Year 1 Peer Based Learning 2020
Gastrointestinal Answers

Please note – this learning resource has been produced by the GUMS Academic Team. It is possible that there are some minor errors in the questions/answers, and other possible answers that are not included below. Make sure to check with other resources.

Case 1

Patient has a history of rheumatoid arthritis for which he takes NSAIDs. Presents complaining of epigastric pain and non-bilious, coffee-ground vomitus.

What is the significance of the vomit being non-bilious and coffee ground?

- *Coffee ground = blood that has been partially digested (eg, from stomach or further down, not from oesophagus)*
- *Non-bilious = does not contain bile = bleeding from proximal to the duodenum*

Explain the pathophysiology of the most likely cause of epigastric pain & vomiting in THIS patient.

NSAIDs have a few effects on the stomach:

- ***LESS MUCOUS** (inhibit COX enzymes → decreased prostaglandin production → less mucous & HCO3 production = less protection of mucosa) – this is the main one*
- *MORE HCl (inhibit COX enzymes → decreased PG production → less inhibition of HCl secretion = more acid = more irritation)*
- *Direct chemical irritation to mucosa*

What are other risk factors for this condition (not necessarily in this patient)? Explain how they contribute to the pathogenesis of the disease.

- *H pylori – invades mucosa*
    - *Produces toxins & inflammatory mediators*
    - *Has urease enzyme (converts urea to ammonia to increase pH, to protect bacteria from H+). Increased pH leads to increased acid production, causing further damage to the mucosa*

- *Smoking (impairs blood flow, reduces healing of damaged gastric mucosa)*
- *Steroids: similar to NSAIDS + impaired healing*

Imagine the patient was asked to do a urea breath test. Explain the basis of this test.

Aims to detect H pylori bacteria.

- *Swallow a capsule containing urea labelled with an uncommon isotope. Wait ~30 minutes.*
- *If H pylori (contains urease enzyme) is present, it converts urea into carbon dioxide & ammonia. The CO2 will be labelled with the isotope and will be expelled and detected in the breath (patient blows into a balloon)*
- *If no CO2 labelled with the isotope is present – no H pylori*

How should THIS patient be treated (and explain the basis of treatment)? What about if a urea breath test was positive?

This patient:

- *Stop NSAID (if possible)*
- *PPI – proton pump inhibitor, to reduce HCl production*

If urea breath test was possible – indicates H pylori resistance, so use triple-therapy:

- *PPI*
- *Amoxicillin – antibacterial (if no penicillin allergy)*
- *Clarithromycin – antibacterial*

Review mechanisms of action of antibiotics.

If this progressed without treatment, what possible consequences might you see and how would you detect these/how would they present?

- *Perforation → pneumoperitoneum (more likely to be anterior ulcer)*
    - *Detected on erect X-ray (air under the diaphragm – air rises)*
    - *Pain (abdominal pain, think about patterns of referred pain in this patient)*
    - *Could lead to peritonitis*
- *Bleeding (more likely to be posterior ulcer) → iron deficiency anaemia, melena, haematemesis*

Ruptured gastric ulcer on the lesser curvature of stomach → bleeding from left gastric artery.
An ulcer on the posterior wall of duodenum → bleeding from gastroduodenal artery.

Imagine this patient has a gastrectomy. Thinking about the functions of the stomach, what advice would you give this patient (and why)?

- *Have smaller, more frequent meals. Otherwise the small intestine will be overwhelmed and food will remain undigested in the intestines, causing osmotic diarrhoea (Dumping syndrome)*

What would you consider prescribing a patient following a gastrectomy and why? If you don't, what might happen?

- *Vitamin B12 injections. Lack of intrinsic factor secreted by stomach. Intrinsic factor is required for Vitamin B12 absorption (by binding to it).*
- *A Vitamin B12 deficiency can lead to ~~pernicious~~ megaloblastic/macrocytic anaemia.*
    - *Pernicious anaemia is a more specific situation where auto-antibodies are created against parietal cells*

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Briefly explain the impact of the following drugs on the gastric acid secretion. Think about the specific receptors and cellular processes involved.

- **Proton pump inhibitor** *Decrease HCl production. This blocks the H+/K+ ATPase pump, decreasing the efflux of H+ into the stomach*
- **H1 antagonist** *No change! There are no H1 receptors in the stomach. H2 receptors are found in the stomach. A H2 antagonist would decrease gastric acid production.*
- **Muscarinic agonist** *Increase HCl production. This mimics the effects of the parasympathetic nervous system.*

What if: This patient started taking an ACE-inhibitor and loop diuretic for hypertension and heart failure. What condition do you have to closely monitor for? Explain the pathophysiological basis behind this.

Prostaglandins dilate afferent arteriole; angiotensin II constricts efferent. Loop diuretic causes fluid loss → all lower GFR – this is known as the 'triple whammy'
PDA ACE

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Case 2

A patient presents complaining of passing fatty, bulky stools with an offensive odour. She states that they are difficult to flush in the toilet.

What is this sign called?

- Steatorrhea

There are many possible causes of this. Based on the additional symptoms described in the table below, think about a possible diagnosis, and explain the cause of fatty, bulky, malodorous stools.

Additional Symptoms	Diagnosis	Cause of fatty, bulky, malodorous stools
History of chronic epigastric pain radiating to the back, tenderness on abdominal palpation, nausea, vomiting and heavy alcohol intake	*chronic pancreatitis → pancreatic insufficiency*	*Lack of lipase → unable to break triglycerides (to fatty acids and glycerol) → less fat absorption from intestine → more fat remains in intestine → steatorrhea*
Treated with broad-spectrum antibiotics in hospital for the last 2 weeks **Bonus question: what is the most common bug that causes infection in hospitals following antibiotic use?**	*Bacterial overgrowth* *Clostridium difficile*	*Antibiotic use → kills normal gut flora → overgrowth of pathogenic bacteria → less bile acid deconjugation/ enterohepatic recycling → bile acids remain in GIT → steatorrhea*
Greatly elevated serum ALP and GGT, painless jaundice	*Bile duct obstruction/ cholestasis, due to pancreatic head tumour* **(explain that PAINLESS jaundice suggests distal obstruction of bile duct as oppose to something like cholelithiasis)**	*Lack of bile salts entering duodenum → less fat emulsification → less fat absorption → steatorrhoea*
History of diarrhoea and weight loss, positive anti-endomysium and anti-tissue transglutaminase antibodies	*Coeliac disease*	*Villous atrophy → less absorption → steatorrhoea*
Recent surgical resection of ileum due to Crohn's disease		*No ileum (where bile salts are usually reabsorbed) → lack of bile salt reabsorption → steatorrhoea*

This should prompt discussion of these diseases e.g. histological findings in coeliac disease, key features of Crohn's and ulcerative colitis etc.

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CASE 1: GUT STUFF AND BUTT STUFF

A patient presents to you in the community with complaints of recurrent abdominal pain.

For RLQ pain, give some differentials for each system below.

Gastrointestinal	Appendicitis (classically right iliac fossa (RIF) pain) Diverticulitis (much more commonly is left sided though) Inflammatory bowel disease
Gynaecological	Ectopic pregnancy, ovarian cyst, ovarian torsion
Urological	Urolithiasis (kidney stone), pyelonephritis

If the pain localised to the RUQ, what would your differentials be?

- Liver pathology (ex. cirrhosis, fatty liver, etc.) → hepatomegaly can lead to RUQ pain, but before this mostly asymptomatic
- Gall bladder/biliary tree pathology (ex. cholecystitis, cholangitis, etc.)
- Others: duodenum, pancreas, colon, kidney, diaphragm

If the patient's stool is positive for blood, what would your differentials be?

- Ulcerative colitis
- Colorectal cancer
- Anal fissures/hemorrhoids
- Any infectious causes
- Any ischemic causes

Inflammatory bowel disease is often seen in young women as recurrent bouts of bloody diarrhea and abdominal pain, compare its subclassifications: 1) ulcerative colitis and 2) Crohn disease.

	Ulcerative colitis	**Crohn disease**
Wall involvement	Mucosal/submucosal inflammation	*Full thickness* inflammation
Location	begins in rectum and extends from there *continuously*	Anywhere in GI tract, contains *skip lesions* (terminal ileum most common)
Gross appearance	Pseudopolyps; *loss of haustra* ("lead pipe" sign on imaging)	*Cobblestone mucosa*, strictures (thin and string like)
Effect of smoking	Protective	Increases risk
Intestinal complications	Stenoses Anal disease (fissures, abscesses, fistulas) Fistulas Lower cancer risk	colorectal cancer (higher cancer risk) toxic megacolon

Given the patient's history, you decide to perform a colonoscopy as a screening test and you discover polyps. Describe the adenoma-carcinoma sequence and outline the roles of oncogenes, caretaker genes and gatekeeper genes.

NB. I don't think the adenoma-carcinoma sequence has ever been tested but it's useful to illustrate: 1) multiple mutations must occur before colorectal carcinoma occurs and 2) the role of oncogenes/caretaker genes/gatekeeper genes

1. APC mutation -> increased risk for polyp formations
2. K-ras mutation -> formation of polyp
3. P53 mutation (and increased expression of COX) -> progression to carcinoma

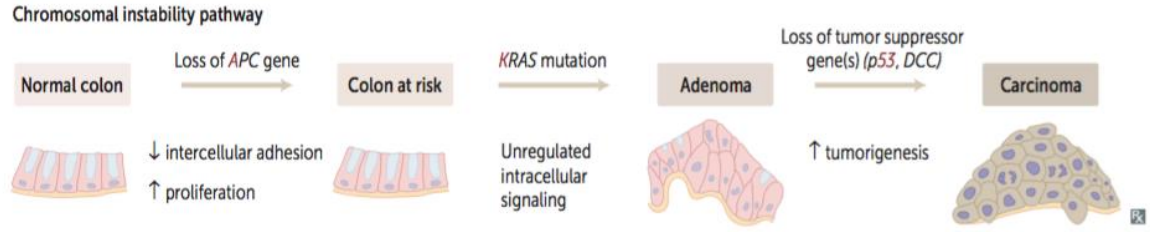
Oncogenes: genes that are important in regulating the cell cycle but, once mutated, will cause cancer (they have the potential to cause cancer but *must* be mutated first)

- APC, K-ras and p53 are all oncogenes

Caretaker genes: genes involved in *DNA repair* and help prevent the accumulation of mutations
Gatekeeper genes: genes encoding proteins that *regulate cell proliferation*

- APC, K-ras and p53 are tumor suppressor genes which prevent a cell from advancing in its cell cycle

(firing order of events is AK-53).



CASE 2: DO YOU EVEN LFT BRO?

NB. things in brackets are low yield but are useful in understanding/remembering how things work

Quick rundown of liver enzymes:

- AST
    - Elevated in **alcohol injury** (aspartate aminotransferase is a mitochondrial enzyme and alcohol is a mitochondrial toxin, hence, alcohol kills mitochondria causing the release of AST into the blood)
- ALT
    - See in **liver damage** (alanine aminotransferase is found in the cytosol of liver cells, hence, necrosis of liver cells cause ALT to be released into the blood)
- ALP
    - Found in **bone and liver disease**
    - Decreased bile flow will result in decreased excretion which will then cause ALP to be released into the blood
    - In periods of bone growth, there will be increased osteoblastic activity which causes elevated ALP (ALP creates an alkaline environment under which osteoblastic activity occurs)
- GGT
    - Think of it as useful in **differentiating bone and liver disease** if ALP is elevated
    - Especially elevated in **bile duct** pathology and in **alcoholics**
    - Can be elevated in a lot of things

Quick rundown of liver markers:

- Bilirubin
    - Some enzyme (UDP-glucuronosyltransferase) within the liver conjugates bilirubin to make it soluble in the blood
    - Depending on where the problem is, there will be high levels of unconjugated/conjugated bilirubin which build up and then overflow into the blood
        - High levels of **unconjugated** bilirubin indicate that there are issues at the level of the liver since it can't conjugate
        - High levels of **conjugated** bilirubin indicate that there is a blockage in the biliary tree since it can't be excreted into the duodenum
- Albumin/platelets (liver makes thrombopoietin which stimulates bone marrow to make platelets)
    - Normally produced by the liver (low levels mainly seen in advanced liver disease)

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What changes in liver enzymes would you expect to see in a patient with…
Alcoholic hepatitis?

- AST > ALT, 2:1 – **in most liver disease, the ratio is the opposite – alcoholic liver disease causes AST > ALT**
- Elevated GGT
- Elevated unconjugated bilirubin

Obstruction of the common bile duct?

- ALT > AST
- Elevated ALP
- Elevated GGT
- Elevated conjugated bilirubin

Advanced cirrhosis of liver?

- AST > ALT
- Normal GGT
- Elevated unconjugated bilirubin

Viral hepatitis?

- ALT > AST **(both are in the thousands)**
- Elevated GGT
- Elevated unconjugated bilirubin

Explain the mechanisms for the following in advanced liver disease:

Finding in liver disease	**What it is caused by**	**Mechanism**	**Name another cause for this finding**
Oedema	Albumin deficiency	Less oncotic pressure	Renal disease: Nephrotic syndrome
Elevated prothrombin time	Less production of clotting factors	Self-explanatory	Warfarin therapy
Confusion	High levels of ammonia → encephalopathy	Direct effect of ammonia on brain	Wernicke's encephalopathy
Gynaecomastia	Elevated estrogen levels	Failing liver does not metabolize estrogen	Prolactinoma

Bonus question: which of these conditions reflect the reduced metabolic/synthetic function of the liver vs chronic liver disease?

Signs of chronic liver disease	**Signs of liver failure**
Gynaecomastia	Jaundice
Palmar erythema (also occurs due to estrogen)	Bruising
Testicular atrophy	Pruritis
Altered hair distribution	Asterixis

- **Differentiating between signs of chronic liver disease and signs of liver failure can help narrow the differentials**

- **E.g. autoimmune hepatitis can cause acute liver failure signs without the signs of chronic liver disease → shows its an acute process where oestrogen-related gynaecomastia demonstrates a longer duration of liver dysfunction**