of the muscle of the esophagus or either of the sphincters is a motility disorder.
- What the patients find most frustrating is that it can be diagnosed, but there are few treatments available for most of them.
- They can all be diagnosed through a motility study, using a probe with sensors to measure the muscle movement of the esophagus as a bolus of liquid passes through it.
- It will demonstrate the contractions as the swallow passes, as well as measures the strength of both the LES and UES, the strength of the contractions, and the direction the swallow is moving.
- A hiatal hernia can also be accurately measured.
- The Chicago Classification is the newest system to plot disorders.

- Achalasia has three key features, although all may not be present.
- Peristalsis occurs at the same time, as the whole esophagus contracts together.
- High pressures in the Lower Esophageal Sphincter.
- Little or no relaxation in the LES as the esophagus contracts.
- These patients report chest pain, dysphagia, aspiration, weight loss, and sudden, unexpected regurgitation.
- There is no known cause, but it does tend to run in families.
- There is an increased risk of esophageal cancer with achalasia.
- A patient may casually tell you they drink a litre of water or more at meals. That is important information for the physician.
- A Barium swallow will show a wide, loose esophagus, coming down sharply to a “bird beak” appearance at the LES.



- If the motility confirms achalasia, the patient may be sent for a Heller's myotomy to cut the muscles of the LES, or the GI physician may arrange an endoscopy to balloon dilate the LES in an attempt to destroy it.
- Botulinum toxin can be used in four quadrants of the LES to paralyse it if they are not a candidate for either. This will temporarily paralyse the LES.
- Nifedipine (Adalat), a calcium channel blocker, may be used to decrease the pressure.
- Diffuse Esophageal Function (DES) has no known cause, or pathophysiology.
- Patients report chest pain that is so severe, it may mimic a heart attack. They may also report dysphagia, and be most severe with extreme temperatures.

- A motility study will probably show normal LES pressures, some normal peristalsis, but many that contract all at the same time, and do not stop. Only the first is triggered by a swallow, so the latter ones are secondary contractions.
- Giving nitroglycerin may help, as it relaxes smooth muscle.
- Medications have shown to have a mild effect: nitrates, anticholinergics, smooth muscle relaxants, or calcium channel blockers.
- If it is severe, and there is no response to the medication, dilation may give some relief, and a long esophagomyotomy to cut the muscles of the esophagus may be performed.
- Nutcracker Esophagus has normal LES pressures, but the contractions are 2-3 times stronger than normal.
- It is the most common cause of non-cardiac chest pain.
- The same medications as for DES may be used.

# Diverticula

- A diverticulum is an out-pouching in the esophagus.
- It can occur anywhere from the proximal to the distal esophagus.
- Zenker's Diverticulum
  - It is a false diverticulum (not involving all layers of the esophageal wall).
  - There is no known cause, but it is thought that a weakened UES may be a contributing factor.
- Patients report trouble swallowing, gurgling noises when talking, cough, aspiration, halitosis (food decaying in the diverticulum), or regurgitation.
- A Barium Swallow will diagnose it, as will an endoscopy where the clinician suspects its presence.
- If surgery is necessary, the diverticulum may be removed.
- If the patient is not a surgical candidate, it may be improved with a Zenker's diverticulotomy performed under endoscopy.

- A traction diverticulum is probably unnoticed until it is found on endoscopy.
- They may be caused by a motility disorder, or a lung tumor that has increased the intra-thoracic pressure, and pulled the esophagus towards it.
- Epiphrenic diverticulum is found just above the LES and may be related to an incoordination between the LES and the esophageal contractions.
- The patient with this difficulty may bring up significant quantities of liquids when lying flat.
- Surgery may be considered if it is severe.

# Eosinophilic esophagitis (EOE)

- Even 15 years ago, this was considered a rare condition.
- Today, more and more people are being found to have this esophageal condition.
- A typical patient is young (under 30 years old), male, with many environmental allergies, who reports dysphagia.
- Another name for it is allergic esophagus.
- Often they present to the emergency room with food stuck in their esophagus, and a long history of dysphagia, unreported to physicians.
- On endoscopy, the esophagus is ringed in appearance (trachealization of the esophagus), and when biopsies are obtained, it is very difficult to pull the tissue from the site.
- Pathology will show 15-20 eosinophils on a high powered field.
- A significant number will respond to PPI therapy, while others will require H2 blockers, montelukast (Singulair), or steroid inhalers (to be swallowed).

# Infections

- The most common infection of the esophagus in Canada is candidiasis.
- The patient probably has an underlying condition that may contribute to it, such as diabetes, immunocompromised, or steroid medications (including inhalers).
- Many report difficulty swallowing.
- An endoscopy will show small white patches that cannot be removed with flushing.
- Brushings or biopsies will confirm it.
- Nystatin may be used, or fluconazole if it is more severe.
- Other causes of esophageal infections include herpes, cytomegalovirus, or HIV.
- All can cause dysphagia, and are diagnosed with brushes for cytology.
- These patients are already immunocompromised.

# Foreign bodies

- People will swallow anything, especially children, or patients with psychiatric issues.
- The greatest danger is when things get stuck, or are sharp, and have to be removed.
- A variety of tools are available, the same as for a food bolus.
- X-ray images can be helpful in identifying where the object is and how it is positioned.
- Batteries swallowed by children need to be removed swiftly before the fluids can corrode the battery.
- Complications include perforation and bleeding.
- Occasionally, surgery may be required. For instance, if the object is too close to the pharynx, if it has gone out of scope reach, if it has already perforated, or if they have swallowed bags of narcotics, those are all cases for the surgeon.

# Caustic injuries

- Patients can accidentally or deliberately swallow alkaline or acidic substances.
- When they first present, they may have dysphagia, or odynophagia, accompanied by chest pain.
- Like any other burn, it is classed as first, second or third degree.
- You do not want to induce vomiting in these patients, but those who have ingested acid may be asked to drink milk in order to dilute the mixture.
- An alkaline substance will probably cause more damage than an acid substance.
- When the incident first occurs, x-rays may be obtained, and if there is no sign of perforation, an endoscopy carried out.



- Very little may be seen over the first few hours, but in 24-48 hours, the damage will become more evident, as the scope is repeated.
- They need hydration, and a strict NPO status until the damage begins to heal.
- In the coming weeks and months, they will be re-evaluated, and if there has been sufficient damage to stricture, they will require dilation.
- If the case is severe, and the lungs are involved, a respirologist is consulted, and intubation may be required.
- These patients are at a much higher risk of squamous cell cancer post injury.

# Congenital defects

- Atresia: the esophagus does not connect to the stomach, but ends in a blind sac.
- The baby will cough, become cyanotic, and regurgitate feedings.
- Often, they will have fistulas connecting the trachea and the esophagus in at least one area.
- An x-ray will confirm the diagnosis, and surgery must be performed promptly to seal the fistulas, and repair the esophagus.
- The earlier it is found, the better the prognosis.

# Stomach

## Anatomy and Physiology

- The stomach consists of four main areas:
  - The cardia: the area just as you enter the stomach from the esophagus.
  - The fundus: the upper portion of the stomach, shaped like a dome.
  - The body: below the fundus, ending at the incisura angularis.
  - The antrum: the very bottom of the stomach, ending at the pylorus, the thick muscular ring that is the control for food entering the small intestine.

- The wall of the stomach are composed of five layers:
  - The serosa(the outside layer)
  - The subserosa
  - The muscularis propria
  - The submucosa
  - The mucosa (the innermost layer)

The muscles of the stomach have three layers that are involved in the peristaltic movement of food for the digestive process.

- Inside the stomach, the walls are arranged in a multitude of folds called rugae, which allow for distention, and churning of the food particles.
- The vagus nerve is the parasympathetic supply for the stomach, and is involved in acid secretion and the movement of food through the stomach.
- Sympathetic nerve supply is provided by the celiac ganglia and splanchnic nerves. These are responsible for pain, secretion and motility.
- The stomach's main function is to start the digestion both by chemical and mechanical processes. As well, it is a storage facility for the food content, and regulates how much passes into the small intestine. The liquid and food mixture is termed chyme.

- Three types of glands are involved in secretion:
  - Cardiac glands: mucus and pepsinogens secreted
  - Pyloric glands: mucus and pepsinogens secreted
  - G cells: gastrin secreted
  - Oxyntic glands: are four kinds of cells in these glands:
    - chief cells: secretes pepsinogens
    - Parietal cells: hydrochloric acid and intrinsic factor are secreted
    - Mucus neck cells
    - Endocrine cells

# Pathophysiology

## Stomach



# Hiatal Hernia

- As people age, the opening in the diaphragm that the esophagus runs through may widen, allowing the upper portion of the fundus to slide through.
- They may report reflux, heartburn, regurgitation, a feeling of food sticking, or even chest pain.
- These patients may develop LES weakening.
- Diagnosis may be determined by barium swallow, chest x-ray, endoscopic examination, or a motility study will clearly demonstrate a hiatal hernia.
- This is normally not an emergency condition, and most patients are managed with PPI medication and lifestyle changes, but occasionally a patient may develop a paraesophageal hernia that can become strangled, and needs immediate surgery before infarction develops.

- A Nissen fundoplication may be performed as an open procedure, or laparoscopically for both patients who are emergencies, or those who choose to have it done.
- Occasionally, someone with a large hiatal hernia may develop linear erosions that run straight down in the diaphragmatic hernia area.
- This is termed Cameron's erosions. They are caused by the constant rubbing together of the stomach lining each time the patient breaths.
- Some patients with iron deficiency anemia can be attributed to Cameron's.

# Gastritis

- Is defined as inflammation of the mucosa in the stomach.
- It may be mild or severe, and it could be acute, or chronic.
- Anything that disturbs the mucus layer can contribute to gastritis: h. pylori infection or other bacteria/viruses, NSAIDS, alcohol, cigarette smoking, previous stomach surgery, ASA, allergic reactions, parasites, or lymphoma.
- Some patients may have low iron or hemoglobin as a result of a slow leak, or if the irritation is acute, there may be a significant blood loss in a short span of time.
- The most accurate diagnosis is by endoscopy, but blood work may also be obtained for gastrin levels.

- For patients with an acute bleed, thermal therapy (heater probe, bipolar probe, etc.) may be used, as well as adrenalin injection, clip application, APC treatment, or Hemospray.
- For patients with a chronic bleed, APC therapy is helpful.
- All these patients will probably need PPI therapy, with, or without H<sub>2</sub> blockers, and the physician may add sucralfate.
- Ask about specific behaviours, including smoking, alcohol, NSAID use, recent illnesses, and if they are taking their PPI at the proper time.

# Gastric Ulcers/Peptic Ulcer Disease

- Irritation can in turn, lead further to erosions, and full blown ulcers.
- Anything disturbing the mucus layer can continue to do so, and cause the erosions to widen, and deepen, leading to hemorrhage as it penetrates the blood vessels, and to perforate the stomach as it develops even deeper. Those in the pylorus may cause obstruction. Ulcers may even penetrate into surrounding organs, particularly the liver or colon.
- Contributing agents may include NSAIDs, cigarette smoking, h. pylori, family history of ulcers, some medications (steroids, for example), and gastrinomas such as those in Zollinger-Ellison syndrome.

- Patients may report burning pain in the epigastric area, nausea, indigestion, black stools, loss of appetite and weight loss.
- Later symptoms include abdominal pain spread to back, and vomiting blood.
- Intervention is critical at that point.
- The best way to diagnose an ulcer is through endoscopy.
- The most common site for ulcers is the pylorus, and the greater curvature of the stomach.
- Bleeding ulcers may be treated with thermal therapy, APC, injections of adrenalin, clips, or Hemospray.
- If it has penetrated or perforated, surgery is required.

- Surgery was done routinely for ulcers prior to the advent of H<sub>2</sub> blockers and, later, PPI therapy.
- Most ulcers are now found in an earlier state, and can be treated less aggressively.
- All gastric ulcers should be biopsied because they are potentially malignant, and a repeat upper endoscopy scheduled for 2-3 months after the original scope to ensure healing has occurred.
- Medications are the first line of healing for gastric ulcers, and include: PPI's, H<sub>2</sub> blockers, sucralfate, or antacids.
- Surgical intervention is usually if there is hemorrhage, or perforation. A Bilroth 1, Bilroth 2, gastric resection, or total gastrectomy may be performed, depending on the location of the ulcer.

- Be aware that post operative patients with stomach surgery are at risk for hemorrhage, further ulcer development, weight loss, anorexia, bile reflux into the stomach, dumping syndrome, nutritional deficiencies, and chronic diarrhea.
- These patients all require routine endoscopy over their lifetime as stomach surgery increases their risk of gastric cancer.



# Gastric Cancer

- There is no definite cause for gastric cancer, and it may stem from any number of factors.
- Those at high risk include men, someone who is positive for h. pylori, those with a family history of gastric cancer, those who eat a high starch diet, those who eat preserved foods, including pickled meat or vegetables, or who are eating a diet low in fruits and vegetables.
- Most of these cancers are adenocarcinoma, but GIST, lymphoma, carcinoid, and squamous cell are all possible.

- Symptoms are often non-specific, and may include anemia, anorexia, nausea or vomiting, feeling full after a small meal, weight loss, or tired.
- Diagnosis is best made with endoscopy, although CT scan and x-rays may be useful. Biopsies may be done to confirm type of cancer.
- If it is very small, and has not spread, and EMR may be used to remove the lesion, but surgery is the usual option.
- If the patient is not a surgical candidate, the physician may try to inject absolute alcohol into the lesion to shrink it, and delay the spread.
- For a patient with metastasis, palliation is the only choice. Chemotherapy or radiation may be useful.

# Stress Ulcers

- There is a disagreement on whether or not life stresses can cause gastric ulcers.
- This is a different type of ulcer.
- It develops when the body is under a particular physical stress of a severe illness:
  - Trauma
  - Burns (Curling's ulcer)
  - Head injury (Cushing's ulcer)

Usually, the first sign of this ulcer is severe bleeding, so an endoscopy is performed, and the bleeding controlled.

# Gastric Varices

- Gastric varices have the same etiology as esophageal varices. Portal hypertension has increased the size of the veins in the fundus of the stomach.
- Two thirds of patients with esophageal varices will also have gastric varices.
- If these bleed, the mortality rate increases significantly.
- Sclerotherapy is used to inject into the varix, filling the area of bleeding, and allowing it to stop. N-butyl-2-cyanoacrylate (Histacryl) is in use in Canada.
- Potential side effects includes embolization, perforation, and leaking of glue into surrounding area.
- Interventional radiology can perform a percutaneous transhepatic embolization, or a TIPS procedure if endoscopy is not successful.

# Gastric Outlet Obstruction

- When the pylorus is too tight, and the food is not able to pass into the duodenum, patients may report pain, or nausea and vomiting.
- Often seen in boys under the age of 12 weeks, especially if they are premature. Pyloric stenosis causes them to projectile vomit, becoming dehydrated, with electrolyte imbalances.
- Surgery is the treatment in the case of infants to release the sphincter.
- In an adult, peptic ulcer disease may have contributed to the obstruction.
- An endoscopy may be performed, and the pylorus dilated with a balloon to relieve the obstruction, or, if unsuccessful, surgery performed.

# Bezoars

- Anything that is not digestible can clump together to form a concentration in the stomach.
- Diabetics have slower motility, and are prone to food staying in the stomach longer, and those who have had previous stomach surgery may also have bezoars of food.
- Others ingest things that are indigestible deliberately.
- A phytobezoar is composed of plant material (grass, leaves, roots, or skins of fruit).
- A trichobezoar is composed of hair.
- Psychiatric patients may struggle with these issues.

- A patient may report nausea, anorexia, vomiting, or pain.
- X-rays may show a bezoar, but endoscopy can not only see it, but be able to retrieve it using snares, baskets or nets.
- A food bezoar may require a gastric lavage to remove. Remember this is a high aspiration procedure on a sedated patient.
- Occasionally, surgical intervention is required to open the stomach and remove the offending object, especially in the case of a trichobezoar that fills the stomach completely.
- In even rarer circumstances, objects may fill the entire stomach, and need to be removed in a lengthy procedure (e.g. 175 quarters).

# Gastric Antral Variceal Ectasia (GAVE)

- Most commonly termed “watermelon stomach” because of the specific pattern of bleeding that occurs, strongly resembling the fruit.
- Patients see their physician with reports of weakness, tiredness, black stools, or vomiting blood. Blood work will show anemia, at times severe enough to require a transfusion.
- CT scans, or other x-rays may be ordered, but the diagnosis is plain on upper endoscopy when the red, raised lesions are seen in a linear pattern, appearing to originate at the pylorus. It is possible to even see the blood leaking from the areas.
- This is not usually an acute process, but a chronic one that is a slow loss of blood.



- There is no definite cause, but those with liver cirrhosis, portal hypertension, chronic renal failure, CREST syndrome (calcinosis, Raynaud's phenomenon, esophageal dysmotility, sclerodactyly, and telangiectasia), or autoimmune disorders are more prone. Also at risk are women over the age of 70.
- Treatment is often long term, and is repeated at regular intervals, or when the patient has required transfusions.
- Argon Plasma Coagulation is used to burn the bleeding areas, creating scarring, and allowing it to heal.
- Laser light may also be used endoscopically for the same purpose.
- A few patients may be treated successfully, and cured, but many require more than one treatment, and many more are regulars in the endoscopy clinic.
- PPI's have been used to improve bleeding with some success.
- Currently there are investigations in the use of Radio Frequency Ablation to treat GAVE.

# Infections

- With more patients using chemotherapy, and those who are immunocompromised, infections are less rare than they used to be, but are still not frequently seen.
- It is possible to have parasites (giardia), CMV, tuberculosis, syphilis, and candida.
- The most frequently diagnosed infection is helicobacter pylori.

# Helicobacter Pylori

- In the early 1980's, a link was demonstrated between this bacteria and peptic ulcer disease.
- It is not destroyed by the stomach acid because it is able to use the flagellum of the tail to burrow underneath the surface mucosa.
- The most common place for it to grow is the antrum, unless previous attempts have been made to eradicate it, and then it moves to the body, or the incisura angularis.
- No one is able to demonstrate the origin, but it is thought to have an oral-fecal transmission, or an oral-oral transmission.
- It is more common in third world countries, or overcrowded areas, or areas with poor sanitation, but is seen in all countries in the world.

- Reported symptoms include pain, nausea, anorexia, anemia, indigestion, or weight loss.
- Blood tests, stool tests, and breath tests are available to check for the bacteria, but the best way is by endoscopy, with biopsies for rapid urease detection, or histology.
- It is important to treat h. pylori, as those with the bacteria may have gastritis, duodenitis, or ulcers. H. pylori has a high correlation to gastric cancer, another reason to attempt to eliminate it.
- The current recommendations in Canada for first line drug therapy are the quadruple therapies: PBMT (PPI, Bismuth, Metronidazole, Tetracycline) and PAMC (PPI, Amoxicillin, Metronidazole and Clarithromycin) for a two week regimen. There are other combinations, but these are the first line. All are difficult to take, and if someone is allergic to penicillin, it becomes even more difficult.
- After treatment is completed, a stool or breath test may be obtained to confirm eradication.

# Anorexia Nervosa

- An eating disorder that may cause people to lose too much weight for their body size.
- They may feel fat, or think they look fat, even when confronted with a mirror or photos that show them severely under weight.
- They may be afraid to gain weight, and stop eating, or exercise excessively. It is not uncommon for them to be obsessed with the weight scales.
- No one is able to state a definite cause, but society's focus on thin body types may contribute.

- It may begin in pre-teen or early teen years, and it is more common in females than males.
- Often there is an issue with their self image, or food, or society's image of perfection. They may be obsessive about other things in their lives, as well.
- You will see a person too concerned about how much they are eating and exercising, an image of their body that is not reasonable, unable to believe that they are not overweight, and someone who continues to lose weight despite being underweight already.
- They are cold, wearing multiple layers of clothes, have no muscle or fat tissue over bones, may have osteoporosis, are depressed, or confused, and they will not want to join you for meals.
- If they eat with you, they may just move the food on their plate, or cut it into small pieces. After a meal they may go to the bathroom, or take diuretics/laxatives to move things along.

- Testing should include CBC, lytes, liver enzymes, albumin, thyroid, kidney function, bone density, ECG and urinalysis.
- Treatment is often rejected, and it may take persistence to have the person accept therapy.
- Therapy is life long, beginning with an in patient program with emphasis on psychological evaluation to attempt to find the root of the issues, and heal them. Once the patient has begun to eat, and gain weight, they may be moved to an outpatient program with more therapy and support.
- It is helpful if they attend support groups after the treatment, to find help when they are tempted to go back to old ways of coping with their problems.

# Bulimia

- Another eating disorder that may be found with Anorexia.
- These patients feel a loss of control, and binge, eating huge amounts of calories, then vomiting, or using laxatives to purge the calories.
- Again, more common in young women, these girls often know the behaviour is not normal, and try to hide their behaviours.
- No one factor is known to be a cause, but a combination of social, cultural, genetic, psychological or emotional factors are the issue.



- These patients are more difficult to identify, because most of them are a normal weight. You have to look more closely.
- You may see a lot of cavities, dehydration, cuts on the fingers from where they put their fingers in their throat to force vomiting, esophagitis from reflux of acids, Mallory-Weiss tears, hemorrhoids from diarrhea, constipation from overuse of laxatives, cardiac arrhythmias from low potassium levels, or even pancreatic damage.
- Therapy includes psychological approaches, and the use of SSRI's (selective serotonin-reuptake inhibitors) to ease symptoms.
- Prognosis depends on whether the individual realizes they need help, and if they are willing to work on it over a lifetime.

# Metabolic Syndrome

- Identified less than 20 years ago, practitioners are still debating over what is really is, but it is a topic high on everyone's list to discuss.
- Approximately 1:6 Americans have this problem, but it is most prevalent in those of African, Asian, Hispanic, and indigenous populations, and the older one is, the more likely they are to have it.
- It is actually a group of diseases, that together form a syndrome.
- Included are high cholesterol, high blood pressure, high blood glucose, and abdominal fat.
- Having the syndrome doubles your chance of heart disease, and quintuples your chance of diabetes.

Large waist size	Men 40 inches or larger (102 cm)	Women 35 inches or larger (89 cm)
High triglycerides	150 mg/dl (1.7 mmol/l)	
Low HDL	Men less than 40 mg/dl (0.56 mmol/l)	Women less than 50 mg/dl (0.45 mmol/l)
Blood pressure	Greater than 135/85	
Fasting blood sugar	Greater than 100mg/dl (5.5 mmol/l)	

- Three or more of these is a diagnosis of metabolic syndrome.
- Risk factors may include insulin resistance, abdominal obesity, eating high calories, exercising little, and hormonal imbalances.
- It is not a death sentence, but a call to a healthier lifestyle of exercise, weight loss, diabetes control, cholesterol control, and healthy eating.

# Malnutrition

- There are several factors that may cause a person to not be able to eat a healthy diet.
- Around the world, there are many who cannot afford it. There are those who are overweight, but are in reality, malnourished, because they cannot afford healthy food, and processed food is less expensive.
- Countries may be in the middle of a war, or famine, or flood, or have experienced other natural disasters.
- Some people have eating disorders that leave them malnourished.
- Physical disorders may make patients unable to eat (achalasia), or may speed up the process of digestion so fast that food does not have the time to release the nutrition (dumping syndrome).
- Other medical conditions inhibit the ability of the body to absorb nutrition (celiac).

- Children who do not receive adequate nutrition may develop lifelong complications (weakened bones, teeth, muscles not developed properly)
- Symptoms vary by what is missing from the diet, but one might expect fatigue, dehydration, weight loss, anemia and electrolyte imbalances from most patients. Death is certainly a possibility.
- Lab work should include CBC, lytes, total protein, and albumin, along with a nutritional assessment.
- The cure is to replace what is missing, and do whatever is possible to promote healthy eating. This may include a psychologist's care whose speciality is eating disorders.
- Prognosis varies, depending on what the cause of the malnutrition is, and it may be very difficult to obtain help for those who require it the most.

# Bariatric Patients

- Defined by the World Health Organization as obese if the body mass index is above 30, or severely obese if the BMI is above 40.
- The WHO reports over one billion people meet this definition.
- Many of those in the health care profession have noted that we are not well equipped to handle these patients.
- They are more prone to sleep apnea (a difficulty for those in endoscopy clinics), respiratory illnesses, high blood pressure, high cholesterol, stroke, heart attack, skin disorders, gall bladder disease, certain cancers, and statistically, they are likely to die 10-15 years earlier than others.

- Many of our stretchers are not able to accommodate the weights of some of our population.
- When you have to move the stretcher, use the steer option on them, and get assistance from colleagues.
- If transfers are required, and the patient is unable to assist you, use slide boards/sheets, lifts, extra assistance to pull, turn and reposition.
- Always use correct lifting techniques.
- When sedating, ask if they have sleep apnea. If a respiratory therapist is available, have them come for the endoscopy case to assist.
- Be prepared with reversal drugs in the case of an emergency.
- Never break confidentiality or discuss a patient's weight with your co-workers.



- It is becoming more common to see patients who are post bariatric surgery in the endoscopy clinic.
- The “gold standard” is considered the gastric bypass, or Roux-en-y procedure which connects the fundus of the stomach with the small intestine.
- Thus, fewer calories can be consumed at a time.
- The downside is, it can stretch, and allow the person to eat more at a time. Patients can also have difficulties with vitamin deficiencies.
- The gastric sleeve removes most of the stomach, leaving the area above and below the lesser curvature.
- Less complicated surgically, it still has the issues associated with the bypass.
- The gastric band is performed less often than the previous two, and is an adjustable balloon that tightens around the fundus of the stomach, allowing less food through.
- It may not work as effectively as the other two procedures.

# Enteral Nutrition

- Percutaneous endoscopic gastrostomy is usually performed in the endoscopy suite, but there are a number of ways to feed a patient who is unable to consume his own nutrition.
- NG tubes may be used in the short term, but have a high risk of aspiration, jejunostomy tubes are often inserted in ICU settings, or in radiology, and are appropriate for patients who need surgery on their GI tract, with less risk of aspiration.
- PEG tubes can be inserted for those who are unconscious, physically unable to eat, have strictures, aspirate on food, have experienced trauma, are physically challenged, or diagnosed with progressive neurological diseases (multiple sclerosis, ALS, etc.).
- They are able to be left in long term, and are easy enough for family members to use at home.
- It is even possible to remove the previous tube, and replace it with a shorter button, making it easier to manage clothing.

- When feeding a patient who is in the hospital setting, check the tube prior to feeding to ensure the tube is still at the correct number of centimeters at the skin.
- Aspirate to check for stomach contents at least once a shift for continuous feeds, and before a bolus feed.
- The head and chest should be elevated prior to feeding a bolus, and for an hour post bolus, and elevated at all times for continuous feeds.
- Rate of feeds and types of feeds will be determined by the dietician, starting slowly, and increasing until goal has been reached.
- Prior to giving medications, and after each medication, tube should be flushed with 15-30 ml warm water to maintain patency.
- If you are giving bolus feeds, flush with 60 ml water after feed, and 60 ml water every 4 hours for continuous feeds (follow hospital policy if different...these are guidelines only).
- For tubings that are blocked, never use Coke. Use warm water to try to unblock. Remember to crush meds finely, and flush well.

- Aspiration is the most common complication, and may be prevented by keeping their head and chest in an upright position. If this is not effective, the physician may decide to place a j-tube instead.
- Intake and output measurements are important, as it is possible to become dehydrated. Monitor bowel movements, as constipation and diarrhea are also problems. You may have to consider a change of formulas. Nausea and vomiting are possible, especially if the stomach is not emptying well. Monitor for distention, and check for bowel sounds each shift.
- PEG tubes are durable, and can stay in for months, but it is possible they may become broken, especially at the medication port. This requires the placement of a new PEG via endoscopy.

- Occasionally, the stoma site is well established, and begins to leak stomach contents onto the skin, and the skin breaks down quickly under this assault. Good skin care needs to be done to prevent further problems. Barrier ointments, frequent dressing changes, and referral to wound care may be needed.
- Each shift, examine the bumper at the base of the tube to ensure it is not too loose, nor too tight. Too loose will cause it to move too much, and too tight can cause necrosis of the inside stomach wall.

# Small Intestine

## Anatomy and Physiology

○ The small intestine is approximately 5-6 m (16-19 feet), and is composed of four layers:

- Mucosa
- Submucosa
- Muscularis
- Serosa

The first 30 cm (12 inches) is the duodenum, the next two fifths is the jejunum, and the final three fifths is the ileum, ending at the ileocecal valve.

- The inside of the small intestine is covered with finger-like projections called villi, which are involved in the absorption of nutrition.
- The folds, along with the villi, increase the ability of the small intestine to absorb by 600 times.
- The stomach dumps almost 8 liters of fluid each day into the small intestine, and by the time it reaches the large intestine, that number is about 1000-1500 ml.
- The duodenum is responsible for the absorption of iron and calcium.
- The jejunum is responsible for the absorption of protein, fat and carbohydrates.
- The ileum is responsible for the absorption of bile acids and vitamin B 12.



- The small bowel also secretes mucus, hormones, and digestive juices.
- This is also where the intestinal flora is regulated.
- As the digested food moves along, the villi absorb nutrition, and the peristaltic movement propels it along until the ileocecal valve is reached, and the food received by the large intestine.

# The Small Intestine

## Pathophysiology

# Duodenitis

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- Inflammation of the small intestine is caused by the same mechanism as the stomach.
- Endoscopy demonstrates reddened areas, and biopsies will be obtained.
- Most often, *h. pylori* will be isolated, and the patient will need appropriate therapy.

# Duodenal Ulcer

- Almost all duodenal ulcers are caused by *h. pylori*.
- It occurs when something removes the protective mucus layer of the small intestine, and the bacteria takes hold.
- The most common site is in the duodenal bulb.
- Symptoms include heartburn, epigastric pain, or they may be silent, the first symptom being a GI bleed.
- These are very likely to perforate, or hemorrhage.

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- If the patient has a stable ulcer, with no fresh bleeding noted, biopsies, then treatment with a PPI to cure the ulcer is recommended.
  - If there is fresh bleeding, injection of adrenalin, thermal therapy, clip application, or Hemospray may be used.
  - Less commonly, surgery may be required, especially for perforation.

# Celiac Disease (Celiac Sprue)

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- In the 1940's when bread was difficult to come by in the Netherlands, a group of children who were malnourished began to improve in their health.
- It was discovered that they were unable to process gluten present in the wheat.
- Celiac is described as the inability of the body to absorb gluten.
- Gluten is found in wheat, rye, barley, and anything in their by-products.

- Very common in Canada; as many as 1:22 may be affected.
- Most common in those of Western European descent, especially Irish, and Italian.
- It is genetic, and environmental. If you have a first degree relative with Celiac, you have a 1:20 chance of having the disease.
- It is most common in women, those aged 1-2, and it peaks again in the 20's, and 70's.
- For every person diagnosed, seven more go undiagnosed.

- Symptoms vary widely, and can be difficult to diagnose: bloating, pain, diarrhea, vomiting, constipation, weight loss, iron deficiency anemia, fatigue, steatorrhea, malnutrition, anorexia, osteoporosis, arthritis, infertility, depression.
- Many women go to the physician with infertility issues, and celiac may be the culprit.
- A TTG lab test may be drawn, but the results are not definitive. They depend on the IgA levels, and if someone is IgA deficient, the numbers are not accurate.
- The only definitive results are from an endoscopy, with multiple biopsies from the small bowel.



- On examination, the small bowel may have lost the “furry” appearance, and may appear blunted, or even have smooth or notched walls.
- Biopsies will show the loss of the villi, and prove celiac disease.
- The treatment is difficult- to stop eating wheat, rye, barley and oats for the rest of their lives.
- It is also used in preservatives, so care must be taken to read the labels on food, as well as other products. Restaurants have to be questioned carefully as to their gluten friendliness, as saltshakers may contain it to keep it from clumping. Gluten is commonly used in other beauty products, as well, so read labels and ask questions.
- Vitamin supplements are important for complete nutrition.
- Celiac, left untreated, can lead to osteoporosis, cancer of the small intestine, esophagus, or stomach.

# Viral and Bacterial Infections

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- Some bacteria produce enterotoxins that cause the patient to have diarrhea, including *Escherichia coli*, cholera, *staphylococcus aureus* and *clostridium*.
- Other bacteria are able to get into the walls to damage the mucosa, resulting in blood, mucus, diarrhea, leukocytes in the stool and fever. Those on the previous list are included, as well as *salmonella typhi* and *shigella*.
- Viruses such as rotaviruses, Norwalk and adenovirus can also cause extreme diarrhea and malabsorption.

- Identifying the type of infection is the first challenge.
- Careful history of travel, food eaten (and when), others they have encountered who are ill, water supplies, and abdominal examination should be included in the history.
- Lab work to determine white count, hydration status, and stool for c. diff, ova and parasites, and culture should be obtained.
- If the patient is severely dehydrated, IV therapy is used. Anti-diarrheal medications should not be used, as you want the bacteria/virus to clear the body, and that is what the diarrhea helps accomplish. No diet changes are necessary.
- If a bacteria is found, antibiotics may be ordered.

# Parasites

- Giardiasis is from the protozoan *Giardia lamblia*, and is contracted through contaminated food or water.
- Most adults have no symptoms, but may have diarrhea, or malabsorption.
- At the highest risk are the young, the elderly, and the immunocompromised.
- Stool cultures will show either the parasite or the ova.
- Treatment is metronidazole (Flagyl).

# Crohn's Disease

- One of the two Inflammatory Bowel Diseases.
- Often called the “gum to bum” disease as it can effect the whole GI tract from the mouth to the anus.
- If effects all four layers of the small intestine, and is found most commonly in the terminal ileum, although it can be anywhere.
- Strictures are common, as is inflammation, bleeding, and ulcerations.
- There is no known cause, but genetics, environment, and autoimmune diseases are thought to play a part.
- Canada has one of the highest rates of IBD in the world, per capita, with the highest rates in the four eastern-most provinces (New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland).

- It is a young person's diagnosis, commonly being found in a person's 20's and 30's, but it is not uncommon to have it for an average of two years prior to diagnosis.
- Symptoms can have periods of remission and exacerbation. Fever, weight loss, anorexia, abdominal pain, bloody diarrhea, feeling unwell can all signal the remission is at an end.
- Even in a remission, patients may experience pain, diarrhea, deficiencies in nutrition, arthritis, osteoporosis, iritis, and rashes on their skin.

- Endoscopy may reveal ulcerations in the small bowel with a cobblestone appearance, strictures, or bleeding. Biopsies should be obtained.
- CT scan, M2A capsule endoscopy, ultrasound, and barium scans will show small bowel involvement, and stricture formation.
- Lab work may show low hemoglobin, low iron, malnutrition, a high CRP and sedimentation rate.
- Stool for fecal cal protectin may also be obtained, and will be high if the patient is not in remission.

- First line treatment is medication, and we will discuss that later. The goal of most GI physician is to limit the number of surgeries a Crohn's patient is exposed to over their lives. Often, after a surgery, the disease may gone in that area, but reappear in another.
- Diets high in calories, nutrition and fat may be useful, as well as lowering the fiber content in a flare.
- Stress reduction is important, as is quitting smoking, as cigarettes will make symptoms worse.
- Crohn's can cause fissures, fistulas, perforation, abscesses, obstructions, bleeding, and predispose people to cancers of various types.



# Angiodysplasia

- Small areas of bleeding in the small intestine leach blood slowly, causing iron deficiency.
- Approximately 40% of patients with low iron with a normal upper and lower endoscopy will have this.
- It is possible that renal failure contributes to it, but no one cause is isolated.
- Most common in persons over the age of 60.

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- Diagnosed with endoscopy, double balloon endoscopy, or M2A capsule endoscopy, treatment of choice is APC to visible bleeding areas. Injections of adrenalin or thermal therapy may be useful, but APC is usually most effective.

# Small Bowel Obstruction

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- Etiology may include cancer, Crohn's disease, volvulus, or benign strictures of any type.
- CT scan, ultrasound or M2A capsule are helpful in finding the problem area.
- If the area is within the reach of a scope, it is possible to dilate a stricture with a balloon.
- Other instances usually require surgical intervention to relieve the obstruction.

# Cancer of the Small Intestine

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- Less than 5% of tumors are found in the small intestine.
- The most common tumors include lymphomas, adenocarcinomas, sarcomas, GIST and carcinoid.
- Peutz-Jeghers syndrome is **genetic dominant**, characterized by tumors in the GI tract, with pigmented hands, feet and face.

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- Symptoms of small intestinal tumors may include pain, anemia, vomiting, loss of weight, and a hard, firm abdomen.
  - CT scans, x-rays may be used for diagnosis.
  - Surgery is required in most cases, but radiation and chemotherapy are often adjuncts to surgery.
  - If the area is benign, and within reach of the endoscopist, it is possible to remove it with a scope.

# Diverticula

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- Diverticula may appear in any part of the GI tract, but in the small intestine, the two most common areas are at the site of the Ampulla of Vater, and a Meckel's diverticulum.
- A Meckel's diverticulum is found most often in boys under the age of two, two feet from the ileocecal valve, and may contain two types of tissue: gastric or pancreatic.
- If it secretes either acid or pepsin, it may cause erosions or bleeding.

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- It is possible for it to twist, and form a volvulus, or intussusception.
  - In adults, if it has not been diagnosed, it may lead to sarcomas, carcinomas or adenocarcinomas.
  - Diagnosis is difficult, and only specific nuclear medical tests detect it. On occasion, it has been identified as a source of bleeding on an M2A study.
  - Patients have been referred for an appendectomy, only to find an inflamed Meckel's diverticulum instead.
  - Surgery is the only approved treatment for a Meckel's.

# Pancreas

## Anatomy and Physiology



- The pancreas looks a bit like a fish, and is divided into three sections, the head, the neck, and the tail.
- Approximately 15-20 cm by 5 cm wide and 110 g weight, it is tucked behind the stomach, liver and small intestine.
- Difficult to perform surgery on, since the tissue does not hold together well in the same manner as the liver does, there are few surgeons skilled enough to perform any required surgery.
- The pancreas contains two cell types, exocrine and endocrine.
- Most of the cells are exocrine cells called acinar cells, grouped together resembling grapes. Connective tissue further connects the lobes. Pancreatic enzymes are drained into the pancreatic ducts. The main duct is the duct of Wirsung, draining into the common bile duct, and emptying through the Ampulla of Vater. The duct of Santorini is present in most people, and drains at the minor papilla.
- Endocrine cells are the vast minority of cells, and are found at the Islets of Langerhans in the connective tissue between the lobes.

- The main function of the pancreas is to produce enzymes for digestion and hormones for glucose regulation.
- Three types of endocrine cells are:
  - Alpha: produces glucagon
  - Beta: produces insulin
  - delta: produces somatostatin
  - These are all involved in the regulation of blood sugar level.

The exocrine cells will make up to one liter of pancreatic juices each day, and depending on whether you have eaten protein or fat, the composition of the juices change to digest the chyme. Drainage of the juices is by the papilla, along with bile from the liver.

Enzymes from the pancreas include amylase, converting carbohydrates, lipase, for fat digestion, and protease, for protein conversion (think lipid=fat, pro=pro, just leaving the amylase to remember)

# Pathophysiology

# Pancreatitis

- Any inflammation of the pancreas. It may be an acute condition, or a chronic one.
- Acute pancreatitis usually has three features: abdominal pain, amylase or lipase more than three times the usual limits, and either a CT or MRI to confirm the diagnosis.
- Symptoms may also include nausea, vomiting, pain in left shoulder, fever, tenderness or distention, or weight loss.
- The etiology may be from a myriad of factors. Many people automatically associate pancreatitis with alcohol consumption, but stones in the bile duct, trauma, infections, ERCP or drug use may also contribute to it.
- One complication of acute pancreatitis is necrotizing pancreatitis, causing fevers several days after the pancreatitis. If a CT scan shows more than 30% damage, this is an emergency situation, and a debridement needs to be performed in the OR. Antibiotics of choice are meropenem.

- Treatment for acute pancreatitis should include NPO with NG as necessary, pain control, bedrest, fluid replacement, vital signs, lab work to ensure improvement of blood work, glucose control, antibiotics as ordered, and ICU treatment for severe cases.
- In the case of a patient with gallstone pancreatitis, an ERCP may be performed to remove the offending problem. Even in the case of sepsis, and a ventilated patient, ERCP may be done to do a sphincterotomy, releasing the stone, and potentially saving the patient.

- Chronic pancreatitis is often perceived by care workers to be the patient's own fault, as we think the person is an alcoholic.
- There are many other things that contribute to chronic pancreatitis than just alcohol. There are a few who have genetic causes (cystic fibrosis, pancreatic divisum or familial pancreatitis) , some are lacking in protein, others may have a mass or stone, or be drug users. Many are middle aged males, although they can be any age or gender. Most have lost some pancreatic function by the time they are diagnosed.
- Along with pain very similar to the acute phase, look for weight loss, fatty stools, recent onset of diabetes, jaundice, or even a mass.
- Diagnosis is made from lab work, CT/MRI/MRCP, endoscopic ultrasound, ultrasound and history.
- These patients need to stop any alcohol intake, watch their diet carefully, and take medications ordered for pain, or pancreatic enzymes.
- Due to the chronic nature of this disease, some individuals may become addicted to the pain medication, requiring another level of nursing and psychiatric care.

# Pseudocyst

- When a person has an acute or chronic attack of pancreatitis, the pancreas may begin to use its enzymes to digest itself. It creates a collection of fluid that begins to encapsulate, and is lined with granulation tissue, not epithelium, hence it is a “pseudo” cyst.
- After some time, the inside begins to necrotise, becoming more liquid than solid.
- Smaller lesions may resolve on their own, but larger cysts can have a variety of symptoms. Pain, particularly postprandial, nausea, anorexia, weight loss, fevers, malaise are all common.
- Often the symptoms are related to the fact that this large cyst rests behind the stomach, and may be pushing the stomach in on itself.
- Drainage is necessary once the cyst is large enough, and liquid enough.

- CT or MRI may be useful, but EUS is very accurate for determining the readiness of the cyst for drainage. Another advantage is that if the physician intends to drain it endoscopically, a marker may be placed showing the best place to put the fistula.
- When draining a pseudocyst by endoscopy, a puncture is made at the area that protrudes the most into the stomach, it is widened with a balloon dilator, and allowed to drain. Any necrotic matter may be removed with baskets, nets, snares, etc., and four double pigtail drains left in place (one end in the stomach, one in the cyst). There should be no leakage into the peritoneum as the cyst is stuck to the side of the stomach. The stents may be left for several months, or if the cyst is not shrinking, another procedure can be performed to remove more necrotic material, and more stents replaced.
- It is not uncommon for bacteria to spill into the blood after this procedure, and antibiotics should be ordered.
- They can also be drained by surgery, or through the peritoneum.



# Pancreatic Cancer

- In Canada, this is the fourth leading cause of cancer deaths.
- Unfortunately, this cancer is quiet, until it gets big enough to impinge on other surrounding tissues, and cause pain, jaundice, weight loss, anorexia or general malaise.
- It is most common over the age of 50, but those with a family history may be affected earlier.
- Risk factors include a family history, smoking, alcohol use, or diabetes.
- MRI, CT scan ERCP or Endoscopic Ultrasound may be used to diagnose, and EUS is able to obtain fine needle aspiration to confirm cell type.
- If the mass is resectable, a Whipple's procedure may be performed, removing the pancreas head, part of the stomach, small intestine, the gallbladder and bile ducts. This is a major surgery, and many who are referred are not candidates for surgery.
- Chemotherapy or radiation therapy may be used pre or post op to increase survival rates.
- Five year survival is approximately 20% in Canada.

# Cystic Neoplasms

- These are fluid filled cysts that occur in the pancreas, most often in the head. They can be very small, or very large, and a person may have one, or several.
- Those with previous pancreatitis are at higher risk.
- Some are benign, and some are malignant.
- EUS can drain a cyst, or obtain a sample for lab testing to confirm the diagnosis.
- These may include cystadenoma, mucinous cystadenoma, or cystadenocarcinoma.
- If they involve the ducts, the prognosis is better than those above. These are termed IPMN (Intraductal Papillary Mucinous Neoplasm).
- Benign neoplasms need to be monitored with EUS on a regular basis, while those that are malignant may be removed via Whipple's procedure.

# Endocrine Tumors

- These arise from the islet cells, and may be malignant, or benign.
  - Gastrinomas: Zollinger-Ellison syndrome causes too much gastrin to be released, resulting in a patient with severe PUD, despite treatment. They may be a frequent GI bleed, that seems to be resistant to any therapy. You may even wonder if they are taking the prescribed medication. Commonly seen is pain, diarrhea, with fatty stools. If the gastrin levels are checked, you will see extreme elevation. CT or EUS may pinpoint the lesion, but octreotide scans are also very useful. Most lesions are in the duodenum, or pancreas. Previous therapy was a total gastrectomy, but currently, high doses of PPI may be effective.

- **Insulinomas:** arising from the beta cells, found in the body or tail, usually alone, they are benign. Patients may show confusion, or low blood sugars after exercise, or even go into a coma and seizure.
- **Glucagonomas:** tumors of the alpha cells, not common. Over 50% are malignant by the time they are discovered. They may present with weight loss, diabetes, have a skin rash, or anemia.
- **Somatostatinomas:** symptoms include fatty stools, diabetes, or cholelithiasis.

Surgical removal is the standard of care, for patients that are surgical candidates.

# Cystic Fibrosis

- The most common fatal genetic disease involving children in Canada.
- Approximately 1:3500 children born in Canada are diagnosed with CF. It is autosomal recessive. Both parents must be carriers, and each pregnancy gives a 1/4 chance of the child being positive for CF.
- Not only does it effect the pancreas, but the other exocrine glands as well, including the sweat glands, lungs and reproductive system.
- Patients need to take dozens of pills each day to replace the pancreatic enzymes that the pancreas does not produce, and to break up the mucus that may block the small bowel, and ducts of the liver and pancreas.
- They have issues digesting fats and proteins, may become diabetic, and have difficulties absorbing nutrition from the small bowel. Stools are frequently fatty, and foul smelling.
- A sweat test is the definitive diagnosis for CF.
- Once the life expectancy for a child with CF was six years of age. With improved medication and care, 30 has become more common.

# Pancreatic Divism

- A congenital defect where the dorsal and ventral pancreatic ducts fail to fuse in utero.
- In this case, the dorsal duct is drained through the minor papilla, and the ventral duct is drained by a short Wirsung duct via the common bile duct.
- Occasionally cases of pancreatitis may be attributed to this defect.
- ERCP can be used, and a short Wirsung will be seen, and if the accessory papilla can be cannulated, contrast will show a long Santorini duct that does not join the Wirsung duct.
- Sphincterotomy of the accessory papilla, and even a temporary stent can be used to improve patient's symptoms.

# Pancreatic Strictures

- Strictures in the pancreas may be caused by inflammation from pancreatitis, a stone in the bile duct pressing on the pancreatic duct, chronic pancreatitis, a stone in the pancreatic duct, or a tumor pressing on the ducts.
- Presentation will be very similar to pancreatitis, and EUS or ERCP, CT/MRI/MRCP will show a dilated duct (greater than the normal 1-2 mm).
- Relief of the primary cause is the obvious therapy, or if the stricture is low in the Wirsung duct, a pancreatic stent may be placed by ERCP.

# Biliary system

## Anatomy and Physiology



- The biliary system is in the transportation business.
- The liver produces bile, and the left and right hepatic ducts carry it to the common hepatic duct, then the cystic duct from the gallbladder joins in at the common bile duct, and it then drains into the small intestine via the papilla of Vater. The sphincter of Oddi controls the flow of fluids into the small intestine.
- Only half of the bile actually drains into the small intestine. The rest is stored in the gallbladder until it is required in the digestion of fatty foods.
- The purpose of the biliary system is to rid the liver of waste, and to digest fatty substances.
- Bile contains waste, cholesterol, bile acids and bile salts. It is the salts that are the component that digests fat.
- Bile is what gives stool its brown color.


# Biliary System

## Pathophysiology



# Cholelithiasis

- Refers to the presence of stones in the gallbladder.
- A person may have stones, crystals, or sludge in the gallbladder, and not be aware of any symptoms. They may reside for years without causing problems, so most symptoms are the result of movement of the stones into the bile ducts, or too many stones in the gallbladder.
- Stones are typically made of cholesterol, or calcium bilirubinate.
- Episodes of gallbladder attacks are referred to as biliary colic. Reported symptoms include sudden onset upper right quadrant pain, often moving into the right shoulder, or back, nausea/vomiting, fever, flatulence or diarrhea. Patients may have rebound tenderness in the right upper quadrant.
- Health care workers often associate the three “f’s” with gallbladder disease: female, fat, and forty, denoting those who are at the highest risk.
- However, biliary colic can occur over any gender, and age group. Risk factors may include: pregnancy, fasting/weight loss, diet high in fat and calories, gastric bypass surgery, drug use, family history, or European descent.

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- Diagnosis may be made with ultrasound, CT scan, HIDA scan, MRI/MRCP, EUS or ERCP.
  - If the patient has no symptoms, they are very often not treated, until they present with biliary colic, or stones in the duct system. In a few cases, if there is concern, the gallbladder may be removed prophylactically (Cirrhosis, Portal hypertension, children, candidates for transplant, stones greater than 2 cm, etc.).



# Choledocolithiasis

- When a stone is stuck in either the large hepatic ducts, the cystic duct, or the common bile duct.
- Even if the gallbladder has been removed, it is possible to still form stones if the bile is stagnant in the duct.
- Complaints may include pain, fever, light stools, chills, jaundice, nausea or vomiting.
- If a stone is stuck, jaundice may occur, it can cause pancreatitis, sepsis, inflammation of the liver or gallbladder, or damage to any of the biliary system.
- Along with imaging, blood work should include AST, GGT, bilirubin, alk phos, and CBC.



- Many years ago, the gallbladder would be removed (if it had not already been) the ducts opened, and any stones removed during surgery. A T-tube would be left in place for several days or weeks, until healing had taken place.
- Now, however, ERCP has the ability to thread a wire into the ducts, open the sphincter with a sphinctertome, and pull out stones using a balloon or basket before surgery, saving the patient a large procedure, and enabling the surgeon to remove the gallbladder laparoscopically.
- Occasionally, during gallbladder surgery, stones spill into the duct, and ERCP is used post-op to remove these stones.
- For stones that are large, new techniques allow the endoscopist to use fiberoptic technology to see into the duct, and use lithotripsy to break a large stone into a multitude of small pieces that are easier to remove.



# Cholecystitis

- Inflammation of the gallbladder, often from a stone stuck in the cystic duct, but can be from gallbladder cancer, or inflammation of other areas of the biliary tree.
- Presentation is identical to that of cholelithiasis.
- Bile may become infected, or the gallbladder become necrotic, or even tear.
- Bloodwork imaging, or a HIDA scan may be used to demonstrate this diagnosis.
- Treatment would include a hospitalization with fasting, fluids and antibiotics to settle the gallbladder down, with an urgent cholecystectomy in the future.



# Cholangitis


- Bacterial infection of the bile ducts that may have a secondary cause of a stone or mass.
- Risk factors may include previous stones, travel to countries where parasites or worms are common, HIV, PSC or other types of strictures.
- Because the symptoms are similar to all the rest of the diseases of the biliary system, the imaging, ERCP, EUS and blood work are key to determining which is the cause of the symptoms.
- ERCP can be used to remove stones, or place a stent for drainage, with antibiotics, and fluids ordered, and surgery may also be required at an early date.





# Primary Sclerosing Cholangitis

- A disease affecting the bile ducts where inflammation occurs over and over, resulting in areas that are sclerotic, and narrow. Bile is unable to pass, and damage can occur to the liver or rest of the ducts.
- It may progress over years, but eventually the patient will need a liver transplant in order to survive.
- The etiology is not clear. Most believe there is an autoimmune component playing a role. It may be due to toxins or infections, but it is frequently seen with inflammatory bowel disease, particularly Ulcerative Colitis. It may not appear at the same time. Some patients have PSC for years before developing UC, while some patients have UC for years before developing PSC. In unusual circumstances, they have had a transplant for PSC, and then develop UC.
- Risk factors include someone with IBD, or other autoimmune disorder, males, young (20-30 years old at diagnosis) and Northern European descent. PSC is more prevalent in countries that have high rates of IBD.

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- Early symptoms may include itching and fatigue, which are often overlooked. Later symptoms mimic gallbladder issues: pain, fever, night sweats, chills, enlarged liver or spleen, jaundice and weight loss.
  - Complications may include cirrhosis, portal hypertension (and the resulting risks for varices etc.), osteoporosis, colon cancer (because of the high correlation with UC), and bile duct cancer.
  - Treatment with ERCP stenting if there is a primary stricture is useful, but there are most likely a multitude of small strictures. The only possibility when the condition begins to progress is liver transplantation. If there is a main stricture, the physician may also try to dilate it with a balloon, or straight dilator.




# Strictures

- Bile duct strictures may be benign, or malignant.
- Strictures happen with trauma of some sort to the ducts. Surgery, accidents, stones, pancreatitis, PSC, can all be culprits.
- If left untreated, liver cirrhosis, with all that implies, may occur.
- Malignant strictures are the result of cancer of the bile ducts, liver, pancreas or gallbladder.
- Most benign strictures are the result of a cholecystectomy, and injury to the ducts during the procedure.
- Treatment for malignant strictures would include the treatment of the cancer if possible through surgery, radiation, or chemotherapy, but an ERCP may be performed to open the stricture, and/or placement of stents, and give comfort measures.
- Benign measures include ERCP to dilate, with stent placement as needed.



# Cholangiocarcinoma

- Gallbladder cancer is one of the rarest of GI cancers, accounting for approximately 0.1-0.8 in 100,000 people in Canada.
- More common in women than men, and in those who are elderly, but even the young are vulnerable.
- The symptoms are so vague, that most do not see a physician until it is too late: nausea, weight loss, anorexia, and jaundice in the late stages.
- EUS, ERCP, CT scan, ultrasound, or CEA may make the diagnosis.
- The greater majority are adenocarcinoma, but a few are squamous cell. Benign tumors are almost non-existent.
- Rarely are these tumors found in time to intervene successfully. Surgery, or chemotherapy may be performed, but this cancer has a less than 5% five year survival rate, with a prognosis of less than six months.

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- Bile duct cancer may be related to stones in the duct, PSC, UC or Crohn's.
  - Because the symptoms are just like those of any disease in this category, the only clue may be that the alk phos is always elevated. Imaging scans will show dilated ducts, and ERCP or EUS will demonstrate the stricture, or mass.
  - Surgery would include a resection of the ducts, or a Whipple's procedure, or even a liver transplant. However, if the spread is too far, stent placements, with chemotherapy or radiation are possibilities.
  - This cancer has a poor prognosis.

Anatomy and Physiology

# THE LIVER

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- ✘ The liver rests in the right upper quadrant of the abdomen, weighing in at 1200-1600 g.
  - ✘ Surrounding it is a capsule of connective tissue, covered over by serosa.
  - ✘ The falciform ligament divides the liver into two lobes and attaches it to the diaphragm and the wall of the abdomen.
  - ✘ The lobes become even smaller, dividing into smaller lobes, then lobules, which work together as a unit to perform their task.
  - ✘ Lobules are composed of hepatocytes, which secrete bile, and are connected with their own hepatic artery, portal vein and bile duct. This is the portal triad.
  - ✘ Sinusoids, lined with Kupffer cells, lie between rows of cells. These cells are responsible for the liver's ability to detoxify the blood and remove the debris from the liver, including red cells, bacteria, and harmful substance.

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- ✘ Highly vascular, almost 1.5 liters of blood flows through the liver each minute. The portal vein and the hepatic artery are responsible for this.
  - ✘ The liver is the only organ in the body that can regenerate itself, if no further insults to it occur.
  - ✘ Vitamins B2, along with the fat soluble vitamins (A, D, E, K) are stored in the liver.



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- ✘ The liver is responsible for metabolizing carbohydrates, and proteins, along with many hormones.
  - ✘ The clotting factors of the body come from the liver: prothrombin, fibrinogen, along with anticlotting factors such as heparin.
  - ✘ The bile that is used to digest fats in food is produced in the liver.
  - ✘ The final task of the liver is to detoxify drugs, toxins, and foreign substances into a water soluble base that can be excreted by the kidneys.

Pathophysiology

# LIVER

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# CIRRHOSIS

- ✘ When liver cells die from an assault of some kind, scarring occurs in that area.
- ✘ One assault is reversible, but a multitude of assaults will result in permanent damage to the liver, and continued damage will increase the amount of fibrosis present, making the tasks it is assigned very difficult to perform.
- ✘ Presentation may include loss of weight, anorexia, pain, easily bruised, ascites, confusion, jaundice or itchy skin.
- ✘ Liver biopsies may be obtained, or a fibroscan performed.
- ✘ There are several scoring systems in place to decide if a person is eligible for transplant if they have irreversible damage.
- ✘ It may be possible to slow the disease process if they can change their lifestyle to improve their prognosis.

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- ✘ Cirrhosis causes the liver to become more stiff, increasing the amount of pressure in the portal system, resulting in portal hypertension.
  - ✘ It acts just like a beaver dam, trapping the fluid behind it, leaving it to enter other close blood vessels, including those of the stomach, esophagus, and small intestine.
  - ✘ Beta blockers help lower the pressure in the system, or octreotide (Sandostatin) may be given to lessen the flow in the portal system.
  - ✘ Shunts may be used as a last resort to shift the excess fluid into another blood system.
  - ✘ As the liver continues to increase in size, the splanchnic artery continues to dilate, resulting in fluid leaking into the peritoneal cavity. This is known as ascites.

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- ✘ Ascites is often a later complication of cirrhosis.
  - ✘ Salt restriction, or diuretics may be ordered, or a shunt placed in rare circumstances.
  - ✘ For those with difficulty breathing, or abdominal pain, a paracentesis may be performed to alleviate symptoms. Unfortunately, it will probably have to be repeated on a regular basis.

# HEPATIC ENCEPHALOPATHY

- ✘ During the breakdown process of protein, ammonia is produced, which the liver changes into urea to be eliminated.
- ✘ With cirrhosis, the blood bypasses the liver, and with it, all the ammonia is free to enter the brain.
- ✘ Early on in the process, the person is mildly confused, and their mood may be off. They may even be noted to flap their wrists.
- ✘ These symptoms progress until they are severely confused, their personality changes, and they have slurred speech and unable to move.
- ✘ At the end, they may enter a comatose state, with no reactions to any stimuli.
- ✘ Treatment includes low protein diet, and administering lactulose to allow the ammonia to pass through the body through the stool.

# HEPATITIS

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- ✘ Any inflammation of the liver that can lead to damage. It may be acute, or chronic, with many possible causes.
- ✘ The tendency is to think of it as being caused by high risk activities (unprotected sex, alcohol or drug use) but this is not always the case.

# HEPATITIS A (HAV)

- ✘ The most common cause of hepatitis in North America.
- ✘ Risk factors would include routine contact with friends, relatives, travelling, or encountering it in contaminated water or food.
- ✘ In third world countries, the vast majority of children are positive by the time they are old enough for school.
- ✘ Vaccine is available for those who are involved in high risk activities: working in day care, travellers, military personnel, those who have been exposed already, those who live in endemic areas, or IV drug users.
- ✘ Symptoms are often mild, and may include malaise, nausea, fever, anorexia, jaundice, and abdominal pain.
- ✘ This type rarely develops into chronic hepatitis, and most often goes away with rest.



# HEPATITIS B (HBV)

- ✘ Transmitted by blood, semen, saliva, or from mother to infant.
- ✘ Tests that are available to diagnose it include hepatitis B antigen (HBsAg), hepatitis B surface antibody (anti-HBs), hepatitis B core antibody (anti-HBc), and hepatitis B DNA.
- ✘ Vaccines are available, and are required in Canada for infants just after birth, then one and six months of age (each province has different recommendations). If the mother is positive, the infant should also receive the immunoglobulin.
- ✘ At risk adults should also receive the vaccine, including health care workers, day care workers, IV drug users, those who work with refugees, dialysis patients, prisoners, and those involved in high risk sexual activity.
- ✘ Because the symptoms are almost identical to Hepatitis A, blood work is necessary for diagnosis.
- ✘ Most people will recover with rest, balanced diet, fluids, and avoidance of alcohol.
- ✘ In Canada, treatment options include lamivudine, adefovir, telbivudine, tenofovir, and entecavir not to cure, but to prevent damage to the liver.

# HEPATITIS C (HCV)

- ✘ Transmitted by contaminated blood products, IV drug use, or blood exposure.
- ✘ Many have symptoms that are so mild, they assume it is a simple virus, and that it goes away.
- ✘ The acute phase may turn into a chronic phase, and it may be the diagnosis is made when the patient has liver cirrhosis, up to 20 years later. At this point, the patient is at a high risk for liver cancer.
- ✘ There is no vaccine available for Hep C.
- ✘ In Canada, a new drug is in use that is a combination of two therapies. Harvoni (ledipasvir and sofosbuvir) in clinical trials has cured between 92-98% of patients with Hep C. However, it is only effective for genotype 1. Hepatitis C has six genotypes.

# HEPATITIS D (HDV)

- ✘ Can only exist in the presence of HBV.
- ✘ It is most common in the Mediterranean, and South America, but it is transmitted by transfusions, homosexual activity, and IV drug users.
- ✘ With HBV, it seems to increase the symptoms of the person, and make the disease process worse.
- ✘ Interferon may help to decrease the viral load.

# HEPATITIS E (HEV)

- ✘ Found mostly in areas with contaminated food and water supplies, or those with poor sanitation.
- ✘ It may take up to 8 weeks for symptoms to appear, and can be fatal in a small number of people. Since they tend to live in poorer areas, the death rates may be from poor access to health care.

# ALCOHOLIC HEPATITIS

- ✘ The symptoms for this are almost identical to other forms of hepatitis, but jaundice is not present, and increased mental disturbances are likely.
- ✘ A good history, including alcohol intake is necessary. One may note both an enlarged spleen, and liver on physical examination.
- ✘ Treatment might include fluid and vitamin replacement, good nutrition, and counselling for alcohol abuse.
- ✘ If there is no cirrhosis, it is possible to reverse any damage that alcohol has caused.

# DRUGS

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- ✘ Certain drugs are known to be toxic to the liver including acetaminophen (Paramecatol/Tylenol).
- ✘ When they present to the ER with known overdoses, activated charcoal or ipecac is used, or a gastric lavage is performed to neutralize the medication.
- ✘ It is possible for the liver to die after an assault from drug toxicity.

# NAFLD/NASH

- ✘ Non-alcoholic fatty liver disease is swiftly becoming a problem in North America due to poor eating habits.
- ✘ As the rates of obesity grow, fat gets deposited in the liver, obstructing the flow, causing cirrhosis, which may then progress to liver failure, or cancer and death.
- ✘ It is defined by a liver that more than 5-10% is fat.
- ✘ Risk factors may include diabetes, overweight (although some are normal weight), high cholesterol or triglycerides, or metabolic syndrome.
- ✘ Some physicians include NAFLD in the categories for metabolic syndrome.
- ✘ Symptoms are non-specific, and look just like all the other ones for liver disease, so an ultrasound, or other imaging techniques are useful in the diagnosis.
- ✘ Treatment might include reducing alcohol, drinking 3 cups of coffee a day, healthy eating, weight loss, diabetes control, and avoiding medications that are not necessary.
- ✘ NASH stands for non-alcoholic steatohepatitis, and falls under the NAFLD category.

# PRIMARY BILIARY CHOLANGITIS (PREVIOUSLY PRIMARY BILIARY CIRRHOSIS)

- ✘ Damage to the bile ducts in the liver themselves can lead to scarring, and eventually cirrhosis.
- ✘ It is believed to be from an autoimmune disorder, like that of PSC.
- ✘ People may experience dryness of mucus membranes, itching, jaundice, vague pain, or fatigue. As the disease progresses, ascites, varices, or osteoporosis may develop.
- ✘ A liver biopsy is the definitive diagnosis, but antimitochondrial antibodies (AMA) and alk phos will be elevated.
- ✘ Ursodiol (Urso) may be used to move the bile more swiftly into the small intestine, but there are few treatments available, except to ease the symptoms.
- ✘ At end stage, a liver transplant may be performed, but the new liver may also develop PBC.



# PORPHYRIA

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- ✘ A genetic, or acquired defect in which the manufacture of heme is interfered with, resulting in too many porphyrins in the blood.
- ✘ There are four different types with different symptom presentations.
- ✘ Some are autosomal dominant, while others are not genetic.
- ✘ This is the disease that gave rise to the legend of Dracula.
- ✘ Patients should follow a low porphyrin diet, avoid alcohol and smoking, avoid oral contraceptives, iron and chloroquine.

# HEMOCHROMATOSIS

- ✘ The body has too much iron in it.
- ✘ There are several types, but the most common one is genetic.
- ✘ If left untreated, it may damage organs, joints, and eventually, cause death.
- ✘ The “classic” type causes too much iron to be absorbed from your food, and it stays in your blood stream, the body is unable to process it.
- ✘ Early symptoms may include fatigue, and joint pain. The specific sign is termed the “iron fist” and patients experience pain in the joints of the knuckles of the first and second finger. Unfortunately, not all those effected have the sign.
- ✘ Later on, abdominal pain, trouble concentrating, irregular heart beat, lack of energy may also be present.
- ✘ Most at risk are those with a family history, young men, and women 10 years or so after menopause.
- ✘ If left untreated, possible complications include diabetes, hypothyroidism, osteoporosis, congestive heart failure, liver cirrhosis or cancer, and an enlarged spleen
- ✘ Serum Iron, Serum Ferritin and Total Iron Binding Capacity will confirm diagnosis.
- ✘ Treatment includes phlebotomy at regular intervals to control the iron, and a diet low in heme (red meat, and leafy green vegetables).

# WILSON'S DISEASE

- ✘ A rare, autosomal recessive disorder where too much copper is released into the bloodstream, and it build up in the brain, liver, eyes and kidneys.
- ✘ A patient has a classic rust colored ring around their eyes that is diagnostic.
- ✘ AST and ALT may be high, indicating liver disease, or they develop brain symptoms, including tremors, or seizures, depression, psychosis, pancreatitis, or kidney failure.
- ✘ Penicillamine is a life long drug therapy to encourage the kidneys to excrete the copper, and zinc can stop the copper from binding.
- ✘ Patients need to avoid copper rich foods (nuts, shellfish, organ meats) and drink bottled water, or filtered water if the pipes are made of copper.

# LIVER CANCER

- ✘ Liver cancer may arise from the liver itself (primary cancer), or be metastasized from another area (secondary cancer).
- ✘ Because all the blood supply of the body travels through the liver for detox, this is often a common site of spread.
- ✘ Haemangiomas are benign tumors of the liver.
- ✘ Hepatocellular cancer is the most common term for liver cancer (HCC).
- ✘ Rarely, sarcomas, non-Hodgkins lymphomas or neuroendocrine tumors may develop.
- ✘ Often, those with cirrhosis of the liver may cause the growth of HCC, believed to be related to the damage, allowing the hepatocytes to mutate.

- ✘ Risk factors include those that create cirrhosis (NASH/NAFLD, HBV, HCV, alcohol), along with obesity, diabetes, smoking, drug use, PSC/PBC, or exposure to toxins.
- ✘ Symptoms are the same as for all types of cirrhosis, so a differential diagnosis is made from imaging scans, along with liver enzymes, and a liver biopsy to confirm diagnosis.
- ✘ If the cancer is small and has not spread, a liver resection, or even transplant may be performed. If it cannot be removed, TACE (**Transarterial chemoembolization**) delivers chemotherapy right to the liver. Injections of ethanol, or radio frequency ablation are other therapies that have proven helpful for many people. Radiation may also slow the spread of the cancer.
- ✘ If no therapy is available because the spread is too severe, a percutaneous drain may allow the bile to drain, if there is a blockage, and jaundice is present. It may also be necessary to perform paracentesis for the comfort of the patient with ascites.

# The Large Intestine

Anatomy and Physiology

- The large intestine is 120-150 cm long (4-5 feet) and 4-6 cm wide (2 inches)
- The ileocecal valve is the gateway, controlling access from the small intestine of approximately 1500ml of liquid each day.
- From the valve, the fluid goes into the cecum, into the ascending colon, the transverse colon, the descending colon, the sigmoid colon, the rectum, and is excreted in solid form from the anus.
- The two major turns are the hepatic flexure, and the splenic flexure.
- The four layers that line the colon are the mucosa, submucosa, muscularis and serosa.

- The walls of the ascending are thinner, with a wider circumference, while the walls of the sigmoid colon are more muscular, with a smaller circumference.
- Neither the sigmoid, nor the transverse are attached to the peritoneum, instead, they flow freely in the abdominal cavity.
- Movement of the colon consists of peristalsis squeezing the material into the next section. The haustra are the small pockets that contain the fluid, and move it along.
- There are very few things that the colon secretes, but it does secrete mucus, water, potassium and bicarbonate.



- The most important function for the colon is the absorption of fluid and the excretion of the stool.
- Only 150-300 ml is evacuated each day of stool, compared to the 1.5 liters it receives. Most of this process is accomplished in the ascending colon.
- The colon is a huge reservoir of millions of normal bacteria, used in the breakdown of stool. Each person has their own variety, although those who share a household may have almost identical micro universes.
- Scientists are now noticing that different people from different countries have similar bacteria in their colons, and that it may be possible to treat diseases with stool transplants from one person to another. Those who are overweight have lost weight when given a transplant from someone with a low BMI. It appears to be related to the types of bacteria in their colons.

# The Large Intestine

Pathophysiology

# Diverticular Disease

- The incidence of diverticular disease in North America is approximately 50% of people over the age of 50.
- There are several postulated causes, including genetics, increased pressure if the colonic peristalsis is not working together, age, those with long-standing constipation, poor diet, low fiber diets, or obesity.
- Barium enema, colonoscopy or virtual CT scan will demonstrate diverticular disease.
- In approximately 15% of cases, these “pockets” or “tics” can become infected or bleed.
- This is known as diverticulitis.
- Symptoms include abdominal pain, fever, or bleeding if they have a bleed, rather than an infection.

- When a patient presents with a diverticular bleed, it needs to be dealt with swiftly, but a colonoscopy can be frustrating, with potentially hundreds of pockets in sight, and only one bleeding. It may be like looking for a needle in a haystack. If you can find it, injections of adrenalin, APC or application of clips will stop it. Hemospray may be an option if you know you are in the right area. If it cannot be found, interventional radiology may be able to stop a bleed. Occasionally, the bleed will also stop on its own.
- For infections, a CT scan can be performed to confirm, as colonoscopy will be very painful in the acute phase. Abscesses may form, or they may become septic. Antibiotics are becoming less likely to be used in diverticulitis, as many patients heal on their own. A low fiber diet is recommended until the inflammation settles.
- Surgery may be required for severe/repeated infections, or bleeds.

# Toxic Mega Colon

- An acute toxic colitis with dilation of the colon to greater than 6 cm in the transverse colon.
- It must be accompanied by at least three of the following: fever, high WBC count, pulse > 120 or anemia, along with one of these: dehydration, low BP, electrolyte imbalance, or confusion.
- It may be a complication of any type of colitis, but it is seen more frequently with pseudomembranous colitis. Potential causes may also include certain bacteria. Some medications that slow the colon motility may also be culprits.
- Hirschsprung disease and Olgivie syndrome create the large colon, but are not an emergency situation.
- If antibiotics, IV fluids, and colon rest do not settle the situation, a total colectomy may be required.

# Volvulus

- A condition where the colon twists in on itself. It is most common in the sigmoid colon (not attached to the mesentery) and the cecum.
- Those with neurogenic disorders (Parkinson's, MS etc.) are more likely to develop sigmoid volvulus, as are those in a nursing home (use of enemas, suppositories, etc.)
- Suggestive of a volvulus is an elderly patient, with abdominal pain, distention, tenderness, lessened bowel sounds, and obstipation.
- CBC will show elevated white count, and imaging will show the distention.
- Treatment may include decompression by colonoscopy, but it may only succeed for a short time. Surgical intervention is usually needed to remove the volvulus.
- The unfortunate part is that these patients often have many co-morbidities, so the mortality rates are high.

# Angiodysplasia

- Small surface blood vessels, typically found in the cecum, or ascending colon, that are leaking blood.
- They may be the cause of someone having IDA, or they may be found on routine colonoscopy. If they are not symptomatic, they may be left alone.
- Since they are often in the right colon, treatment must be used with caution, since the walls are thinner, but APC on low setting, adrenalin, thermal therapies or clips may be used.
- Surgery is a last option, as the bleeding can return post-op, and interventional radiology may also be useful if GI therapy was not successful.

# Irritable Bowel Syndrome

- This is probably the most common reason people go to the office of a GI specialist.
- No one is sure of the cause, but it may involve the abnormal motility of the GI tract, and increased sensitivity of the nerves that supply the colon.
- On endoscopy, there are no abnormal findings.
- This is often frustrating to patients that have pain, bloating, constipation, diarrhea, or combinations of both. Stress may worsen symptoms. They may feel you are not taking their symptoms seriously.
- Treatment can include reassurance that nothing “bad” has been noted, increasing their fiber and fluid intake (adding Metamucil or Restoralax), trying a low FODMAP diet, probiotics, amitriptyline for spasms, linaclotide (Constella) for constipation and loperamide (Imodium), for diarrhea.



# Parasites

- There are few parasites common to Canada, but many people are travelling to parts of the world that may have contaminated food or water, and bringing them home.
- The most common parasite here is the pinworm. Occasionally, they are seen on a scope, retreating from the light.
- They are an oral-fecal transmission route, and are often picked up by children, and spread to the adults in the family.
- The worms migrate through the anus during the night, resulting in scratching of the anal area, and spread to others with whom they may contact.
- Mebendazole is often the drug of choice.

- Roundworms (ascaris) are common in children under the age of ten.
- They live in the ground where they can grow colonies big enough to breathe in, or swallow. Once in the lungs, there may be short respiratory illness, then they head to the small intestine to live.
- They may cause malnutrition, as they process the food that goes by.
- They are diagnosed by stool for O and P.
- Treatment is the same as for pinworms.

# Hemorrhoids

- Each person is born with three veins in the rectum, that end at the anus.
- With pressure, these veins dilate, and may cause pain, itching, or bright red bleeding in the toilet.
- Those who have a profession that requires a lot of sitting, those who are pregnant, or have chronic constipation, or eat a low fiber/fluid diet are at a higher risk.
- Hemorrhoids are graded from I-IV. If they are small, treatment should be sitz baths, ointments/creams, a diet high in fiber to decrease straining.
- For those who have more severe hemorrhoids, a band may be placed around the bottom of it, to ligate it, and cut off the blood supply.

- The band will fall off once necrosis of the area has taken place, and the vein will be smaller.
- After this procedure, a small amount of blood is normal, but if the person has trouble voiding, he should contact a physician, as there may be edema closing off the urethra.
- If banding fails, or the hemorrhoid is too large, surgery may be done to remove the excess tissue.
- This is avoided, if possible, as the recovery is very painful.

# Anal Fissure

- Individuals with constipation, or eating a low fiber diet may have a very difficult bowel movement, and experience sharp pain, bleeding, or a tearing sensation.
- The fragile tissues of the anal sphincter may be torn, and it may take weeks, or months to heal.
- Sitz baths may be helpful, but ordinary creams do not promote the healing process.
- Nitroglycerin or calcium channel blocker (Diltiazem/Cardizem) may be added to a cream to decrease the size of the tear, promoting healing, or Botox (botulinum toxin) may be injected into the area of the tear to paralyze the muscle, making defecation easier, promoting healing.

# Colitis

# Necrotizing Enterocolitis

- Found only in neonates, particularly in premature babies, and those with low birth weight.
- Perforation is possible, and they may require a colectomy.

# Ischemic Colitis

- Is the loss of the blood supply to the colon, most often at the splenic flexure area, from the descending colon to the mid transverse colon. (There are other areas that may be affected, but this is the most common)
- It has been referred to as an “MI of the colon”.
- The onset is sudden, with the classic symptoms being bloody diarrhea, fever, and severe abdominal pain.
- Part of the arterial supply has been interrupted. It is not uncommon for the person to have been doing exercises (shovelling snow, aerobics, or running a marathon.)
- Colonoscopy will show normal colon wall, with a sudden onset of inflammation mid descending, continuing around the splenic flexure, and ending abruptly mid transverse colon.
- Most will recover with no treatment, but IV fluids, antibiotics, and colon rest may also be prescribed for more severe cases.

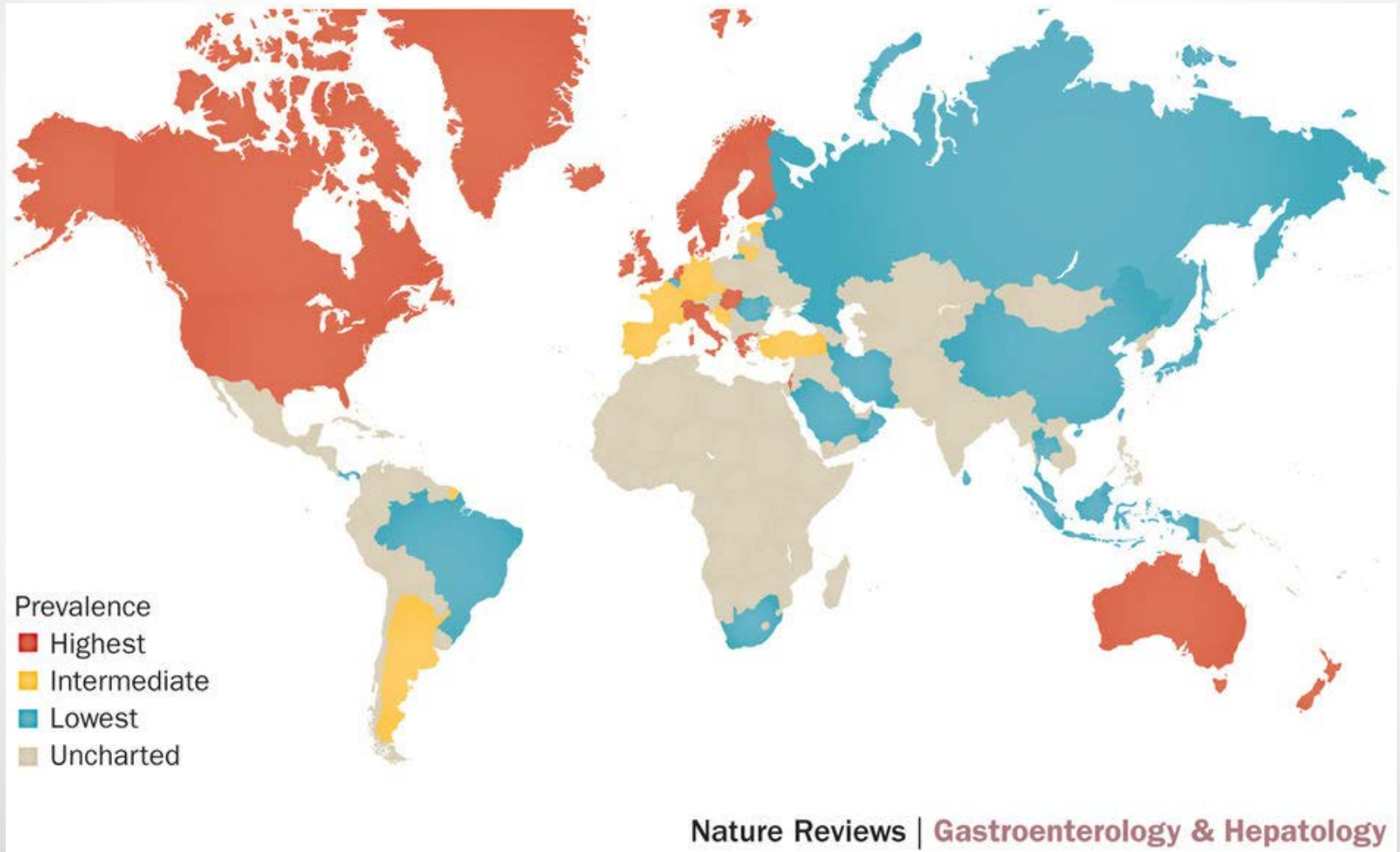


# Infectious Colitis

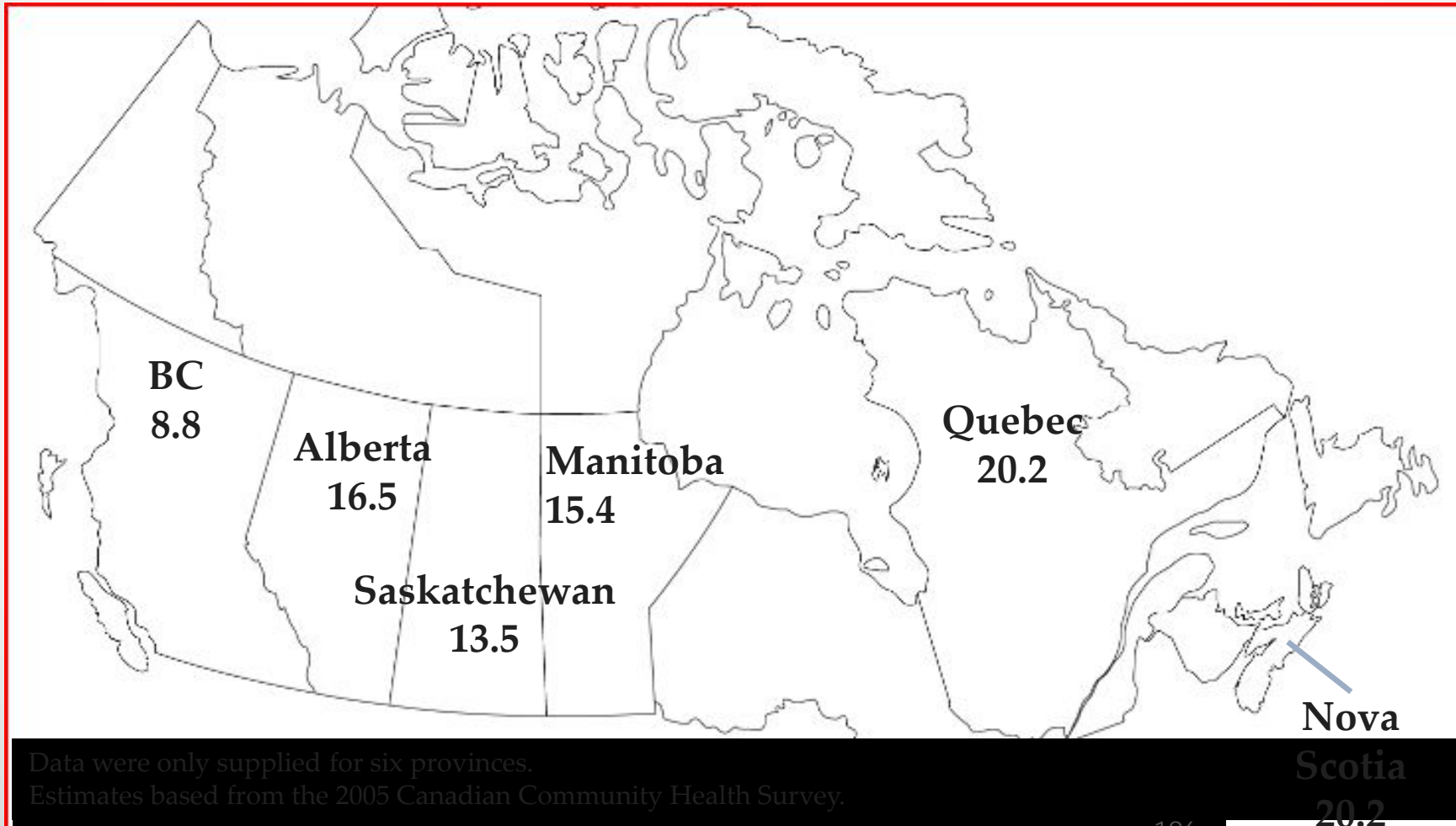
- By far, the most common infection to take over the bacterial flora of the colon is *Clostridium difficile*.
- The infection may be so severe, that areas of the colon are covered in an inflammation of thick white plaque. This is referred to as pseudomembranous colitis.
- This bacteria produces toxins that are able to overwhelm the normal colon flora, and take over.
- Unfortunately, it is most often acquired in the hospital, and because it is a spore, it is difficult to treat. Antibiotics that kill normal flora, allow the *c. diff* to proliferate, causing smelly diarrhea, pain, fever, and high WBC.
- Stool should be collected for *c. diff*, cultures and O&P.
- Metronidazole (Flagyl) and vancomycin are the antibiotics of choice, but some people become resistant to the antibiotics, and are not able to clear the bacteria.

- Those who are the most vulnerable are the young, the elderly, the immunocompromised, and those with underlying disorders such as Crohn's or Ulcerative Colitis.
- Until the last few years, treatments for those who are refractory have been rare.
- Presently, it is possible to do a fecal transplant to change the microbiome, and allow healthy bacteria to grow.
- Donations may be from healthcare workers, or family members, or other volunteers (the US has a lot of people who routinely donate).
- The stool is collected, taken to the lab, where water is added, to liquefy the sample.
- It is then placed in the cecum during colonoscopy, and allowed to remain. (Some centers place it with an NG tube into the jejunum, or into special pills. We place it in cecum)
- Specimens collected in a few days will show the c. diff is eradicated.

# Inflammatory Bowel Disease



# Crohn's Disease Incidence Rate by Province (cases per 100,000)



Data were only supplied for six provinces.  
Estimates based from the 2005 Canadian Community Health Survey.

CCFC. The Burden of Inflammatory Bowel Disease

# Ulcerative Colitis

- Chronic, recurring inflammation of the colon
- Canada is among the countries with the highest incidence of IBD in the world.
- For those who have immigrated to Canada from areas of the world with low incidence of IBD, within a few years, their risk for IBD is the same as someone born here.
- There is no one cause, but it may be genetic, or an autoimmune disorder. It has been linked to up to 30 genomes.
- Most commonly diagnosed in the second and third decades of life, with another peak in the sixth and seventh. Children are not exempt.
- It effects only the first two layers of the colon, and is continuous in nature. When a colonoscopy is performed, inflammation starts at the rectum, and is continuous. If only the rectum is involved, it is referred to as proctitis.

- If the inflammation continues past the splenic flexure, it is referred to as “pan colitis” .
- This type of colitis may develop large inflammatory polyps, that may even run across the lumen of the colon. They are inflammatory, not malignant, and are termed “pseudopolyps” .
- Symptoms may depend on the severity of the disease process.
- Pain, diarrhea, with, or without mucus or blood, weight loss, fever, night sweats, malaise, and in the case of toxic megacolon, dehydration and shock.
- Lab work may include CBC, sedimentation rate, CRP, stool samples for c. diff, O&P, culture, and fecal calprotectin, which shows the amount of inflammation that may be present.
- Colonoscopy with biopsies is definitive.
- Once diagnosed, medication should be started to decrease inflammation.

- Even a decade ago, therapy was aimed at treating the patient by how they felt, not by the inflammation shown on the colonoscopy. The current therapy is aimed at decreasing the inflammation, to decrease potential complications later in life.
- There is a strong correlation between the length of time a person has been diagnosed with UC, and the chance of developing colon cancer. The longer the UC, the more frequently they are being scoped (up to once a year).
- These patients do not tend to develop traditional polyps, and physicians are using special dyes (methylene blue, indigo carmine) to stain the colon, and look for spots that are suspicious to biopsy. Scopes also have different settings to change the wavelengths to examine the colon.

# Medications

- We will discuss these in more detail later.
- Steroids
- 5-ASA
- Immuno suppressive agents (azathioprine, methotrexate, etc.)
- Biologicals



- No dietary restrictions apply, except if something irritates your colon, don't eat it.
- It is important to follow a healthy diet, using Canada's Food guide, with dietary supplements as needed.
- Stress reduction may be helpful.
- There is a phenomenon that smokers who quit, can develop UC. If they start smoking again, it goes away. That is not a recommended treatment.
- If medication fails, it is possible to cure this disease, removing the colon totally, leaving an ileostomy, or performing a J-pouch procedure. Young women with a J-pouch may experience fertility issues.
- The Crohn's and Colitis Foundation of Canada are a big resource for those with this diagnosis, and they may find it encouraging to meet with others with this diagnosis.
- It has many psychological issues attached, because it is chronic, often diagnosed in the youngest years, when self image is still developing, and if surgery has been performed, all those make coping difficult. No one wants to discuss bowel habits with friends, and they may not understand why someone is constantly on the look out for a restroom.
- Physicians do not often have the time to discuss problems, so GI nurses may find themselves in a position to assist someone who is struggling, in the endoscopy setting, in a physician's office, post-op, or with a friend.

# Crohn's Colitis

- Inflammation of the colon that involves all four layers.
- Can occur anywhere in the GI tract, except it tends to spare the rectum.
- The cause is unknown, but genetics play a role, as does environment.
- Like UC, the same age groups tend to be higher risk.
- Symptoms include diarrhea, bloating, pain, and anorexia.
- Is segmental. When looking at a colonoscopy, there is a "skip pattern". Some segments are affected, while others are not.
- There is often a distinct cobblestone pattern to the inflammation.
- Crohn's colitis is the most likely to form strictures, abscesses (it involves all layers, so can perforate, and cause infection outside the colon), fissures, and fistulas. The perianal area is a common site for fistulas, but it may fistula into surrounding organs (bladder, small intestine etc.).
- If surgery is used to remove a stricture, or section of inflammation, it will reoccur at the same spot, or another. Many older Crohn's patients have endured multiple surgeries when there were no other alternatives.

- The medication pyramid is the same as for UC, but the group for 5-ASA tends to be not as effective. Physicians move to immunosuppressives and biologicals faster to obtain mucosal healing.
- Good nutrition is important, but when a person does not feel like eating, they should be encouraged to consume high calorie food frequently, avoiding fiber, lactose or high fat foods.
- Stress reduction is important, and exercise may be helpful in this.
- Smoking will worsen Crohn's, so they should be encouraged to quit if they smoke.
- A food diary may help pinpoint trigger foods.
- Keeping a log of symptoms to discuss at the physician's appointments may be useful in tracking the disease process.

- Again, for the same reasons, a counsellor may be helpful in working through some of the psychological issues inherent with this disease.
- Many of these patients have been perceived as difficult to deal with by healthcare workers because they may be obsessive about their care.
- When one considers the daily struggles to control their bodies, it is no wonder that they want to control other areas of their lives so zealously.

# Radiation Proctitis

- For patients who have had radiation therapy to the pelvic area, it is possible to have colitis of just the rectum anywhere from 3 months to 2 years post radiation.
- They are anemic, and often see blood in their stool. Pain is a possibility, along with the feeling of fullness in their rectum.
- A scope will show red, irritated areas, with blood seeping from a multitude of tiny lesions.
- APC is used in an attempt to scar some of those areas over, and create healing.
- More than one treatment may be required.

# Strictures

- Colon strictures may form as a result of a disease process, like Crohn's, or may be from previous scarring at an anastomosis, a colonic mass, or scar tissue from the outside.
- If there is a mass in the way, a stent may be placed in the colon to open the lumen to provide comfort, or as a temporary measure until surgery is performed to remove the area.
- A stent may also be an option for scar tissue impinging from the outside, or surgery performed to relieve the adhesion.
- For other stricture, they may be dilated with a balloon to open the scar tissue, or anal strictures may be dilated with uterine dilators to stretch the area open.

# Polyps

- Polyps are growths on the inside of the colon that may be benign, or malignant.
- The great majority are benign. Hyperplastic polyps will never be anything other than benign, but some, if left long enough, may develop cancer.
- The most common type of polyp is adenomatous. There is a new category of polyp, found in the right colon that is being described as a sessile serrated adenoma, that may be more dangerous, and more easily missed during surveillance.
- Pedunculated polyps are attached to the wall by a stalk, which may have a strong blood supply.
- Sessile polyps grow on the wall itself, and may cover a wide area.
- Screening with removal of polyps has been demonstrated to decrease the incidence of colon cancer.

# Colon Cancer

- Colorectal cancer is the 2nd most commonly diagnosed cancer in Canada. Approximately 1:5 will develop it.
- It is the 2nd leading cause of death from cancer in men and the 3rd leading cause of death from cancer for women in Canada.
- In the endoscopy suite, we spend a lifetime trying to prevent this cancer; which is the only preventable cancer.
- Canada is divided into 10 provinces and three territories. Health care is the responsibility of the provinces, not the country, so standards vary from province to province. Most provinces have instituted the FIT test (Fecal Immunochemical) for those who are willing to participate in the colon screening program, and are over the age of 50. If the test is positive, they are referred for a colonoscopy.
- However, family physicians are still free to continue referring patients over the age of 50, or those with a family history of colon cancer for a colonoscopy. The guidelines say 50, or 10 years younger than the age a first degree relative was diagnosed with colon cancer.



- If they have a screening colonoscopy, and the results are negative, they are recommended for a repeat in 5 years if there is a family history of polyps or cancer, or 10 years if there is no history.
- Studies indicate that it takes 7-10 years for a polyp to develop into a cancerous tumor, hence the guidelines.
- We know from other studies that 1-5% of polyps are not seen during the examination, resulting in a repeat of 5 years for family history.
- Things that improve adenoma detection rates include a good preparation, a 7-10 minute withdrawal time (cecum to rectum), turning the patient into a different position for withdrawal, and a nurse who has been in endoscopy for more than six months.
- Patients that are at a higher risk for colon cancer include those who eat a high fat diet, are over the age of 50, have a family history, previous colon cancer or polyps, ulcerative colitis over 10 years, breast cancer, or certain genetic syndromes.
- Removing polyps is the key to preventing colon cancer, and the withdrawal time is critical.
- If the polyp is small enough, it may be removed endoscopically. Even larger polyps may be injected, and removed in pieces, using a snare. A 2 mm margin is required of normal tissue for the polyp to be considered completely removed.

- If the polyp is too large, the margins are not clear, the tissue comes back as malignant, or the polyp is too large to remove by colonoscopy, surgery is required to remove it.
- Various types of surgery are used for these polyps.
- A right hemicolectomy: removal of the right side of the colon, attaching the small intestine to the large.
- A left hemicolectomy: removal of the left side of the colon, attaching the mid transverse to the rectal remnant.
- A sigmoid resection: removing the area with the polyp, and reattaching the two ends.
- A total colectomy: removing the whole colon, leaving an ileostomy, or converting the ileum into a J-shape, attaching it to the rectal stump.
- A Hartman's procedure: removing the low part of the rectum, leaving a colostomy. Often performed if the polyp is in the bottom 9 cm of the rectum. It is possible that this is only temporary, and may be reversed, or it may be permanent.
- An abdomineal-perineal resection: completely removes the distal colon, including the rectum and anal sphincter. This is for lesions in the very low colon.

- Of course, the bigger the polyp, the more likely it is to have become malignant.
- The vast majority of colon masses are adenocarcinomas.
- Most cancers of the colon are found in the sigmoid, or ascending colon.
- Reported symptoms may include pain (often late stages), anemia, weight loss, change in bowel habits, feeling like they have trouble emptying their rectum, and general malaise.
- At times, they may have noticed no symptoms, and have come into the clinic for a routine screening endoscopy.

- Since this is a slow growing cancer, odds are good that the patient may be cured if it has not already spread through the wall. Cancers of the ascending tend to spread more quickly to the liver, than those in the sigmoid colon.
- Chemotherapy or radiation may be required before surgery to shrink it, or after surgery, if there were lymph nodes involved.
- Surgery is as previously mentioned.

# Poor Prognosis

- Polyps that have these characteristics are not good signs:
  - ❖ Does not lift up with injection
  - ❖ Covers more than 1/3 of the diameter of colon.
  - ❖ Friable
  - ❖ Hard
  - ❖ Bleeding
  - ❖ More than 2-3 cm long
  - ❖ Specimens pull off easily

# Care of the Ostomy Patient

- There are a multitude of issues when working with patients with an ostomy.
- They are performed on infants, children, teenagers, and adults of all ages.
- They may be permanent, or temporary. Even those with a temporary ostomy will struggle with body image issues.
- Ostomies may be the result of surgery for cancer, perforation, diverticulitis, IBD, or after trauma.
- It may be difficult for a person to learn to care for the ostomy, either from psychological issues, or they may be unable to manipulate the equipment.
- They may need the chance to talk with someone about any self-image issues they are struggling with. If they have a spouse/partner, they wonder how they will be perceived.

- It is difficult to discuss an ostomy in the beginning of a new relationship, and young people struggle with forming friendships, and sexual relationships.
- A counsellor, or close family member may be able to help.
- They need to learn how to care for the stoma site, to deal with odor issues, leaks, bleeding, how to use the equipment properly, and how to choose comfortable clothes to decrease the chance of accidents.
- During a post op stay, this is a lot to accomplish. There are wound/stoma care specialists in many pharmacies who are available to consult, and assist in care once they have gone home.

# Hereditary Nonpolyposis Colorectal Cancer(Lynch Syndrome)

- Those with Lynch Syndrome are at higher risk for a multitude of cancers, including Colon.
- As many as 1:300 may be carriers for the gene, and it is autosomal **dominant**.
- they are at risk for uterine, prostate, ovarian, breast, bladder, kidney, pancreatic, bile duct, small bowel, stomach, liver, and brain cancers.
- Once someone has been proven by genetic testing to be positive for Lynch genes, all family members should be tested.
- The risk over a lifetime for colon cancer alone jumps to 40-80%, and screening should begin at age 20.
- Many of these patients will not see beyond the age of 40, unless vigilant care is taken of them, by checking for cancers of every type on a strict schedule.



# Familial Adenomatous Polyposis (FAP)

- Another genetic **dominant** diagnosis, these patients develop hundreds to thousands of polyps in their small intestine, and colon.
- All family members of an FAP patient need to have genetic testing performed.
- There are so many colon polyps that it is impossible to remove them, and they require a total colectomy.
- Because it begins at the advent of puberty, screening of children of known FAP parents should begin at around the age of 12.
- Many of these children have had a total colectomy by the time they turn 18 years old.

- Even after surgery, screening is required. They frequently develop adenomatous polyps at the ampulla, and they need to be checked routinely (every 2 years or so) by an upper endoscopy.
- Surgery may include an ileostomy, which requires no further colon screening, or a J-pouch procedure.
- If they have elected a J-pouch, yearly flexible sigmoidoscopies are performed to check the anal cuff for any polyp formation.
- Because a J-pouch involves surgery in the pelvic cavity, a female may struggle with infertility after surgery. Some opt to have the pouch after their family is completed.
- Psychological issues, besides having an ostomy, may include the choice to produce children or not, knowing this is a genetic dominant mutation.

# Gardner Syndrome

- A rare genetic defect, it may be related to FAP. It is autosomal **dominant**.
- It produces multiple adenomatous polyps in the GI tract, or on bones (mandible, skull, or long bones).
- Polyps are likely to be cancerous if left for more than 10 years, so a total colectomy is recommended.

# Procedures

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# Upper GI Endoscopy Esophagogastroduodenoscopy (EGD)

- An upper GI is used to examine the esophagus, stomach, and duodenum for irritation, inflammation, bleeding, varices, polyps, masses, or ulcers.
- Patients considered for this procedure include those with liver disease, dysphagia, family history of cancer, chest pain, vomiting blood/tarry stools, history of GERD or strictures, PEG tube placement, low iron or hemoglobin, or suspected malabsorption syndromes, or those with food bolus/foreign body.

- It is not usual to perform this on a person with perforation, however, if placing a stent in the esophagus may allow that area to heal, then it can be done.
- Even those who are in unstable condition may be scoped in the ICU if the procedure may be curative, and allow the patient's condition to improve.
- It should not be performed on a patient who is not willing to have the procedure.
- Preparation is to keep the patient NPO for at least 6 hours pre-procedure, unless you have a food bolus situation.

- Complications may include infection, bleeding, perforation, aspiration, over sedation, and laryngeal spasms.
- Infections will be noticed some days after discharge, and antibiotics would be prescribed, the scope tracked, cultured, and an attempt would be made to find the original source of the infection. It is preferable to use only single use equipment instead of those that are reprocessed.
- Immediate bleeding may be threatened with thermal therapy, injection of adrenalin, application of clips, or Hemospray. It is possible for biopsy sites, or polyp removal sites to bleed post procedure, and the patient may need a repeat scope to assess and treat the bleed.

- Perforation noted prior to the end of the procedure may be closed with clips, or may need admission and possible surgery if it does not resolve on its own.
- It is important during the procedure to remember the gag reflex has been frozen, and the head needs to be kept forward, and the fluids removed with suction if necessary from the mouth and upper esophagus.
- If aspiration is suspected, admission, and antibiotics, with oxygen therapy, and treatment for pneumonia may be required.
- Some people are more sensitive to medication than others, and may be in a deeper level of consciousness, and unable to rouse. Oxygen, if not already on, is placed, along with one on one nursing care, frequent vital signs, and the consideration to using a reversal drug like Flumazaniil (Anexate), or Nalaxone HCL (Narcan).



- Laryngeal spasms may be caused from the numbing agent on the vocal cords, and can be life-threatening. Immediate removal of the scope, oxygen therapy, respiratory therapy, use of Salbutamol/Ventolin, and even placing the patient on a ventilator is possible.

# Colonoscopy

- A colonoscope is used to examine the large intestine, and possibly part of the small intestine for inflammation, infection, strictures, polyps, cancers, or other disease processes.
- Patients considered for this procedure include those with family or personal history of polyps or cancer, those with abdominal pain, loss of blood, colonic decompression, those with genetic predispositions to colon disorders, or symptoms of diarrhea or constipation.

- Contraindications may include those who have diverticulitis, those on anticoagulants if there is a possibility of removing polyps, those who are pregnant, or have a perforation, (unless the procedure is an attempt to close a small perforation), and those who have not had a preparation.
- Complications may include perforation, bleeding or infection, and over sedation, and are treated in the same manner as previously discussed. In rare circumstances, if the colon is not adequately prepped, and an attempt is made to remove polyps, the methane gas may cause the colon to have a large perforation. If blood thinners have been stopped for the procedure, a stroke or heart attack is possible.
- It is also possible to lacerate the spleen during a colonoscopy, causing bleeding, and requiring surgery immediately. Look for pain, tympany, absent bowel sounds, and a firm abdomen.
- The preparation is important, as a clean colon leads to a more accurate exam. Each physician has a preferred preparation schedule that includes a clear fluid diet, and a laxative preparation to remove all the debris from the colon.

# Enteroscopy

- If the physician suspects there may be a stricture, bleeding, or mass just beyond the range of a gastroscope, they may decide to use a colonoscope or enteroscope to see further into the small intestine.
- Preparation includes a six hour NPO status.
- Complications would be consistent with those having an upper endoscopy.

# Endoscopic Retrograde Pancreatography (ERCP)

- Used for those with jaundice, stones, strictures, or masses, in the biliary system, pancreas, or liver, or with pain, or elevated liver tests.
- Contraindications would include those on anticoagulants, or high PT/INR.
- Even those who are septic, or ventilated may be done with support from ICU nurses, and respiratory therapy, if removal of stones, or placing a stent would alleviated the sepsis.

- Blood work should be done prior to ERCP to check liver function, and since bleeding is a potential complication, a group and hold may be performed. The patient needs to be NPO for at least six hours.
- Potential complications would include those from an upper endoscopy, along with the risk of pancreatitis. This may occur prior to leaving the unit, or after discharge, resulting in hospital admission, antibiotics and rest. In some cases, it may be severe. Using less contrast, and trying to avoid the pancreatic duct, may decrease the chances of pancreatitis.
- Stone retrieval may tear the duct or the sphincter, and a sphincterotomy may cause perforation of the small intestine, or excess bleeding.
- A stent may bridge the duct long enough to heal a tear, or even stop bleeding of the sphincter. Injections of adrenalin or clips may assist with perforation and bleeding.

# Flexible Sigmoidoscopy

- For those who only need to have the lower part of the colon examined, potentially extending as far as the splenic flexure.
- These patients may have had a recent colonoscopy, and need a recheck of a polyp site, bleeding, inflammation, or infection. They may be young, with bleeding noted, and since they are at a less risk for cancer, a flex sig may be ordered to check for low sites of bleeding, such as IBD or hemorrhoids.
- Preparation is usually a small tap water enema or fleet enema.
- Most of these patient will not require sedation, so the effects of over sedation will not apply, but other complications of a colonoscopy are possible.

# Anoscopy with or without Hemorrhoid Ligation

- An anoscopy is performed when the physician wants to look at the very bottom of the anal canal.
- They may want to examine the hemorrhoids, or check a low-lying mass.
- If hemorrhoids are seen, they may be ligated.
- Preparation is usually nothing, or a small enema may be given.
- Complications may include bleeding, pain, infections, or post banding, having the ureter block from edema. Pain may be the result of the ligation being too close to the Dentate line, and if it is severe, the band may be removed.



# Endoscopic Ultrasound

- Used to examine the structures outside the stomach and small intestine, including the liver, pancreas, biliary system, esophageal/stomach/small intestine wall, gallbladder, blood vessels, and lymph nodes in the area. Rectal EUS can determine if the mass has spread past the walls, and which surgery is more appropriate.
- Often looking for cancers to evaluate the type, and spread, or stones in the biliary system, or cysts in the pancreas.
- Fine needle aspiration or core biopsies may be obtained to confirm the diagnosis of cancer, and the type.
- It may be used to examine a pancreatic pseudocyst, and determine pancreatitis, or other abnormalities of the biliary system.

- Contraindications may include anticoagulant therapy, a restless/uncooperative patient, or lack of informed consent.
- Risks include perforation of the esophagus, aspiration, bleeding, infection, over sedation, laryngeal spasms, and perforation of blood vessels or bile ducts during needle aspiration.
- Rectal EUS needs the same preparation as for flex sig, and an upper EUS needs a six hour NPO status.

# Double Balloon Endoscopy

- For a patient who has bleeding, suspected tumor, suspected stricture, or suspected inflammation in the small intestine, or for someone with a foreign body in the small intestine (e.g. M2A capsule) it is theoretically possible to examine the whole small intestine with this scope, doing two procedures: first entering the mouth, then on another occasion, entering the colon.
- There are two balloons, one on the scope, and one on the overtube. Using these balloons, it is possible to manoeuvre through the small intestine a bit at a time, anchoring the scope with the balloons, and advancing as far as possible each insertion.
- It is possible to use APC to stop any bleeding from angiodysplasia noted, inject adrenalin, take biopsies, and retrieve foreign bodies.

- Preparation depends on whether the scope is introduced from the mouth or rectum. The upper preparation requires NPO for six hours, and the lower requires a colon prep.
- On occasion, we have used this scope as a colonoscope on a patient who had one or more unsuccessful attempts at colonoscopy for a redundant colon, when it was known there was a polyp in the far colon.
- Complications are as stated for upper GI and colonoscopy.

# M2A Capsule Endoscopy

- Used to take pictures of the small bowel so that it is possible to look for strictures, inflammation, cancers, bleeding, or diverticula.
- Contraindications may include Crohn's disease, known strictures, or diverticula.
- The only risk to this procedure is that the capsule may become stuck in a stricture or diverticula. We have had one that the patient had no symptoms, and it had been stuck for two years.
- If it is far enough toward the cecum, retrieval may be possible with the double balloon, or if all else fails, surgery is needed to remove the capsule.
- Preparation is NPO at midnight for early am testing. Some facilities use a small amount of colon prep prior to swallowing the pill.
- There are a few who after 2-3 hours have not cleared the pill into their small intestine, and require an upper GI to push it into the small intestine. Those have the same risks and complications as an upper GI.

- The patient is allowed water once the pill has cleared the stomach, and the pill takes 4-10 pictures each second for a video of the small intestine lasting 8-14 hours. Ours are checked prior to the clinic closing, and may be removed if they are in the colon (as seen on the monitor screen), or left on for the 14 hours it takes for the battery to die.
- There are now colon capsules available, with the ability to examine the colon. This requires specific preparation instruction.
- There are also placebo capsules that may be given to those with suspected strictures, or diverticula. They are the same size as a regular capsule, but dissolve within 72 hours. An x-ray determines if the capsule is still there in 24 hours. If it is present, the real capsule will not be given, as there is a high probability of it getting stuck. The actual capsule has a battery in it that is obviously dangerous if it remains in the patient.

# Esophageal Manometry

- Manometry uses a probe inserted from the nose to the stomach to evaluate the peristalsis of the esophagus, and the strength of the two sphincters.
- A patient who has dysphagia, odynophagia, heartburn, chest pain, or requires a fundoplication is referred for this study.
- Contradictions include an uncooperative patient, a known diverticulum of the esophagus, recent nose surgery, a broken nose, or a tight stricture or mass of the esophagus.

- Complications may include bleeding from the nares, reaction to the freezing agents used to suppress the gag reflex, aspiration, and infection. Rarely, the probe has become caught in the back of the sinus cavity, and it requires surgery for removal.
- Many are very nervous about this procedure performed without sedation, and may be difficult to induce cooperation.
- The procedure requires an NPO status, but if the person has not been NPO, and they are cooperative, it may still be tried.
- The latest technology is that which uses the Chicago Classification system to qualify the diagnoses so that all physicians use the same parameters.



# Anorectal Manometry

- A probe is inserted into the rectum to evaluate the strength of the muscles of the rectum, the sensation level, and the reflexes that are needed for defecation.
- Many patients that require this testing have constipation or fecal incontinence. Some have such severe symptoms that they have severe excoriation of the skin in the perianal area, and require teaching on skin care.
- Laxatives or an enema may be required depending on hospital policy.
- Risks are few, but the remote possibility of a tear or perforation is possible.
- Complications may include mild discomfort, mild bleeding or infection.

# 24 hr pH Study

- Often performed in conjunction with an esophageal motility study, this evaluates the amount of reflux a patient experiences over 24 hours, how high the reflux extends into the esophagus, and whether the symptoms they experience are related to the reflux.
- The probe is placed via the nare until it rests 5 cm above the LES. The patient is given the instructions as to which buttons to press on the monitor when symptoms occur. The equipment is returned the following day, and the information evaluated.
- Risks, contraindications, preparation, and complications are the same as for esophageal motility.

# Gastric Lavage

- May be performed if the patient has a bezoar, or ingested medications.
- Along with the risks for an upper endoscopy, this carries a severe risk for aspiration, and the patient's condition must be carefully monitored to avoid this complication.
- A large amount of warm water is inserted by a lavage tube in the stomach, until the person begins to vomit it all out.

# Decompression

- For a patient with a volvulus, or other type of obstruction.
- A colonoscopy is performed to remove air/liquid matter from the colon.
- No preparation is given, and risks apply as for colonoscopy.

# Zencker's Diverticulotomy

- When a patient has a Zencker's, it can be a frustrating situation.
- Often they are elderly, and may have many comorbidities, and are not good surgical candidates.
- They may be sent for a diverticulotomy by endoscopy.
- Contraindications are a patient who is restless or those on anticoagulants.
- The endoscopist examines the area with a scope, then places a wire into the stomach. If there is food in the "tic", then it is removed.
- An NG tube is gently placed beside the wire, then the position is confirmed by scope.

- The NG makes it less likely that the esophagus will be damaged during the procedure.
- Using a special needle-knife, the bridge between the diverticulum and the esophagus is cut down to the muscle layer, in effect, causing the food to drop into the stomach and not get caught in the tic.
- This procedure requires a physician with skill, a quiet, well-sedated patient, and three nurses.
- Risks are aspiration, bleed, perforation, laryngeal spasm, over sedation, and infection.
- They are often kept overnight for close assessment, and are discharged the next day.

*A GI nurse must be able to recognize significant deviations from normal, and initiate emergency care immediately.* 5

# Care of the Gastroenterology Patient <sup>6</sup>

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- ⌘ It is not important to just be comfortable with the anatomy, physiology, pathophysiology, and procedures, but the GI nurse must be comfortable in dealing with the patients.
- ⌘ Especially if one works only in endoscopy, it is easy to focus on the procedure, and not on the patient.
- ⌘ There is often much more going on behind the scenes, where an observant GI nurse can intervene.
- ⌘ Patients may be hesitant to discuss with us the medication they are on at home. They may be taking them improperly (especially PPI's), or not at all. They may be taking things that are over the counter, that they do not recognize interact with what they are prescribed, or they may even be taking illegal drugs.
- ⌘ The GI nurse should be familiar with what the drugs are, how they should be taken, adverse effects, drug interactions, how herbal medications or alternate therapies may effect the GI system, and the expected outcome of the drug therapy.

- ⌘ Some people who have GI issues, even serious cancers, try diet regimes that have been recommended by friends, or that they have found on the internet. They may be reluctant to discuss them with the physician, and it is important to check with them on vitamins, herbal supplements, and nutritional therapies they may be on. Some may not have the nutrition they need, especially for IBD or cancer patients who require a significant amount of nutrition each day. Those with liver issues need reminders about alcohol and fat/sugar control.
- ⌘ Probiotics are a topic that in Canada have GI physicians disagreeing over their potential benefits.
- ⌘ As GI nurses involved in caring for nutritional needs, we should be aware of various diets, whether they are oral, parenteral, or enteral.

- ⌘ When the patient arrives in your area of care, it is important to collect all the information you can from the patient, and the chart, including history, laboratory studies, any community care they are getting, family history, environmental toxin exposure, or their lifestyle.
- ⌘ A physical assessment needs to be performed, as appropriate, along with a risk assessment: isolation needed, falls risk, allergies, ID, and implantable devices.
- ⌘ Once you are able to interpret the assessment, a care plan may be formed with anticipated outcomes, and then with the other staff and physicians, you are able to set goals that relate to the patient.

# Assessment

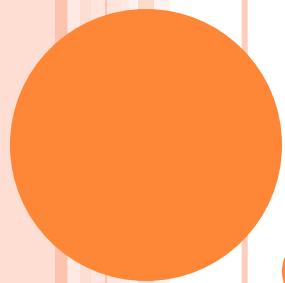
- ⌘ Once the assessment is completed, you are able to see what the priorities are, depending on the resources of the unit.
- ⌘ It is necessary to determine which diagnostic procedures should be performed first, in order to get things done in an efficient manner.
- ⌘ If the patient is having pain, pain relief is always a top priority, and needs to be assessed and managed promptly.
- ⌘ The condition of the patient needs to be monitored, and modified if necessary.
- ⌘ In the work environment, it is important to be able to supervise, and delegate tasks that others are capable of performing, and to communicate appropriately with the team.
- ⌘ many of our GI patients struggle with body image, eating disorders, weight (too much, or too little), and it is important to recognize the psychological impact this has on their disease process. It may be necessary to consult others to assist you in their care, including dietitians, psychologist, or spiritual leader.
- ⌘ A discharge plan is necessary for safe discharge to home, or an alternate facility, and should be done with the patient, family, and team input.

# Implementation and Evaluation

- ⌘ As GI nurses, we have the opportunity on a daily basis, to see a large number of family, and patients that we have the opportunity to counsel, suggest changes in their lifestyle to promote health, improve their diet and exercise to prevent or slow the progress of disease.
- ⌘ Even in the community, as well as the unit, the opportunity is there to discuss with friends and family the necessity for early detection and prevention of a myriad of diseases, and to suggest reviewing concerning symptoms with their physician.
- ⌘ We need to use a variety of methods to teach, including brochures, pictures, internet, and verbal instruction in order for the patient to understand the information.
- ⌘ For those who may have difficulty in grasping the information, it may need to be simplified, or a family member brought into the discussion. We must always be kind and courteous, demonstrating patience.
- ⌘ Remind the patient and family that there are also community resources available to assist them (support groups, social media, internet)

# Education

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# SAFETY

# INFECTION CONTROL

- All healthcare personnel are responsible for preventing infection in the patients, and themselves.
- An infection is the result of an organism (bacteria, virus, parasite, fungi, protozoan) entering the body, replicating, and producing illness.
- An endogenous infection arises from a microorganism from the mucosal surfaces entering the GI tract, to gain access to the bloodstream as a result of a procedure.
- An exogenous infection arises from a microorganism that comes from outside the body due to inappropriate cleaning of surfaces or equipment, improper use of reprocessing machines, or improper storage of scopes.

- It is important to note if the patient is currently ill, or has been ill in the past with serious illnesses (HIV, HBV, HCV, TB, MRSA, VRE, c-diff etc.)
- There are many of our patients who are at risk for acquiring an infection: those who are young, elderly, or immunocompromised, and need to be protected.
- In-patients who arrive for endoscopy on isolation as an admitted patient, need to be kept on isolation in the clinic, and signs posted for appropriate handling of their infection.



- There are three ways that a person may come into contact with microbes in the GI unit.
  - Noncritical items: these only come into contact with intact skin from the outside, with little risk of transmission of microorganisms. Stethoscopes, beds, tables, BP cuffs, etc. are included. These need to be cleaned with a disinfectant appropriate to the equipment.
  - Semicritical items: contact only intact mucus membranes or skin, and do not penetrate the surface. Endoscopes fall into this category. High level disinfection is required to clean.
  - Critical items: items that break the skin, or mucus barrier. Sclerotherapy needles, forceps, clips, IV cathalons would all be included. Reprocessing of these items is **not** recommended, and these should all be single-use items. If reusing them is necessary, they should be sterilized.

- Sterilization completely destroys all microbes, including their spores. It may be done by steam, heat, gas, or disinfectants. GI scopes do not need to be sterilized unless being used on a sterile OR field. Instead, our scopes are recommended to be high-level disinfected.
- Low-level disinfection destroys most of the bacteria, some viruses, and some fungi, but not spores or m. tuberculosis.
- Intermediate-level disinfection will destroy m. tuberculosis, bacteria, most viruses and fungi, but not spores.
- High-level disinfection destroys all mycobacteria, all viruses and fungi, not always all spores.

- In the GI setting, it is necessary to protect the staff first.
- We should all be educated on a regular basis about isolation procedures, and the rules of safe handling of the equipment.
- Gloves, masks with shields, gowns resistant to liquid should be used for blood and body precautions during any procedure, and during the reprocessing.
- Eye wash stations should be immediately available in the event of a splash injury.
- Those who are involved in scope and equipment reprocessing should be vigorously trained in infection control, and be subject to yearly competencies.

- Records need to be kept on each scope, so it may be tracked. The records need to include patient identification number, date, the person who cleaned the scope, and whether the disinfectant passed the effectiveness test. This information can be used to pull the chart, and see which physician performed it, which staff were involved, and if anything unusual occurred.
- The facility's quality assurance should include regular checks for micro bacteria growth in the scopes, and any preventative maintenance performed on the scopes or the processors.
- Reprocessing rooms and procedure rooms need to be separated, with reprocessing having a specific “clean” and “dirty” side. Policies should detail approved storage, drying, and cleaning of scopes, along with how to clean up spills.

- The most important step in the reprocessing of a scope is the bedside decontamination. This is done to clear the channels of debris, and prevent secretions from drying in the scope. It should be performed as soon as possible after the scope has been removed from the patient by someone trained in appropriate technique.
- If properly performed, it is possible to remove upwards of 80% of the microorganisms from the scope before it is reprocessed.
- An enzymatic soap is used to break down the proteins in the scope, then it is taken for further reprocessing where the scope is brushed, flushed, rinsed, and placed in a machine for high-level disinfection.

Product	Product Information	Pros	Cons
Glutaraldehyde	<p>Most commonly used. Needs 45 min of exposure at 25 C to kill 100% of TB without pre-cleaning. If scope was precleaned at the bedside, needs 20 minutes to effectively clean.</p>	<p>Non- corrosive to metal and plastic. Excellent biocidal. Useful in manual or automated reprocessing No safety issues with humans (as far as reproduction issues) Disposal as per WHMIS</p>	<p>Some bacteria have become resistant. May cause biofilm build up. Humans may develop allergies/sensitivities. Irritates skin and mucus membranes.</p>
Peracetic Acid 0.2%	<p>Effective liquid chemical sterilant.</p>	<p>Similar or better biocidal. Less irritating to staff if ventilation is adequate. Safer to the environment. Does not allow for biofilm buildup, and can remove glutaraldehyde from channel. Has not caused resistant organisms.</p>	<p>Depending on temperature, and pH, may be corrosive. May discolor scopes and damage seals. May irritate nose, throat, lungs, eyes, and skin.</p>
Ortho-phthalaldehyde 0.55% (OPA CIDEX)	<p>High-level disinfectant with 12 minutes immersion at 20 C and 5 minutes at 25 C. Effective in bacteria, fungi, and parasites.</p>	<p>May be effective against glutaraldehyde resistant species. Reusable over 14 days Must be tested to ensure still effective.</p>	<p>Potential eye, nose, skin irritant. May cause dermatitis. May cause staining on linen, and in reprocessors.</p>

- In today's era, it is more and more important that manual cleaning of scopes cease, and automated reproprocessors are used. Things to consider:
  - Water should be pre-filtered
  - Fluids should circulate smoothly
  - Following detergent and disinfectant there should be cycles of water and air .
  - Water must be hot enough to allow products to work properly.
  - The ability to properly dispose of waste water.
  - Alcohol and air should be the final two cycles.
  - A high pressure port ensures enough psi to deliver fluids under the elevator channels to the linear EUS and duodenal scopes.

- Duodenal scopes have recently come to the attention of infection control as it is almost impossible to adequately clean the channel with the elevator in the way. There have been a few infections in the US that have been concerning, and new rules are in place to clean these scopes adequately.
- If it is at all possible, endoscopy clinics should be moving away from equipment that is reusable, to equipment that is disposable.
- Special procedures are in place for biopsy forceps, water bottles, argon hoses, and other equipment that may be reused.



# Nursing Ethics

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- The GI nurse must practise according to the Canadian Nurses Association Code of Ethics.
- Each of us must treat the patients with respect, no matter what their culture, their religion, or their own personal values.
- At times, we may not agree with their decision for what they choose as their treatment option, but our task is to ensure that they have all the information they need to make an informed decision. We cannot force our choices on them, but simply support what they choose to do.
- They are also free to change their mind at a later date without us reminding them that they made the wrong choice the first time.

# RESEARCH

# DEFINITIONS

- Researcher: the one doing the study
- Participants/subjects: the ones in a quantitative research project
- Informants: the ones in a qualitative project
- Sample population: the total group of people in the study
- Setting: where the study takes place. If more than one is involved, they may be called “multi-site” studies.
- Quantative research: a disciplined process used to obtain information. Has a specific plan where information can be measured.

- ◉ Variable: something that varies (BP, sats, lab values)
- ◉ Independent variable: the “cause” that should have an “effect”.
- ◉ Dependent variable: the “effect” produced by the “cause”
- ◉ Qualitative research: more interested in understanding what it means to be human
- ◉ Random sample: picking a specific number of people from a large population
- ◉ Non-probability sampling: using the people most easily accessible. May not be a true representation of the population.
- ◉ Experimental group: these people get the experimental treatment.
- ◉ Control group: these people do not get any treatment.
- ◉ Comparison group: these people have scores for the dependent variable that allow researchers to look at the scores of the research group, and compare the results.
- ◉ Double-blind: neither the subjects nor the investigators know who is getting the treatment.
- ◉ Placebo effect: neither the subjects nor the investigators know whether a drug is real or not. The placebo looks just like the real drug, and when given, if it is effective, they are able to separate the psychological effects (placebo) from the real ones.

- ◉ Mode: the number that occurs the most frequently in a set.
- ◉ Median: average position in a set of values. Fifty percent of the values are above it, and fifty percent are below it.
- ◉ Mean: the average. The sum divided by the number of elements in the set.
- ◉ Variability: how far away the subjects vary from each other in a specific way.
- ◉ Range: highest value-lowest value=range

- Standard deviation: how far the numbers are away from their average.
- Nominal data: organizes into categories: race, gender, religion, etc.
- Ordinal data: arranges by rank (pain)
- Interval levels: data that occurs at specific intervals (temperature)
- Ratio: has specific intervals, and a zero point (weight and height)
- Validity: are the findings biased, or true
- Reliability: are the findings consistent and accurate. Can someone else duplicate the findings?

- For someone to participate in a study, they must be completely informed as to the purpose of the study, and what they are expected to do.
- They are allowed to change their minds and leave at a later point.
- They are guaranteed privacy and confidentiality.
- They need to know how much time is required, and any side effects of the procedures, or medications, and that they may not be receiving treatment at all.
- They need to know what the end results will be used for.



# Pharmacology

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- As is the case with any other patient population, the GI nurse needs to know the most common medications prescribed, how it works, the usual doses, and the more common side effects experienced.
- Questions or concerns should be referred to the physician who ordered the medication.
- Children are a particular concern, as dosages change with growth periods, and weight loss.
- The elderly may be on so many different medications that they have a difficult time keeping track of them, taking them at the proper times, or even potential drug interactions between them. This is a problem if there is more than one prescribing physician, ordering multiple drugs, and unaware of any others they may be taking.
- Patients may not be aware that herbal, or over the counter medications may interact badly with their prescribed medications, and often don't think to mention them to health care personnel, because "they are not really medication."

- Prior to giving any medication to a GI patient, the process is the same as any other unit:
  - The right patient
  - The right time
  - The right dose
  - The right route
  - The right medication

# Antacids

- Antacids are easily bought over the counter in any store in the country.
- Used by those with heartburn, reflux, or indigestion, they reduce the acid in the stomach, or, in the case of Gaviscon, provide a barrier so the acid does not enter the esophagus.
- These may be liquid:
  - Amphogel (aluminum hydroxide)
  - Gaviscon (aluminum hydroxide, magnesium and alginic acid)
  - Maalox (aluminum hydroxide, magnesium hydroxide),
  - Mylanta (aluminum hydroxide, magnesium hydroxide, simethicone)
  - Milk of magnesia (magnesium hydroxide)
  - Alka-seltzer: sodium bicarbonate

- They may also be tablets:
  - Gaviscon
  - Maalox plus tabs (includes simethicone)
  - Gas-x: simethicone
  - Tums: calcium carbonate
  - Tums dual action: includes magnesium hydroxide and famotidine
  - Roloids: calcium carbonate and magnesium hydroxide

Side effects may include constipation for those with aluminum, rebound heartburn, diarrhea for those with magnesium, and if they contain calcium, and take more than the recommended number per day, they may have hypercalcaemia.

Many patients are not aware that each of these medications should be followed by a glass of water.

# H2 Blockers

- In the stomach, the parietal cells are stimulated by three different factors to produce acid.
- One of these factors is histamine. H2 blockers block the first stimuli for acid construction, but the other two are free to continue to produce acid.
- They are used for heartburn, and the healing of ulcers in the stomach, esophagus and duodenum.
- Cimetidine (Tagamet) is the oldest. It may cause diarrhea, or headache on occasion.
- Famotidine (Pepcid): Headache, diarrhea, nausea are not uncommon side effects, but the most scary is that the IV form can cause psychic disturbances, with violent behaviour. May be used in someone with Zollinger-Ellison syndrome.
- Ranitidine (Zantac): used for acid reduction, ulcer healing, and may be useful for Zollinger-Ellison. Headaches, body pain, diarrhea, constipation, nausea may be noted.

# Proton Pump Inhibitors

- Used for the same reasons as H2 blockers, but they tend to be more effective, since they block the proton pumps themselves.
- H2 blockers just blocks histamine, but PPI's work on the parietal cells to block the proton pumps which stimulate all three factors in the production of acid.
- These drugs can last up to 24 hours.
- These tablets cannot be crushed, and only omeprazole comes in a liquid.
- Many patients do not realize these need to be taken ½ hour prior to breakfast and supper (if they are ordered bid).
- These are all effecting at slowing the rate of progression of Barrett's esophagus, for ulcers in the upper GI tract, erosive esophagitis and prevention of ulcers.
- Omeprazole (Losec): useful for Zollinger-Ellison. Headache is a common side effect, as is nausea, and diarrhea.
- Esomeprazole (Nexium): preferred for those on NSAIDS, and for treatment of h. pylori.

- Lansoprazole (Prevacid): preferred for NSAID use, and treatment of h. pylori. May cause headache, diarrhea and nausea.
- Pantoprazole sodium (Pantoloc): may be used for Zollinger-Ellison. Side effects include headache and GI upset.
- Pantoprazole magnesium (Tecta): has a longer half-life than the medications listed above, so may be more effective for those with nighttime reflux, especially if a second dose is taken ½ hour prior to supper. The side effects are the same as the rest of those in this category.
- Rabeprazole (Pariet): has the same indications and side effects as the rest of the PPI's.
- Dexlansoprazole (Dexilant): the newest of the PPI's released in Canada, it has the advantage of having two peaks of medication released, so the medication may last for a longer time than other drugs in this category.



# Sucralfate

- Sucralfate may be added to a medication regimen to promote healing of ulcers in the esophagus, or stomach, or duodenum, or to prevent the formation of ulcers.
- For patients at risk of stress ulcers, it may prevent their formation.
- It acts to coat the mucus lining, and protect it.
- It may cause headaches, gas, and constipation.

# Antibiotics for H. Pylori

- Penicillin
- Clarithromycin
- Tetracycline
- Metronidazole
- Like almost all antibiotics, allergic reactions may be seen, and GI symptoms are common.
- The regimens for h. pylori are difficult to manage, and patients must be encouraged to finish the pack as ordered, and to take the pills at the proper time.

# Antibiotics for Prophylaxis Prior to Endoscopy

- Less medications are being given prior to scoping, but for those with prosthetic heart valves, weak valves, FNA, drainage of cysts, or other more invasive procedures, antibiotics may be ordered.
- Like all antibiotics, they have the potential for GI upset.
- Penicillin (po or IV)
- Gentamycin
- Cefazolin
- Metronidazole
- Cipro (for FNA or cyst drainage under EUS)

# Antibiotics

- Penicillin: shigella, salmonella, diverticulitis
- Vancomycin: c. diff, pseudomembranous colitis
- Metronidazole: pseudomembranous colitis, protozoans, giardia, amoebas.
- Levofloxacin: h. pylori (after all else has failed), shigella, traveller's diarrhea
- sulfamethoxazole (Bactrim): travellers diarrhea, diverticulitis
- Ciprofloxacin (Cipro): e. coli, cholera

# Antidiarrheal

- A number of medications and conditions in GI may create diarrhea. Some medications that may be used to combat it include:
  - Peptobismol: may cause black stools. Do not use if allergic to ASA or NSAIDS.
  - Diphenoxylate HCL atropine sulfate (Lomotil): uses opioid derivatives to slow colon down. May cause nausea, sedation and dry mouth.
  - Loperamide HCL (Imodium): used mostly for acute conditions, traveller's diarrhea, virus etc. May result in constipation or nausea.
  - Cholestyramine (Questran): absorbs bile salts, so used for patients that may have diarrhea from that issue (post cholecystectomy). Constipation may be a side effect, but reducing the dosage, or taking it every other day may help.

# Antiemetics

- Some medications are notorious for causing GI upset, as are many GI conditions.
- There are patients who deal with it on a daily basis from chemo, Crohn's, etc.
- Some medications that may be ordered include:
  - Diphenhydramine (Gravol): most useful for hyperemesis gravidarum, or motion sickness. Causes drowsiness in most people, but hyperactivity in others.
  - Metoclopramide HCL (Reglan, Maxeran): used for chemo, and for those with slow motility. Causes drowsiness.
  - Ondansetron (Zofran): used for severe N/V with certain drugs (often chemo). May cause GI upset.

# Steroids- First Level Therapy for IBD

- May be given IV or PO.
- Are used for as short a time as possible, in order to reduce the most damaging of the side effects.
- Most often used for Ulcerative Colitis flare, Crohn's flare, the side effects over the long term may include: osteoporosis, pancreatitis, ulcers, psychotic behaviour, headache, nausea, weight gain, and inability to sleep (especially in children)
- These drugs include:
  - Hydrocortisone
  - Methylprednisolone
  - Prednisone
  - Budesonide

# Second Level Treatment for IBD

- Mesalamine (5-ASA/Asacol/Pentasa): these drugs are most effective for UC, but have been used for CD. They are safe, with few side effects, including headache, and GI upsets. They come in PO, as well as suppositories (Pentasa) and enema form (Pentasa) which may be most effective for someone with only lower colon disease.
- Sulfalazine: one of the oldest medications for UC, it may cause headache, and GI upset.



# Third Level Treatment for IBD

- These are more effective than the previous slide for those with CD, or those who did not respond well with UC.
- They are immunomodulators.
- Prior to any therapy, patients need to be reminded that they are immunocompromised, and should be cautious around anyone who is sick.
- Flu vaccines, HBV vaccines and pneumonia vaccines should be given prior to therapy.
  - Azathioprine (Imuran): may cause liver disease. Needs regular blood work. Start with low dose to see if tolerated, and work up. May cause nausea, headache, leukopenia.
  - Methotrexate (MTX): interferes with the growth of cells. Birth control is a must for both sexes as it can cause severe birth defects if either parent takes it.
  - 6-MP: not an immunomodulator, but instead, is an anti-metabolite that interferes with the reproduction of DNA and RNA. It still results in immunosuppression as it depresses the lymphocytes.

# Fourth Level Treatment for IBD

- These are the biological drugs. There are currently two types:
  - The anti-TNF (tumor necrotizing factor) that is used for moderate-severe CD or UC, for those who have not had a good response to other therapies.
    - Infliximab (Remicade) is given by IV infusion, and Adalimumab (Humira) is given by s/c injection, and Golimumab (Simponi), also given by injection.
    - This drug category works because those with IBD have too much cytokine (TNF) causing inflammation. It may be the result of a malfunction in the immune system.
    - Headache, GI upset, infections in the respiratory, urological, or GI systems are not uncommon, as it suppresses the immune system.
    - Rarely, tumors have occurred, and death has resulted.
    - Patients must be tested for TB prior to the beginning of treatment with a chest x-ray, and skin test.
    - Any patient with a cough or fever after starting these drugs must be evaluated for TB.
    - No live vaccines should be given while on these drugs.

- Ustekinumab (Stellara): it binds to Interleukin 12 and 23, two chemicals that cause an inflammatory response. Used for severe CD It suppresses the immune system, but in a different way from the rest, so it may be useful if someone has failed anti-TNF therapy. All the other things in the other category apply. It is given by IV.
- Vedolizumab (Entyvio): this drug is gut-selective, approved for UC, and for those who may have failed, or become allergic to other biologicals. It may cause headaches, or GI symptoms, and it will lower resistance to other illnesses, like the rest in this category.

Over the years, physicians have started with the first level, and have moved slowly towards biologicals, if the other categories were not sufficient in treating the symptoms. It has become a more common practise to consider remission of inflammation, and they are now moving faster through the medications, and putting more people on biologicals faster, and getting them stabilized. Cost is always the biggest factor. It is possible to then move down the levels to reach the one that keeps the patient in remission.

It is not unusual to have a patient on more than one drug level at a time to achieve healing of the mucosa (i.e. biologicals, and immunomodulators)

# Laxatives

- A multitude of products are available for those who suffer from constipation.
- Some are more prone to it, some have slow motility, or neurological disorders, others do not eat a proper diet with enough water and fiber, and others are elderly, and unable to move well.
- Some laxatives are based on increasing the peristalsis while others are more focused on increasing the fiber.
- Some of the more common products in Canada include: bisacodyl (Dulcolax), docusate (Colace), sennecot, lactulose, magnesium citrate, Milk of Magnesia, psyllium, glycerin suppositories, castor oil, cascara, and Restoralax.
- Side effects would include nausea, diarrhea, abdominal cramps/pain, urgency, and the dark ones (cascara and senna) will result in the colon picking up the color, and tinting the colon brown (melanosis coli).
- Unless they are fiber based, so are just increasing the fiber intake, they should not be used on a regular basis as it may produce a lazy colon, one that does not have much peristalsis.
- All these products require a large glass of water with them.

# Conscious Sedation

- A person who has had conscious sedation has had medication to depress his level of consciousness, but can maintain an independent airway, as well as respond to physical stimulation and verbal commands.
- Goal: to reduce anxiety level and discomfort, making the procedure easier.
- Normally, use a combination of sedative/hypnotics with an opiate.
- Opiates alter the perception of pain, but produces respiratory depression, as well as stimulating the vomiting center, and creating bradycardia. Patients need pulse and O2 monitoring.
- Benzodiazepines reduce anxiety, produces amnesia, and potentiates the effects of opiates. This increases the chance of respiratory depression, hypotension, and tachycardia. Need level of consciousness, O2 and cardiopulmonary status monitored, along with carbon dioxide monitoring if available.

- Need nursing history, including allergies, any sedatives used at home.
- Before inserting IV, inform patients they are not to drive until the next day.
- Ensure a driver has been secured.
- During test, monitor sats, BP, and heart rate, cardiac rhythm and carbon dioxide if available.
- After test, monitor LOC, vital signs as per your policy.

# Common GI Drugs

- ❑ Xylocaine spray/gargle
  - ❑ Used to freeze the gag reflex during an upper GI.
  - ❑ Rapidly absorbed, and works within 1-5 min.
  - ❑ Do not give if allergic to surface anesthetics.
  - ❑ Side effects/adverse reactions: convulsions, dizziness, anaphylactic shock, nervousness, hypotension, bradycardia, cardiac arrest, neuro symptoms.

# Common GI Drugs

- ❑ Demerol (Meperdine)
  - ❑ Synthetic opioid analgesic
  - ❑ Peak action: 5-7 min, lasting 2-3 hours if given IV.
  - ❑ Should be diluted with 5-10 ml NS and given 25mg/min.
  - ❑ Side effects/adverse reactions: dizziness, sedation, euphoria, nausea, vomiting, hypotension, rash at injection site, respiratory depression.
  - ❑ Reversal: Nalaxone (Narcan)
  - ❑ Do not give to patients taking MAOI's!!!
  - ❑ Will lower seizure threshold in patients with seizures. Should use Fentanyl instead.



# Common GI Drugs

- Fentanyl
  - Synthetic opioid analgesic
  - Peak action: immediate, lasting 2-3 hours if given IV.
  - Should be diluted with 5-10 ml NS and given over 3-5 min.
  - Side Effects/Adverse Reactions: dizziness, euphoria, sedation, bradycardia, hypotension, respiratory depression, diaphoresis, nausea, vomiting, increased ICP.
  - Monitor v/s, mental status, analgesia.
  - Reversal: Nalaxone (Narcan)

# Common GI Drugs

## ● Morphine

- Opioid analgesic.
- Peak action: 20 min, lasting 3-5 hours if given IV.
- Can be diluted with 5ml NS and given over 3-5 min.
- Side Effects/Adverse Reactions: orthostatic hypotension, sleepiness, respiratory depression.
- Monitor v/s, respirations.
- Reversal: Nalaxone (Narcan)

# Common GI Drugs

- Valium (Diazepam)
  - Benzodiazepine that depresses the nervous system. Diminishes patient recall.
  - Peak Action: 30 min after IV use.
  - Give undiluted in large vein at rate of 5mg/min. Do not mix with other drugs!
  - Side Effects/Adverse Reactions: bradycardia, cardiac arrest, apnea, ataxia, blurred vision, coma, confusion, respiratory depression, thrombosis/phlebitis at injection site, dyspnea, hiccups, laryngospasm, syncope, vertigo.
  - Monitor IV site, respiratory rate, sats, and bedrest of 3 hours after IV injection.
  - Reversal: Anexate (Flumazaniil)

# Common GI Drugs

- Versed (Midazolam)
  - Benzodiazepine for sedation. Three to four times more potent than Valium.
  - Peak Action: onset 3-5 min, peaking at 15-30 min when given IV.
  - Should be given undiluted over 2 min.
  - Side Effects/Adverse Reactions: respiratory depression, respiratory arrest, agitation, apnea, nausea, vomiting, hiccups.
  - Reversal: Anexate (Flumazenil)

# Common GI Drugs

- Buscopam:
  - Used to relieve GI spasms (relaxes smooth muscle).
  - Peak Action: onset 10 min when given IV.
  - Should be given undiluted at 20mg/min.
  - Side Effects/Adverse Reactions: tachycardia, palpitations, hypotension, dry mouth, visual disturbances, increased intraocular pressure. Use caution in patients with sensitivity to scopolamine or belladonna derivatives.
  - Monitor heart rate, BP.

# Common GI Drugs

- Glucagon:
  - Used to diminish motility in the GI tract.
  - Peak Action: 1 min, lasting 9-17 min when given IV.
  - Reconstitute with supplied diluent. Give over one min.
  - Side Effects: emesis, increased blood glucose levels.

# Common GI Drugs

- Adrenalin/Epinephrine:
  - Used to stop/slow/prevent bleeding.
  - Can be injected IV, used as a flush, or injected via scope into tissue.
  - For direct IV push, dilute to 1:10,000 (1 ml epi +9 ml saline). Flush with 20 ml NS, raise arm to increase flow. May be repeated q 3-5 min.
  - For injection into tissues, normal dose is 1:10,000 (1 ml+9 ml NS) put through an injector.
  - Side Effects/Adverse Reactions: dry mouth, blurred vision, tachycardia, tremors, dizziness, tissue necrosis.
  - Monitor BP and pulse.
  - Use with caution with tricyclic antidepressants and MAOI'S

# Common GI Drugs

## ○ Atropine:

- To combat bradycardia, antidote to cholinergic drugs.
- Dose: 0.5mg-1mg direct IV push, may be repeated every 3-5 min to max of 0.03mg-0.04mg/kg. Flush with 20 ml NS and elevate arm.
- Side Effects/Adverse Reactions: dry mouth, blurred vision, tachycardia, palpitations, dilated pupils, difficulty swallowing, restlessness, tremor, hallucinations.



# Common GI Drugs

- Narcan/Naloxalone:
  - Used for reversal of narcotic depression.
  - Peak Action: 1-2 min after direct IV administration.
  - Dose: 0.4-2mg IV push. Repeat 2-3 min prn.
  - Side Effects: hypertension, tachycardia, tremors, nausea, vomiting, diaphoresis.
  - Need v/s q15 min for one hour. They may not leave the unit for at least one hour to make sure they do not re-sedate.

# Common GI Drugs

- Anexate/Flumazaniil:
  - Used for reversal of Benzodiazepines.
  - Peak Action: initial response 1-2 min, peak response 6-10 min.
  - Dose: give 0.3mg direct IV over 30 sec, with 0.3mg q 60 sec to max dose of 2 mg.
  - Side Effects/Adverse Reactions: nausea, vomiting, flushing, anxiety, agitation, increased pulse and BP.
  - Monitor v/s q 15 min for minimum 2 hours as can resedate. Not to be sent out of the unit for at least one hour, and must be monitored on nursing unit for another hour.

# Sclerosing Agents

- Histacryl for gastric varices
- Ethyl alcohol for varices
- Sodium tetradecyl for esophageal varices

# Botox

- Botulinum toxin may be injected as a paralysing agent into a tight LES sphincter, a tight pylorus, or a stricture/fissure in the anal canal.
- May in rare circumstances cause trouble speaking, breathing, or swallowing in the hours, days or weeks post injection.

# Footnotes

- 1) CNA Exam Blueprint and Specialty Competencies 2017
- 2) ibid
- 3) ibid
- 4) <http://www.webmd.com/heart/metabolic-syndrome/metabolic-syndrome-what-is-it#1>
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