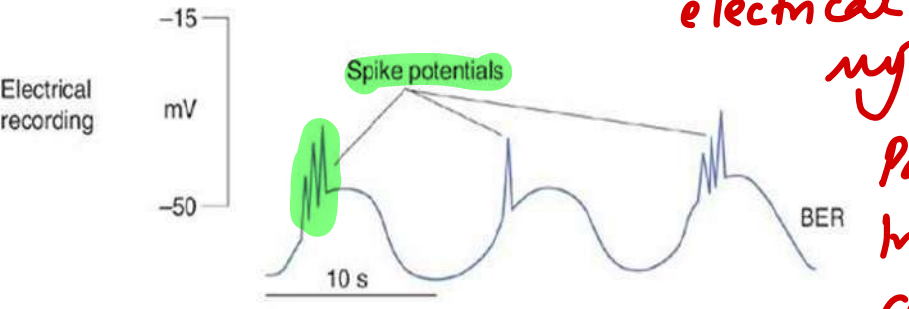
Integrated GI / HPB

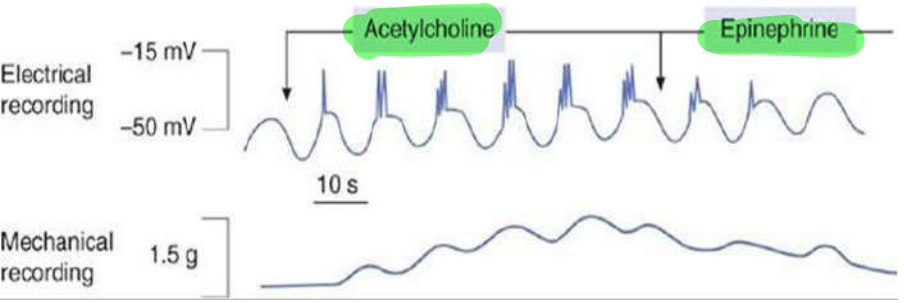
GI MOTILITY

ELECTRICAL

BER: Basal electrical rhythm

Pacemaker: Interstitial cells of Cajal → pylorus





Stomach-4
Duodenum-12 max
Jejunum-11
Ileum-8
Cecum-2 min
Sigmoid-6

MECHANICAL

Fed

Segmentation Peristalsis

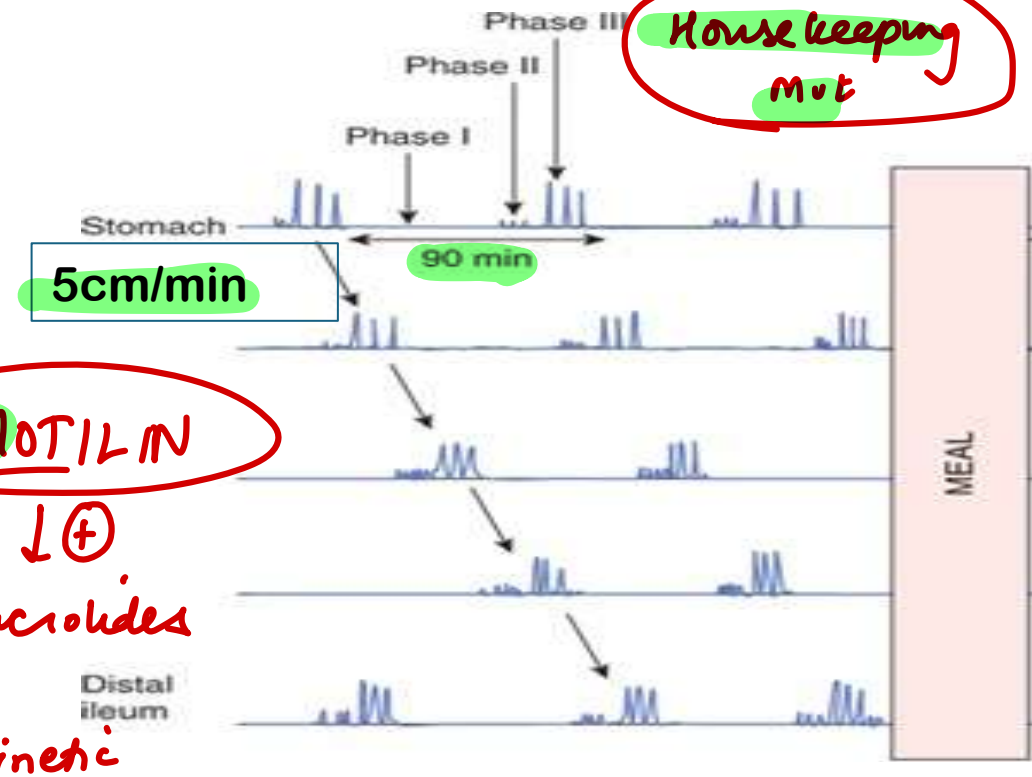
Achalasia

Hunger

MMC

migratory motor complexes

Housekeeping mvt



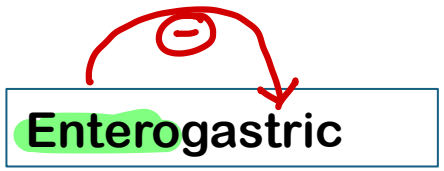
5cm/min

MOTILIN

↓ ⊕ Macrolides

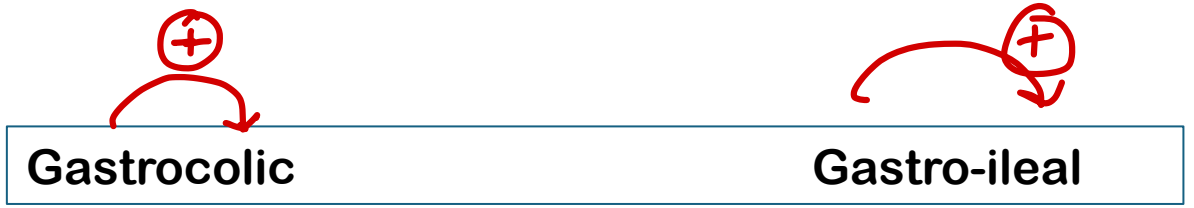
(prokinetic

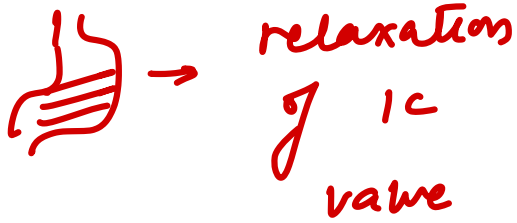
REFLEX



CCK, secretin, Peptide Y

Fat > protein > Carbs
Acidity
Osmolarity



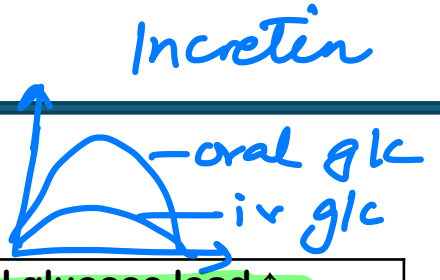


babies ⊕

GI hormones

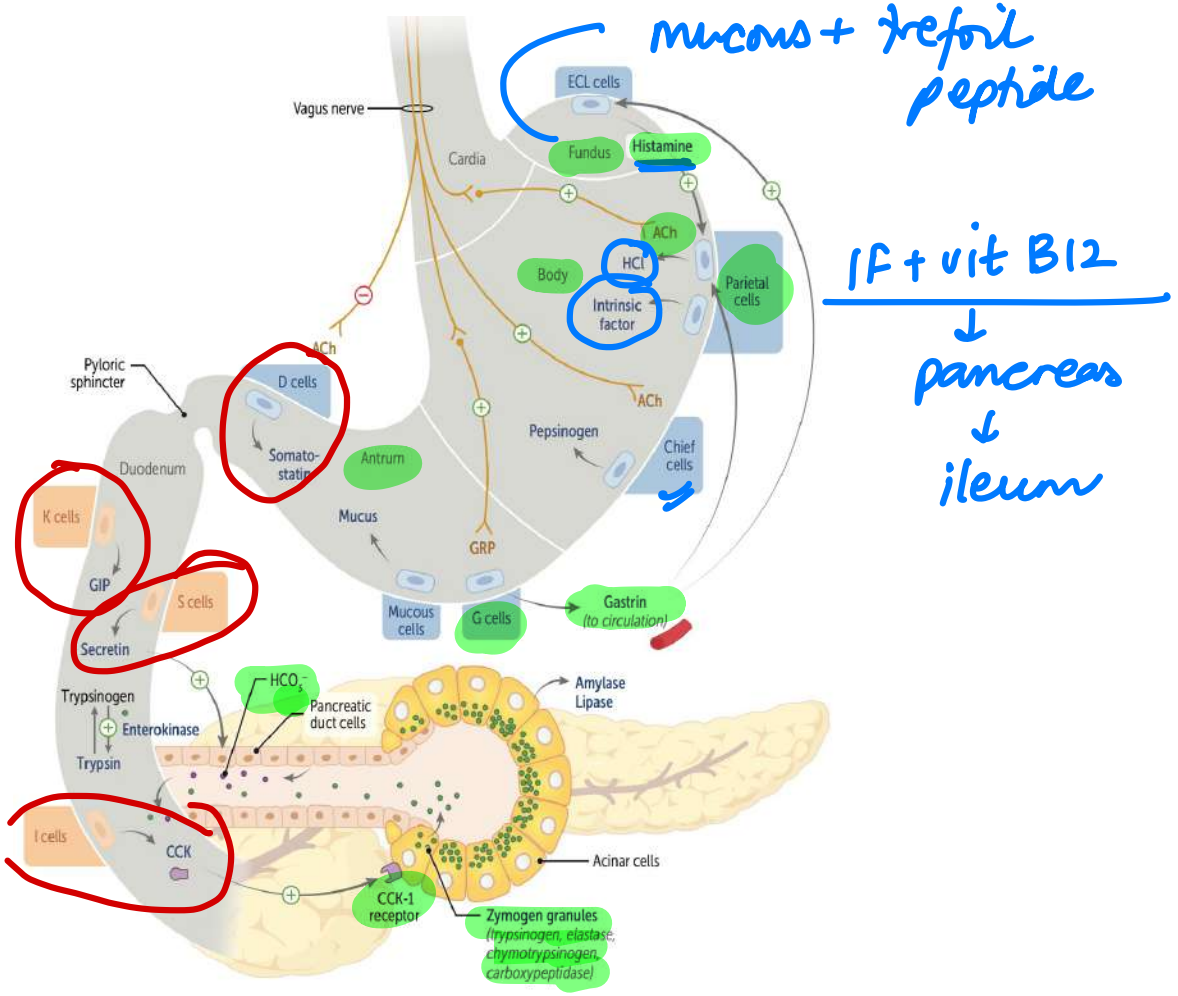
REGULATORY SUBSTANCE	SOURCE	ACTION	REGULATION	NOTES
Gastrin	G cells (Antrum, duodenum)	↑ gastric acid secretion ↑ gastric motility	↑ by stomach distention, amino acids, vagal stimulation via GRP ↓ by pH < 1.5	↑ by chronic PPI use, chronic atrophic gastritis, Zollinger Ellison syndrome
Cholecystokinin	I cells (antrum, SI)	↑ pancreatic secretion ↑ gallbladder contraction ↓ gastric emptying ↑ sphincter of Oddi relaxation	↑ by fatty acids, amino acids	Acts on neural muscarinic pathways to cause pancreatic secretion
Secretin	S cells (duodenum)	↑ pancreatic HCO_3^- secretion ↓gastric acid secretion ↑ bile secretion	↑ by acid, fatty acids in lumen of duodenum	↑ HCO_3^- neutralizes gastric acid in duodenum, allowing pancreatic enzymes to function
Somatostatin	D cells (pancreatic islets)	↓ Gastric acid and pepsinogen secretion ↓ Pancreatic and small intestine fluid secretion ↓ Gallbladder contraction ↓ Insulin and glucagon release	↑ by acid ↓ by vagal stimulation	Octreotide is an analog used to treat acromegaly, carcinoid syndrome, VIPoma, and variceal bleeding S/e: Gallstones

GI hormones



Glucose-dependent insulinotropic peptide = gastric inhibitory peptide (GIP (GLP=GIP)	**K cells** (duodenum, jejunum)	Exocrine: ↓ gastric H^+ secretion Endocrine: ↑ insulin release	↑ by fatty acids, amino acids, oral glucose	**Oral glucose load ↑ insulin compared to IV equivalent due to GIP secretion**
Vasoactive intestinal polypeptide	Parasympathetic ganglia in sphincters, gallbladder, small intestine	**↑ intestinal water and electrolyte secretion** ↑ relaxation of intestinal smooth muscle and sphincters	↑ by distention and vagal stimulation ↓ by adrenergic input	VIPoma- Watery Diarrhea, Hypokalemia, Achlorhydria (WDHA syndrome)
Ghrelin	Stomach	↑ appetite ("ghrowlin' stomach")	**↑ in fasting state** + by food	**↑ in Prader-Willi syndrome** **↓ after gastric bypass surgery**

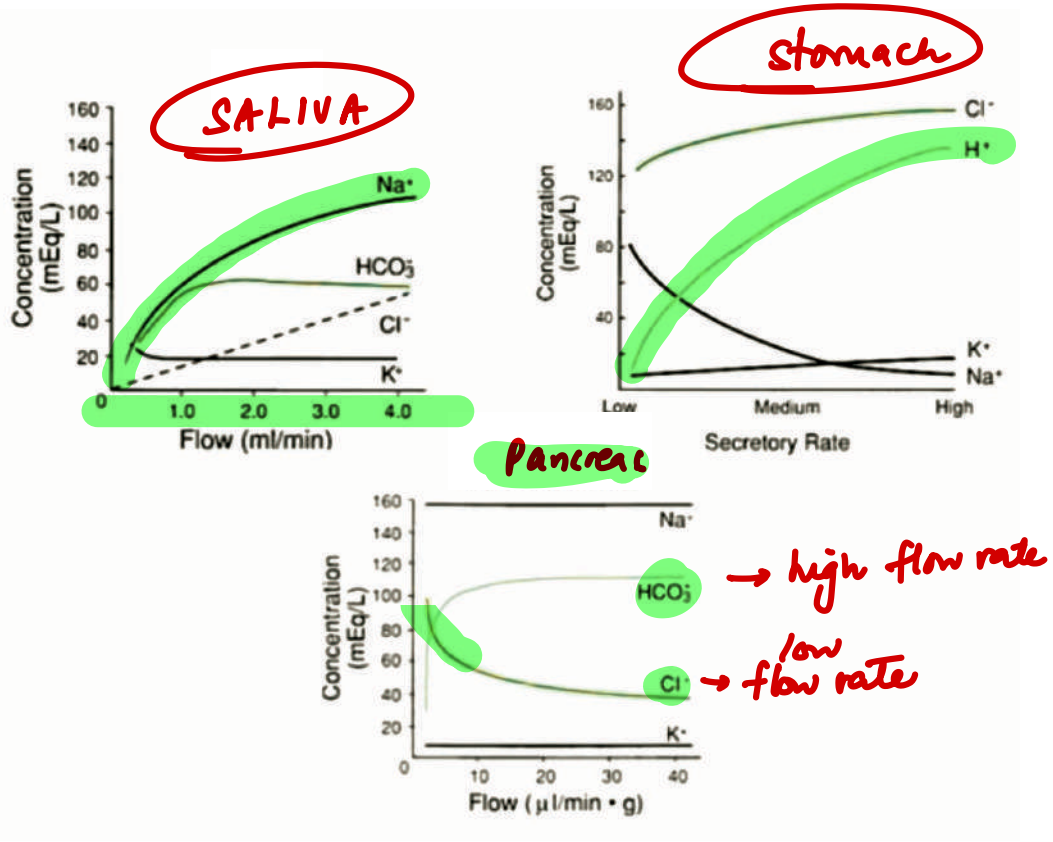
GI hormones



mucus + trefoil peptide

IF + vit B12 → pancreas → ileum

Schilling test



Total volume : 7L/day
Max- stomach
Most alkaline pH: Duodenum (Brunner glands) ~ 8 pH
Most acidic pH: Stomach ~ 1.5 pH
Max K concentration: COLON
Max K amount: saliva

1) oral + IM vit B12 → >10% vit B12 radioact urine
(radioactive B12)

↓ <10%

2) B12 + IF → (N) → Dietary def → vegans
↓ <10% → Pernicious anemia

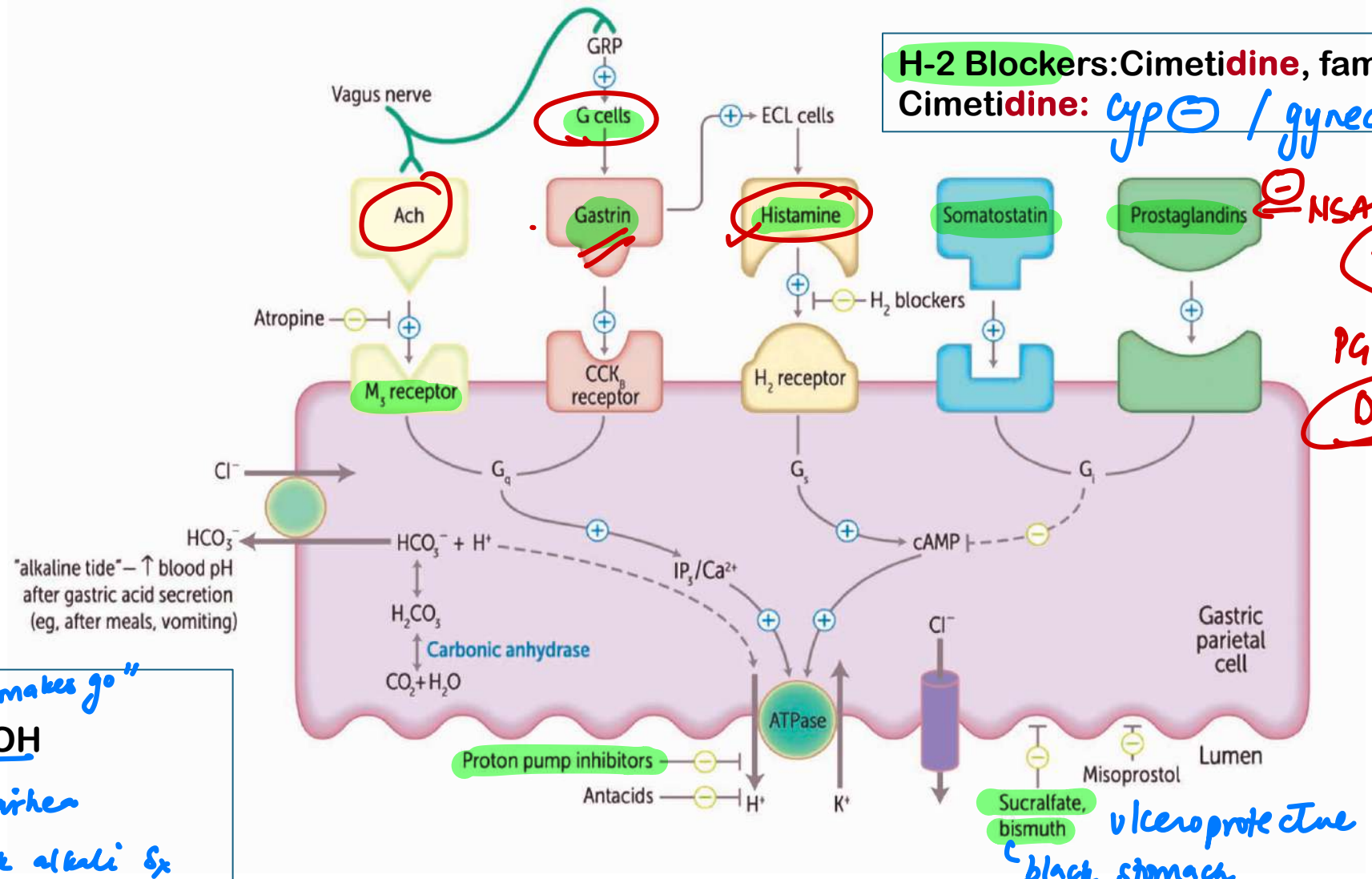
3) B12 + antibiotics → (N) → SIBO / BOGS / strictures / DM
↓ <10%

4) B12 + pancreatic enzymes → (N) → pancreatitis
↓ <10%

MUCOSAL - ILEUM

- CD / Tropical sprue)

D. Lalem



H-2 Blockers:Cimetidine, famotidine, nizatidine
Cimetidine: CYP⊖ / gynecomastia / creat ↑ levels

⊖NSAIDs (∵ peptic ulcer)

PGE1 -misoprostil

DOC: PPI

Antacids: "makes go"
Al OH + Mg OH
↓ constip" ↓ diarrhea

CaCO3 : milk alkali Sx

30min before meal

PPI: Omeprazole, lansoprazole, pantoprazole-DOC
Hit and run (eosinophilia)
S/E: C.difficile, AIN, pneumonia, B12 deficiency, Fracture risk
Omeprazole: CYP2C19-Clopidogrel

Triple drug therapy:
CAP: Clarithromycin + Amoxicillin + PPI
Quadruple: + Bismuth

ulceroprotective

Sucralfate, bismuth → black stomach

CONSTIPATION

Bulk forming: Methylcellulose

Osmotic: Lactulose, PEG → IBS-C

Hepatic encephalopathy

Lactic acid $-H^+$

$NH_3 \rightarrow NH_4^+$

Stimulant: Senna, Bisacodyl

melanosis coli

Cl channel activator: Lubiprostone

Guanylate cyclase Agonist: CFTR +-Linaclotide, Plecanatide

5HT-4 agonist: Prucalopride

NHE3 inhibitor: Tenapanor

$Na^+ - H^+$ exchanger → ↑ Na^+ excr, ↑ H_2O excr

Peripheral opioid inhibitor: For post-op ileus

Alvimopan, Naloxegol, Methylnaltrexone

DIARRHEA

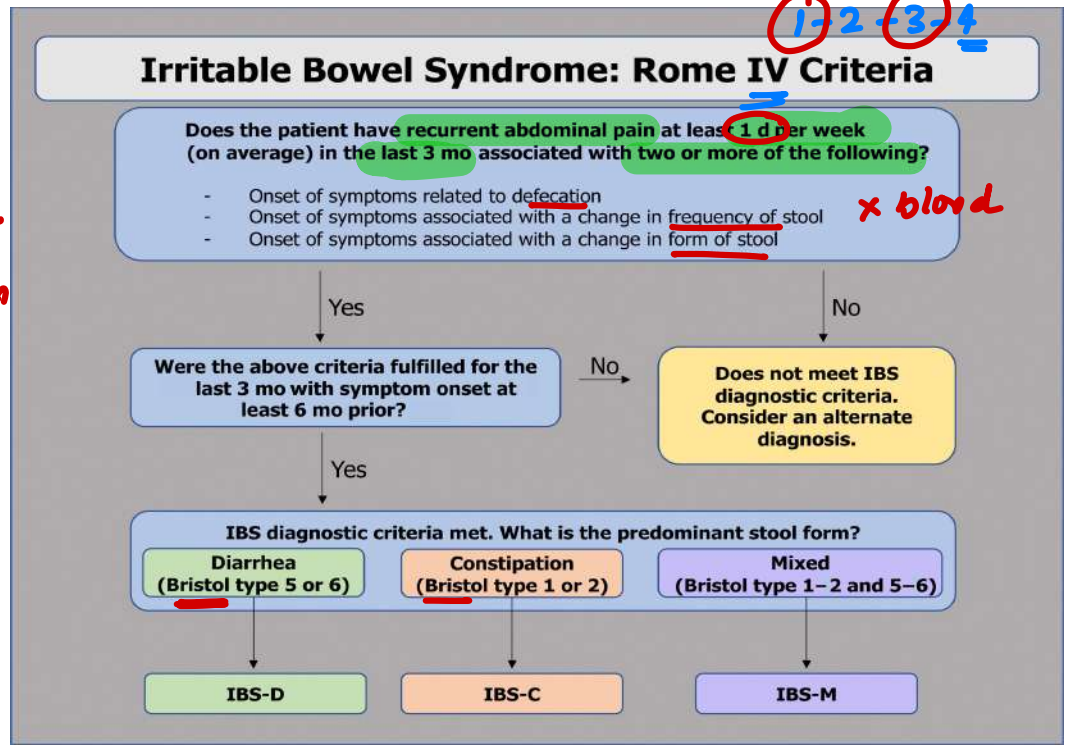
μ Agonist: Loperamide

IBS-D → x sweating / dry mouth

Diphenoxylate-atropine: misuse prevent

Enkephalinase inhibitor: Racecodotril

5HT3 antagonist: Alosetron



LOW FODMAP DIET

VOMITING / OBESITY

5 HT3 blocker: Ondansetron (shortest), Palonosetron(longest, most potent)

Cisplatin - early — can be used

DOC-Post-op/ Post-chemo, Post-RT, Pregnancy

s/e: Headache, QT prolong, Constipation

Morning sickness: Doxylamine + B6

Sea sickness: Meclizine

Motion sickness: Hyoscine

Mountain sickness: Acetazolamide

resp alkalosis

NK1 / Substance P inhibitor: Aprepitant — late onset Cisplatin DOC

CB1 agonist: Dronabinol, Nabilone s/e: red eyes / ↓ BP

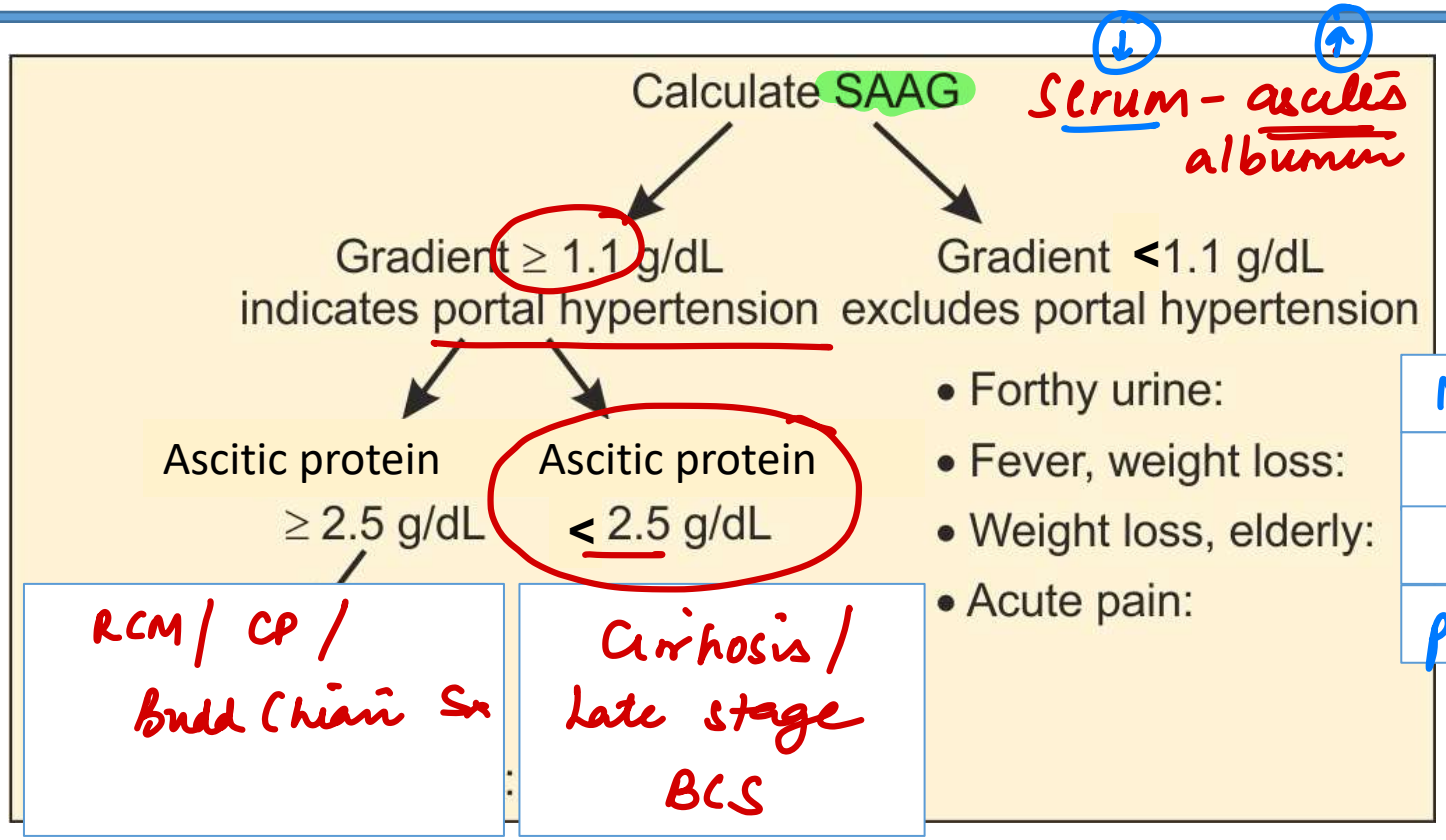
D2 blockers :

Metoclopramide: ↓ BBB → EPS, TPRL — nigrostriatal — tuberoinfund

(5HT4 +: Used in Gastroparesis)

Domperidone: ⊗ BBB

ASCITES



Nephrotic Sx	
TB	
malignancy	
pancreatitis	

VOLUME
USG- 50-100 ml
SHIFTING DULLNESS- 500 ml
FLUID THRILL- 1500 ml

MANAGEMENT:
MILD- USG ↓ Salt restric°

MOD- C/F ↓ (distension) Loop diuretic ✕ → K⁺ sparing diuretics

SEVERE- (resp distress) High vol paracentesis + albumin infusion in 2.5L 6-8g / L - fluid removed

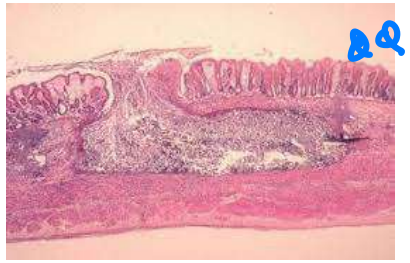
Spontaneous bacterial peritonitis:
Ascitic WBC > 250/mm³

MCC: GNB - E.coli
DOC: Ceftriaxone / Cefotaxime

DIARRHEA

ACUTE

<6HRS Preformed
CHINESE FOOD: B.cereus -emetic
DAIRY: S.aureus
>6HRS
Travelers: ETEC - LT/ST - ↑CAMP ↑CGMP
Rice water: V.cholera
SHELLFISH: V.parahemolyticus & -Kanagawa
Camping/malabsorption: Giardia
Acute RIF pain: Y.enterocolitica
Antibiotics ++ C.difficile
BLOODY:
-Poultry and eggs : Salmonella
-Severe dehydration: Shigella
-GBS, Reiter syndrome: Campylobacter
-Uremia / Anemia: EHEC - HUS O157:H7
-Flask shaped ulcer: Amebic -E.histolytica
-Longitudinal ulcers: Typhoid
-Transverse ulcers: TB



aq

RBC phagocytosis

CHRONIC:

Stool osmotic gap = 290 − 2 × (stool Na + stool K)

resolves upon fasting

HIGH >50 (Osmotic)

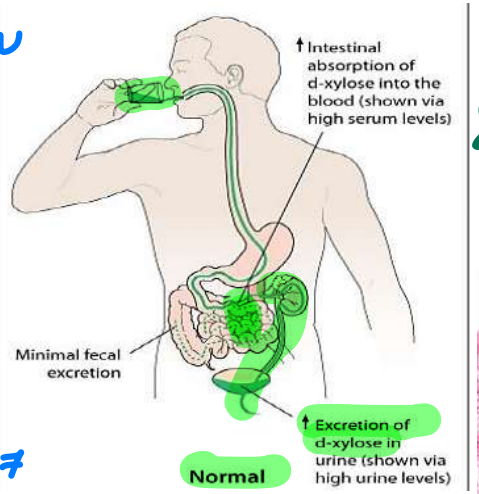
LOW <50: Secretory
-ZES Gastrinoma ↑SHF3
-Carcinoid

Positive hydrogen breath test : Lactose intolerance

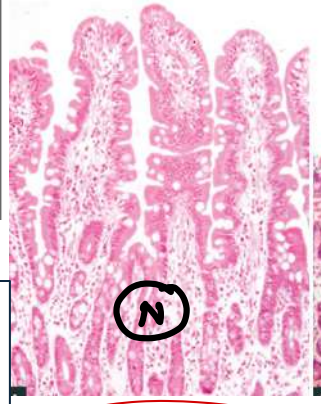
Stool fat >7 % "greasy stools"

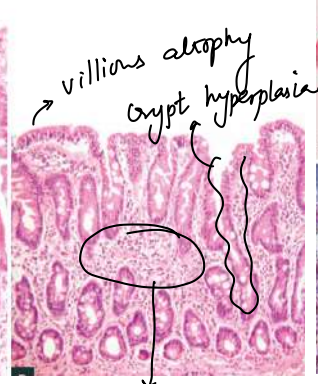
D-xylose - /N
Fecal elastase
Pancreatitis

D-xylose +/Abn
Rifaximin
SIBO/BOGS
Mucosal Biopsy



HLA-DQ2/ DQ8
Alpha-Gliadin
Anti-TTG -Best
Marsh staging
Biopsy: Duodenum IDA / Short stature
Dermatitis herpetiformis

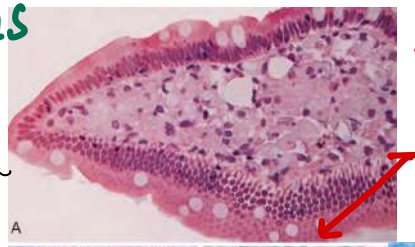




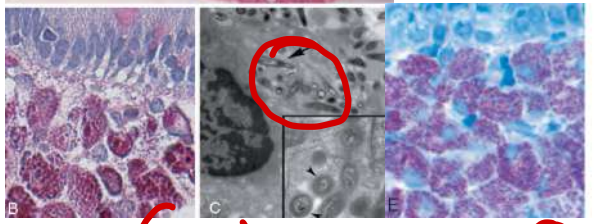
CELIAC disease

Intraepithelial T-lymphocytes

r/o ↑ T cell lymphoma



foamy mphges



PAS+ (DR) Whipple's D Tropheryma whipelli

AFB+ TB

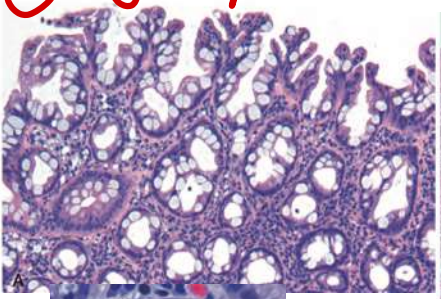
PAS CAN foamy whipped
♥ arthritis neuro

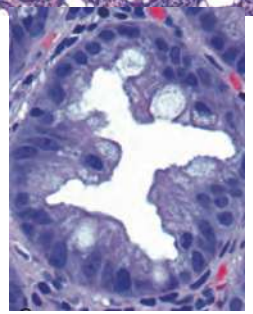
Rx: BROW - Barley / Rye / Oat / wheat ✓Rice / Maize

POLYPS

Non-neoplastic

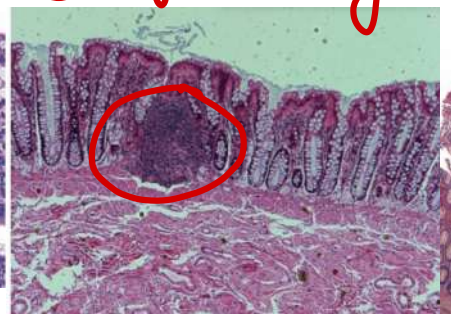
① Hyperplastic





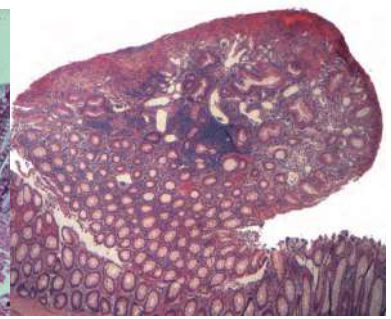
serrations upper

② Inflammatory



Rectal bleeding
mucus discharge

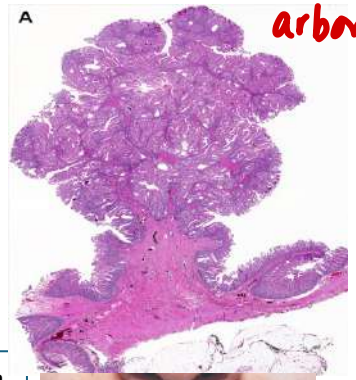
③ Hamartomatous



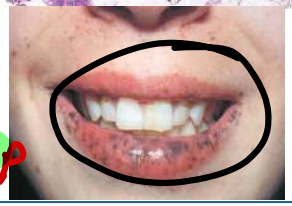
4yr old with rectal bleeding

JUVENILE POLYP

SMAD4



arborising

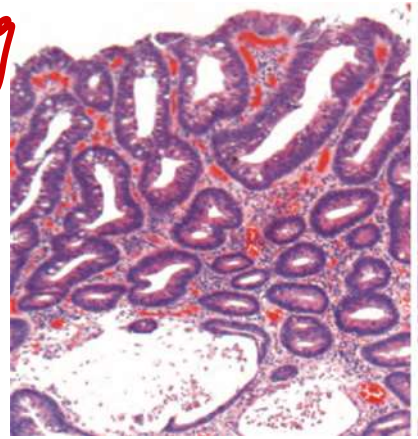


11yr old with intussusception

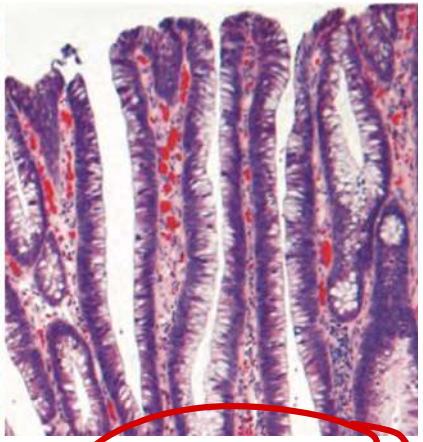
Peutz Jegher's Sx

STK11 & Ca pancreas

Neoplastic



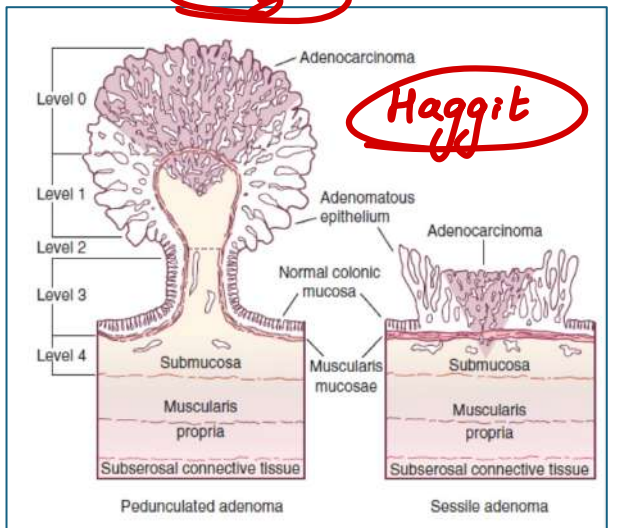
Tubular



Villous

↑ r/o malign

MOST IMP → Size

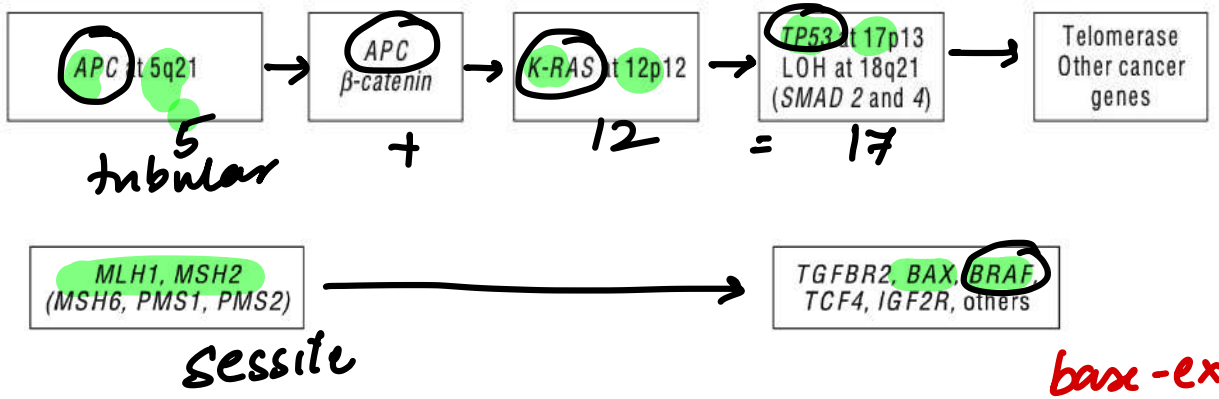


⑤ Sessile serrated adenoma

Cowden syndrome — PTEN (10) — trichilemmomas / BET Breast endometrioid
Crinkhite-Canada syndrome — non inherited ectodermal
TSC
Bannyan-Ruvalcaba-Riley syndrome — MR ⊕ polyps

HNPCC

Adenoma-carcinoma sequence AK53



5 tubular + 12 = 17

sessile

base-excision

Form linked to *APC* gene → FAP	Form linked to *MUTYH* gene MAP
Surveillance should start at age 10-12 with annual colonoscopy every 1–2 years until the patient undergoes surgery	Endoscopic surveillance should start at age 20–25 with chromo-endoscopy every 1 to 2 years

AD, >100 polyps, earlier age
100% risk of ca colon
Left colon MC
Gardner: osteomas, seb cysts, fibromas, CHRPE
Turcot: MB / GBM
Rx - total proctocolectomy + IPAA

AR, <100 polyps, later
Duodenal adenomas,
ovarian and bladder cancers

FAP → VC

Tumors associated with **BRAF mutation** are: V600E

- Melanoma
- Adenocarcinoma of colon
- Papillary thyroid carcinoma
- Hairy cell leukemia
- Langerhans cell histiocytosis

→ BRAF inhibitors **Debrafenib**, **vemurafenib** have demonstrated efficacy in patients with lung cancer harboring BRAF mutations

Revised criteria (Amsterdam criteria II) Mismatch

At least three relatives with an HNPCC-associated cancer (colorectal cancer, cancer of endometrium, small bowel, ureter, or renal pelvis)
One should be a first-degree relative of the other two
At least two successive generations should be affected
At least one should be diagnosed before age 50 years

AD, 80% risk of ca colon
Right colon

1 - 2 - 3

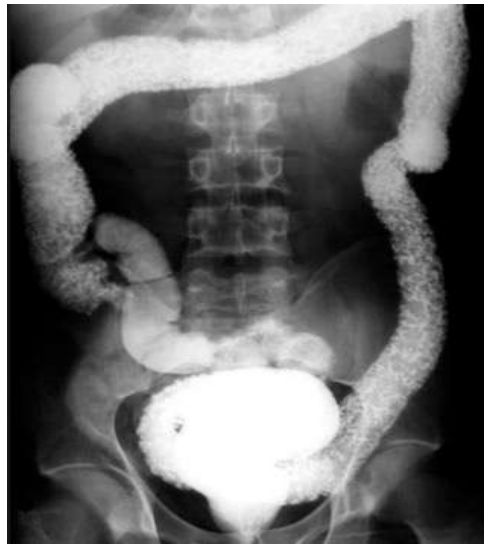
IBD

	Ulcerative colitis	Crohn's disease
Wall layer	superficial - mucosa	transmural
MC site	Rectum	terminal ileum
Stricture, Fistula, Abscess	(-)	+ +
Skip lesions	Continuous	skip lesions
Antibody	p-ANCA	ASCA S. cerevisae
H/P	Crypt abscess. mucosal granularity	NC granuloma aphous ulcers
Earliest imaging finding		
Extra-intestinal manifestations	Rash (pyoderma gangrenosum, erythema nodosum), eye inflammation (episcleritis, uveitis), oral ulcerations (aphthous stomatitis), Peripheral arthritis, Ank spondylitis	
	PSC	Ca oxalate stones
Management	Sulfasalazine (5-ASA) → Steroids → Biologicals; ↓ ca colon ↑UC; Sx	Steroids → Biologicals

Fecal lactoferrin, Fecal calprotectin ↑ inflammation

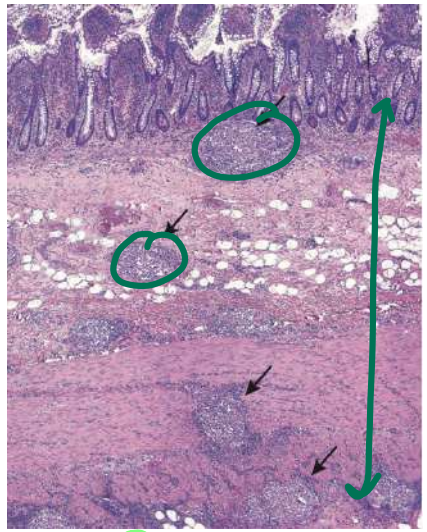
Smoking, Childhood appendectomy: protective (UC)

resolve ⊂ Rp

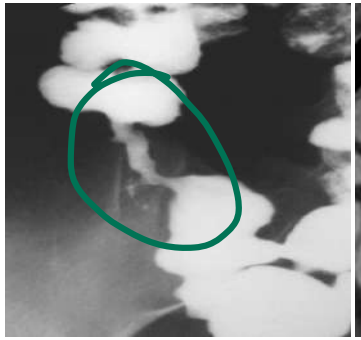


Lead pipe colon

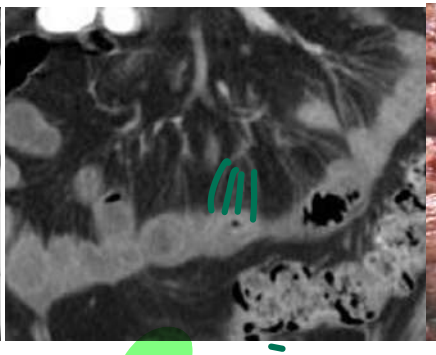
Pseudopolyps



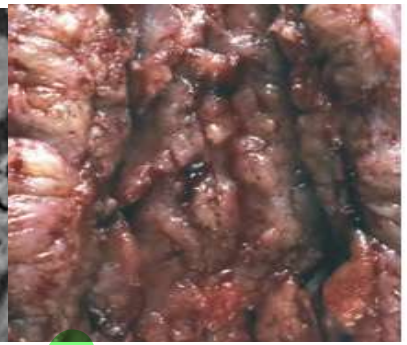
Nc granuloma



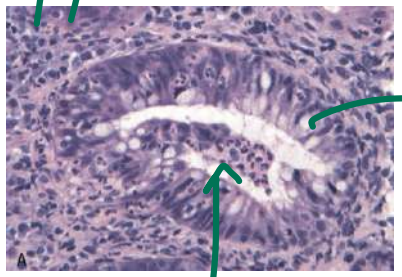
String
s/o Kantor



Comb sign



Cobblestoning
Creeping fat

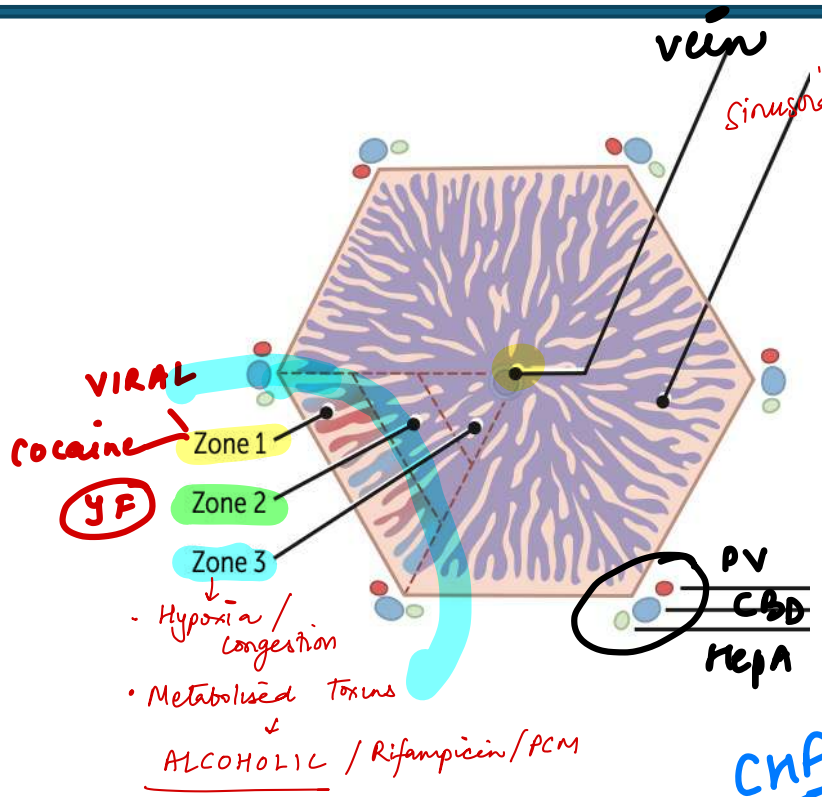


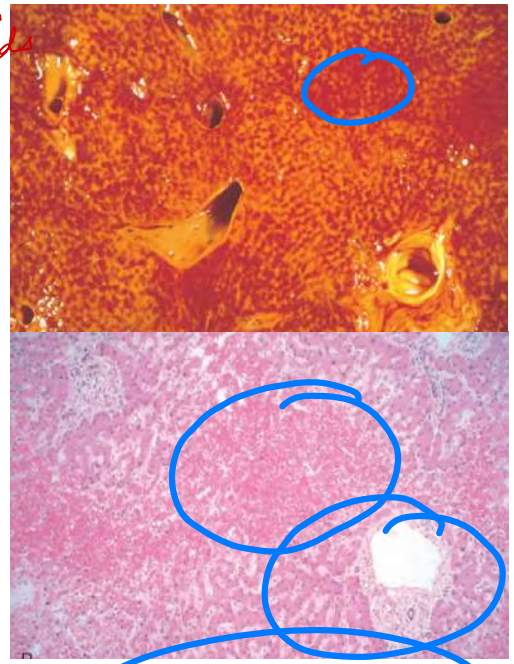
Crypt abscess

UC

CD

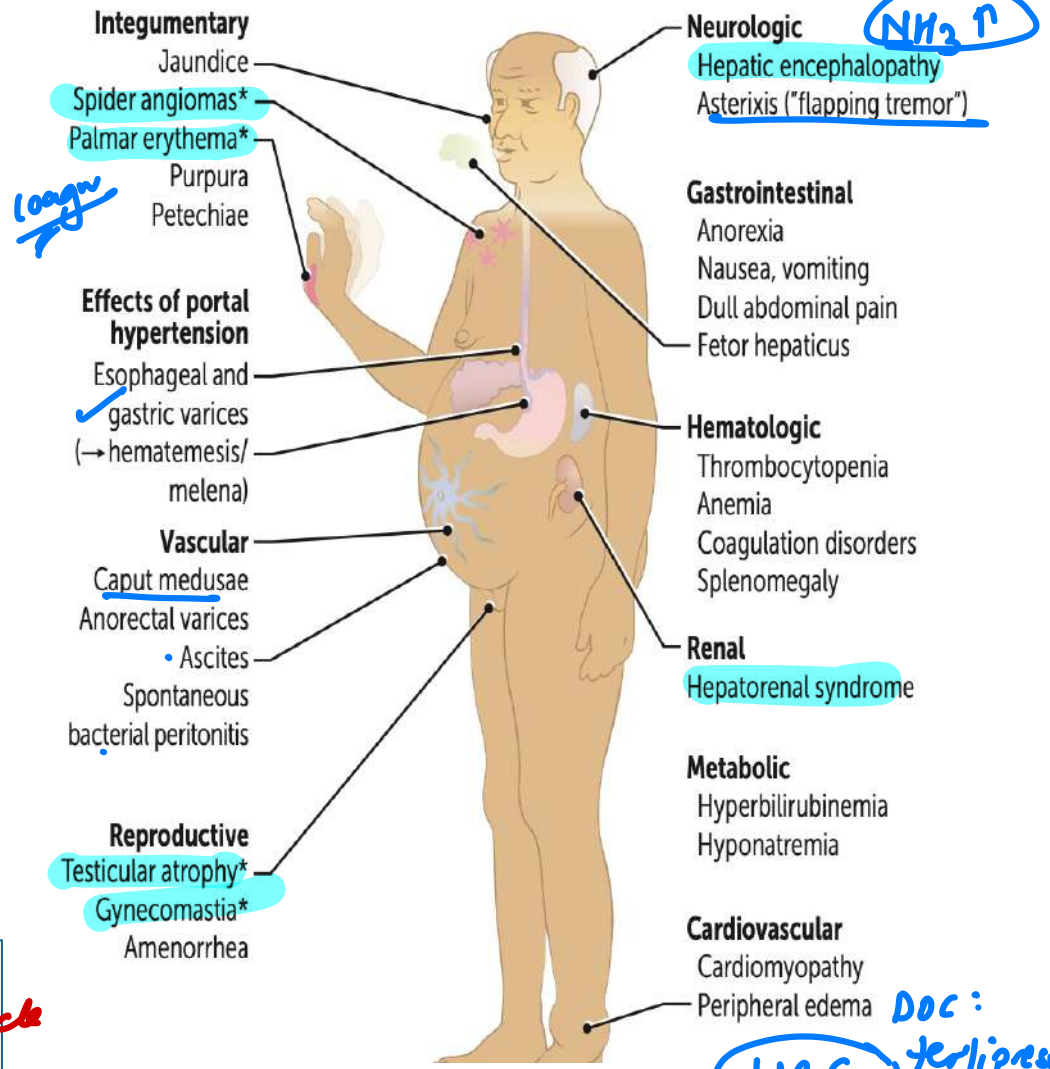
CIRRHOSIS





CHF Nutmeg liver
Centrilobular congestion
+ periportal sparing

Estrogen



NH3 ↑

Space of Disse:
ITO Cells/ Stellate cells

vit A ↓ → Cirrhosis → bridging collagen fibrosis

amyloid

HEPATIC ENCEPHALOPATHY
EARLIEST SYMPTOM: Sleep-wake cycle
SPECIFIC SIGN: Asterixis
EEG: triphasic
Staging: West Haven
Mx: Rifaximin + Lactulose

HPS + albumin

Platypnea
Orthodeoxia

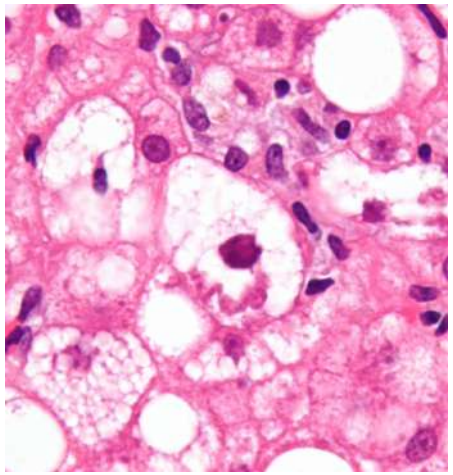
HRS

AKI
FeNa <1%
No s/o shock

Pre-renal

DOC: terlipressin

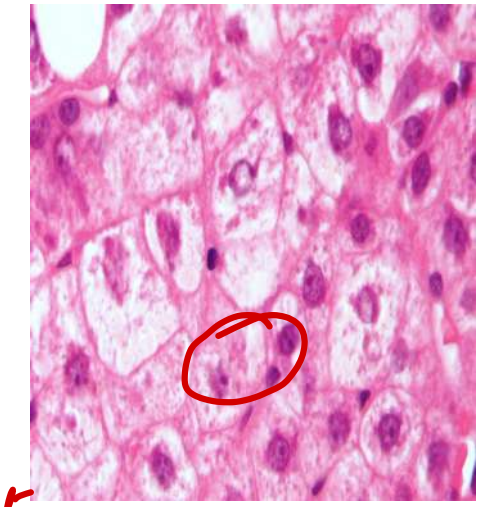
HEPATITIS



ALCOHOLIC hepatitis

SHOT SUPT

AST> ALT >2:1, AST <400
Mallory Denk bodies
CK 8/18
Intermediate filaments
Lille index*
Macrovesicular steatosis

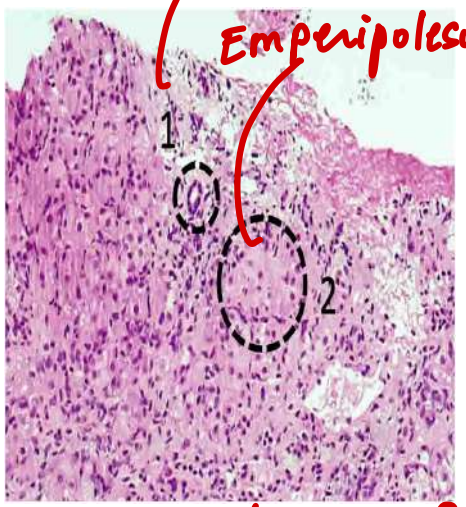


Viral hepatitis

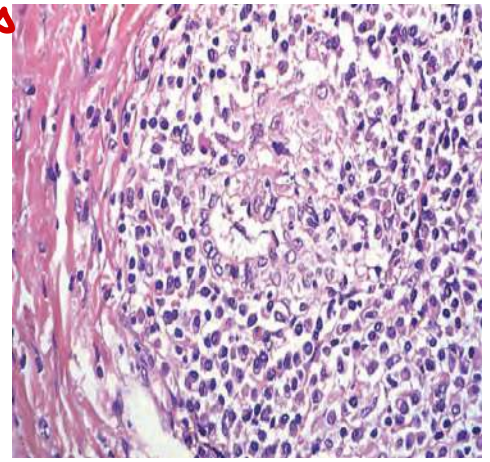
ALT > AST — Hep C
Councillman bodies
Portal tract expansion
Macrovesicular steatosis

Hep B:

Ground glass hepatocytes, Orcein Shikata stain

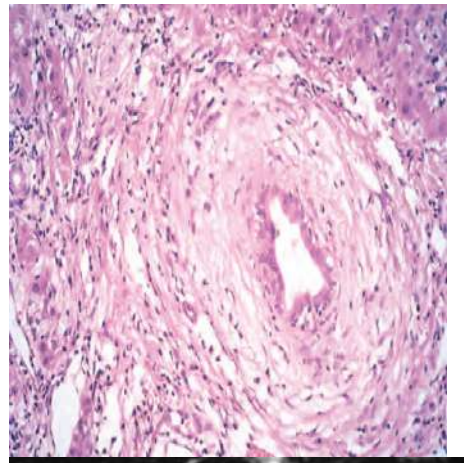


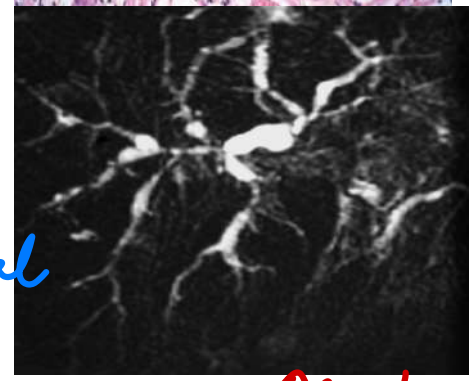
recurrent, graft



- Duct fibrotic lesions
- Anti-mitochondrial Ab
- Pruritis
- osteopenia
- xanthelasma

PBC





↑Ca colon

- h/o UC
- Onion skin "beaded"

PSC

↑CCA pre-malignant

MRCP

AI hepatitis

ANA, SMA: type 1
LKM-1, SLA, LC: type 2

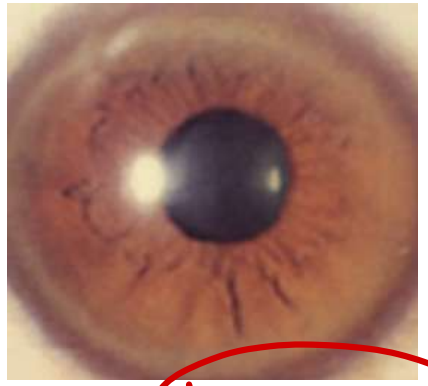
Maddrey's DF - steroids

DF = (4.6 x [prothrombin time (sec) -control prothrombin time (sec)]) + (serum bilirubin)

	Non-severe Disease	Severe Disease
MDF score	< 32	> 32
Short-term mortality	10 %	30–60%
Corticosteroids?	No	Yes

NASH: Vit E approved
Metformin
Liraglutide
Pioglitazone PPAR γ ⊕
Saroglitazor PPAR α + γ ⊕
Lanifibranor Pan PPAR ⊕

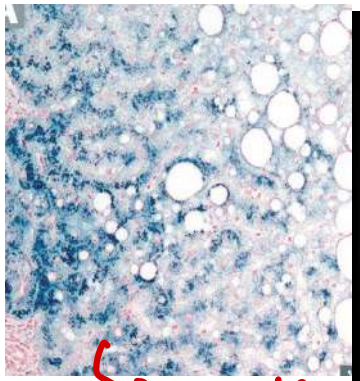
LIVER DISEASES

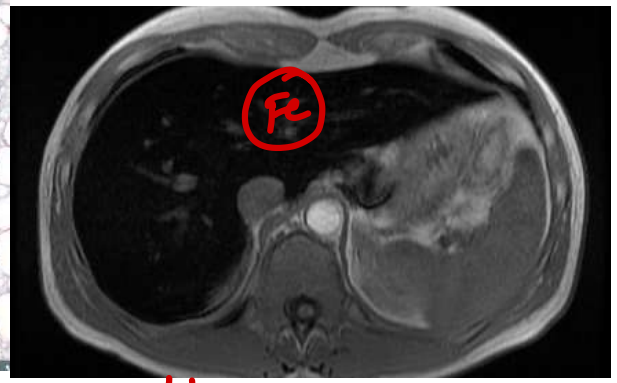


WILSON D

ATP 7B-Chr 13
Ceruloplasmin: ↓
Urine copper: ↑
Type 2 RTA
KF rings- Cu – DM
Neuro- 90%
Hepatic- 50%
TOC: Zn / D-penicillamine
With hepatic decompensation- Trientene

Cu stains: Rhodanine
Rubeanic acid

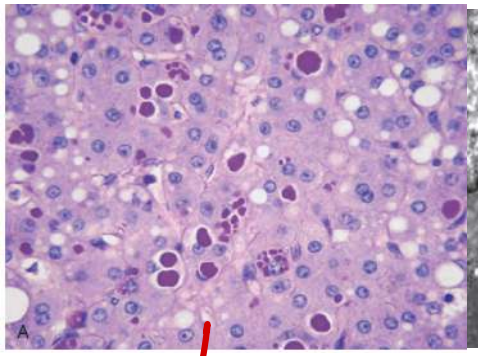




Perls / Prussian blue

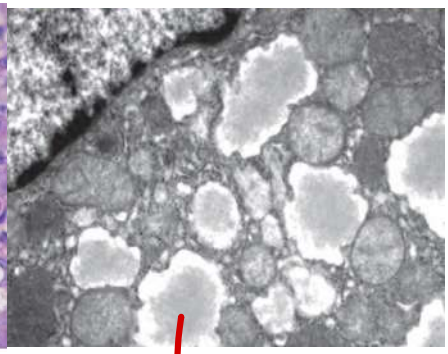
HFE-Chr 6
Hepcidin
Hemochromatosis
Bronze
DM
Liver, Pancreas, Pituitary, Skin
RCM/ DCM
Hook shaped metacarpals
Pseudogout

R_x → Fe chelating / Phlebotomy



PAS + DR

aggregates of misfolded prtn



dense bodies

α_1 AT def

Panlobular emphysema (LL)
+
Cirrhosis
. Co-dominant

Chr 14
M
Z

Viral hepatitis

Risk of ~~chronic~~ Hepatitis:

HBV: 1-90% → HBeAg ⊕ / ⊖

HCV: 85%

Hep A/HepE: 0% (Feco-oral)

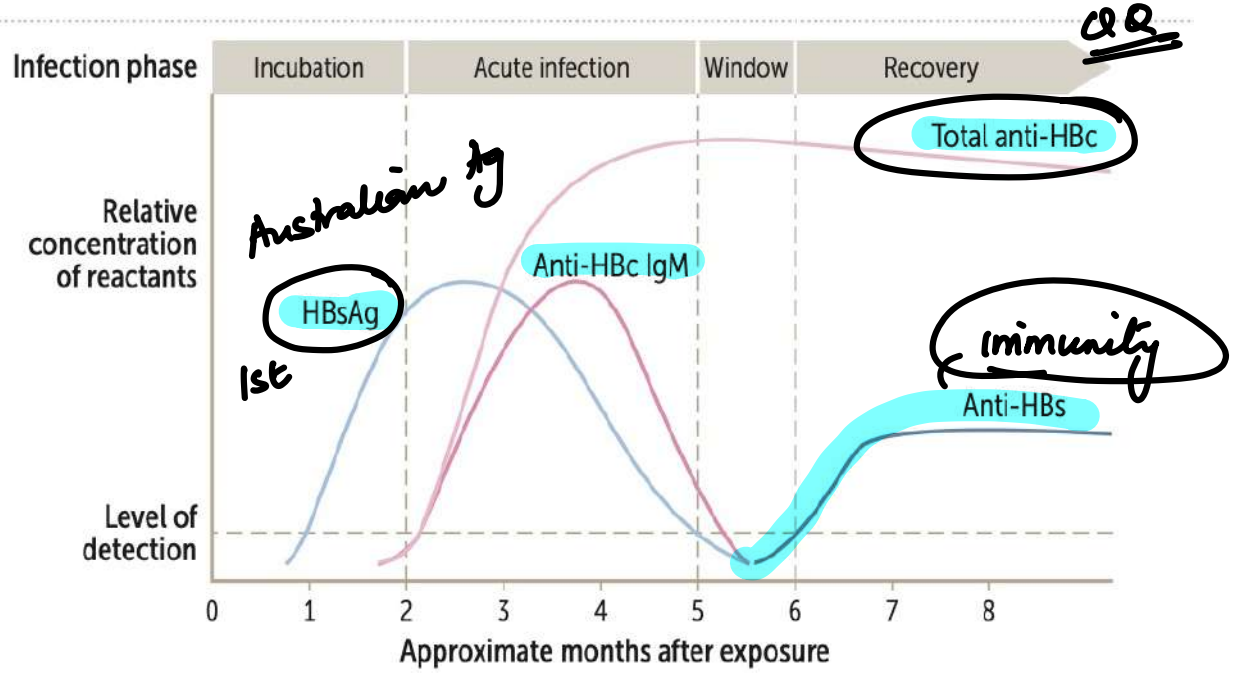
MC acute hepatitis: Hep E → preg -20% mortality

MANAGEMENT:

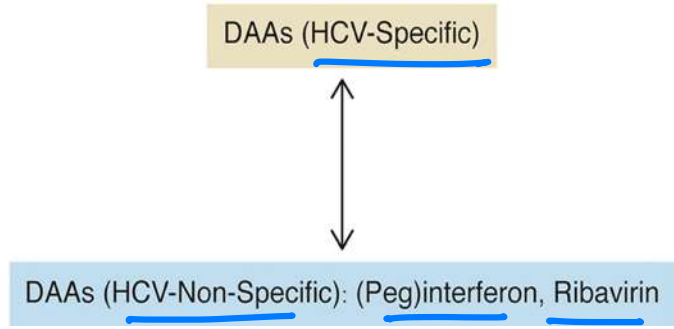
HBV DNA >2000IU/ml :

Tenofovir / Entecavir / IFN a

12 wks



NS3/4A Protease Inhibitors	NS5A Replication Complex Inhibitors	NS5B Polymerase Inhibitors
Telaprevir	Daclatasvir	Nucleoside Inhibitor
Boceprevir	Ledipasvir	Sofosbuvir
Simeprevir	MK-8742	+
Faldaprevir	Velpatasvir	Non-Nucleoside Inhibitors
Vaniprevir	x 12wks	Deleobuvir
Asunaprevir		BMS-791325



HBsAg (Infn)	Anti-HBs (immunity)	Anti-HBc	HBeAg (↑ Inf)	Anti-HBe (↓ Inf)	Anti-HDV	Anti-HCV	HCV RNA	Anti-HEV	
+	-	IgM	+	-	-	-	-	-	Acute Hep B – ↑ Inf
+	-	IgG	+	-	-	-	-	-	Chr Hep B – ↑ Inf
+	-	IgG	-	+	-	-	-	-	ALT normal HBV DNA <2000 — Inactive carrier
+	-	IgG	-	+	-	-	-	-	ALT raised HBV DNA >2000 — Precore mutant
+	-	IgM	+	-	+	-	-	-	Acute Hep B + D — Co-Infn
+	-	IgG	+	-	+				Chr Hep B + D — Super infn
-	-	IgM	+	-	-	-	-	-	Window period
-	+	IgG	-	+	-	-	-	-	Recovered
-	-	IgG	-	+/-	-	-	-	-	Remote past
-	+	-	-	-	-	-	-	-	Vaccinated
-	-	-	-	-	-	+	-	-	Recovered Hep C
-	-	-	-	-	-	+	+	-	Infn - Hep C