



B12
Folic acid

DR PRADNYA ROTITHOR



B complex vitamins

- **Vitamin B₁ (Thiamine)**
- **Vitamin B₂ (Riboflavin)**

- **Vitamin B₃ (Niacin or niacinamide)**
- **Vitamin B₅ (Pantothenic acid)**
- **Vitamin B₆ (Pyridoxine, pyridoxal or pyridoxamine or pyridoxine hydrochloride)**
- **Vitamin B₇ (Biotin)**
- **Vitamin B₉ (Folic acid)**
- **Vitamin B₁₂ (Cobalamines – cyanocobalamin)**





-
- **Deficiency of B12 and folic acid results in megaloblastic anaemia**
 - **Characterized by large sized (mega) RBCs which are short lived.**
 - **Hence b12 and fa are termed maturation factors**

Folic acid

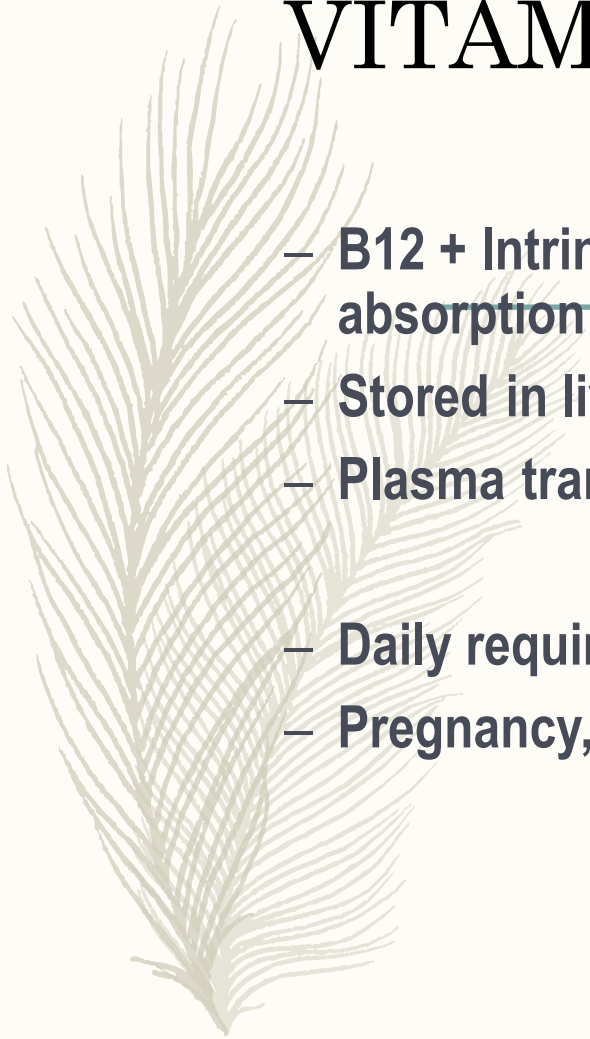




B12	Folic acid
-----not synthesized by humans----- -----GIT flora does synthesize but NOT absorbed -----	
Fish, meat, liver, eggs, milk	Green leafy, fruit, milk, meat, eggs
Requirement: 2-3 mcg / day	Requirement: 50 mcg/day Pregnancy, lactation: 200-300 mcg
Cyano- or hydroxocobalamin 100-1000 mcg/day – alternate days x 2 wks, then every month IM for severe, PO for mild Pernicious: always parenteral: lifelong: later every 3 months	1-5 mg every day PO – mild deficiency 5-10 mg severe deficiency

VITAMIN B12 (cobalamin)

- B12 + Intrinsic factor of Castle (parietal cells) → absorption (ileum)
- Stored in liver
- Plasma transport: bound to Transcobalamin II
- Daily requirement: 1-3 mcg: (dietary deficiency rare)
- Pregnancy, lactation: 3-5 mcg





hydroxocobalmin, cyanocobalmin

- Hydroxocobalmin, Cyanocobalmin- injections
 - Methylcobalamin tablet: 0.5 mg
-

Vit B12 is synthesized in nature only by microorganisms

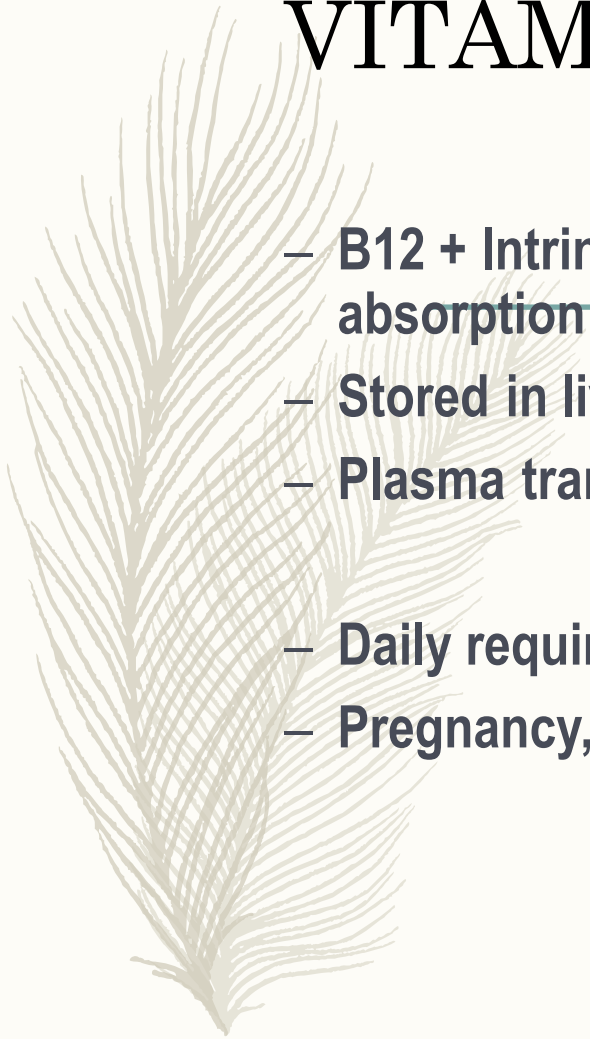
Plants and animals including humans acquire it from them

The ONLY source for pure veg people --sprouted pulses

- ORAL
- PARENTERAL
- - for severe deficiency
- - for PERNICIOUS ANEMIA

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Indications - B12

- **Treatment of deficiency**
- **Treatment and prevention of deficiency in patients with predisposing factors** - gastric mucosal damage: chronic gastritis, gastric carcinoma, gastrectomy --Malabsorption – diseases of ileum -bowel resection-surgical removal of ileum -fish tape worm infestation
- **Pregnancy, lactation—increased requirement**
- **Neuropathies, psychiatric disorders, diabetes, alcoholism, Tobacco amblyopia**



Metabolic functions of B12

Intricately linked with folate metabolism

Active coenzymes forms of b12 –

methyl B12 and DAB12 (deoxyadenosyl)

-methyl B12 --needed for conversion of homocysteine to methionine

This reaction is critical in making THFA available for reutilization

Deficiency of b12 results in **THFA getting trapped in methyl form** and reactions needing one carbon transfer suffer

This is called **folate trap**

Purine and pyrimidine synthesis is affected due to this trap



B12 functions contiuued

Melanoic acid -----DAB12-----succinic acid

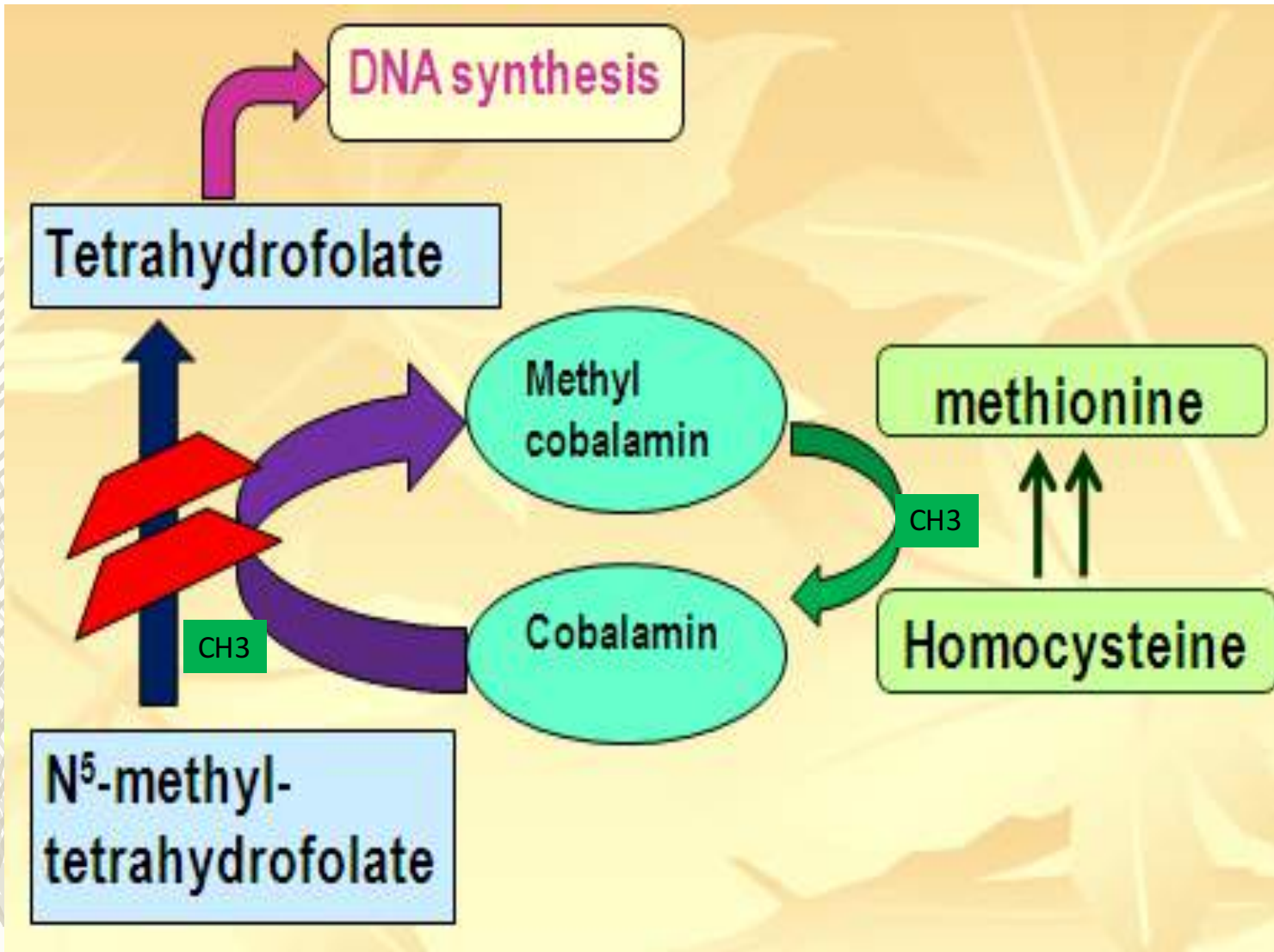
Links cbh and lipid metabolisms

Lack of this reaction results in demyelination of nerves seen in B12 deficiency

This reaction does NOT involve folic acid

Methionine ---DAB12 ----s adenosyl methionine

This reaction appears to be more imp in nerve damage of b12 deficiency as it is needed in formation of myelin and phospholipids



B12 deficiency manifestations

B12 & folate: together termed as maturation factors

Cofactor (transfer of 1-carbon units) → DNA synthesis

Deficiency:

1) First manifests as megaloblastic anemia—

indistinguishable to identify whether caused by either FA or B12

Impaired DNA synthesis and mitosis in precursor RBCs

↓ No of mature RBCs, RBCs

-↑ size / ↓ life span / prone to hemolysis

2) neurologic defects (paresthesia, weakness, fatigue)

Memory loss mood changes

-3) glossitis, GIT disturbances : epithelial damage



Manufactured by
T.P. DRUG LABORATORIES
(1969) CO.,LTD.
98 Soi Sukhumvit 62 Yak 1, Bangchak,
Prakanong, Bangkok 10260
Tel. 0 2311 1911-3
Fax. 0 2331 9018

50 x 1 ml Ampoules

VITAMIN B₁₂

1000 mcg

INJECTION

Each ml contains :-
CYANOCOBALAMIN U.S.P.
1000 mcg
FOR INTRAMUSCULAR USE



Diabetic ,alcoholic
and
other forms of peripheral neuropathies

Methylcobalamin, Adenosylcobalamin,
Vitamins B₁, B₂, B₆ & Folic Acid Capsules

2B12[®]

2बी12

Repairs, Regenerates & Rejuvenates the Nerves

(FOR THERAPEUTIC USE)

2 B 12 150
APPLE CHEMIST-9888054
PBT101 0-48
TAPAS 007180

Rs. 198.00

1 Strip of 15 Capsules

Addisonian pernicious anemia

- Hereditary autoimmune disease → parietal cell destruction

- OR

- Antibodies against intrinsic factor

- -bind to intrinsic factor and prevent B12 binding

- or

- -bind to IF-B12 complex, prevent binding of complex to IF receptors on ileum

Succinyl coA
(easily metabolizable)

Methyl malonyl
COA mutase

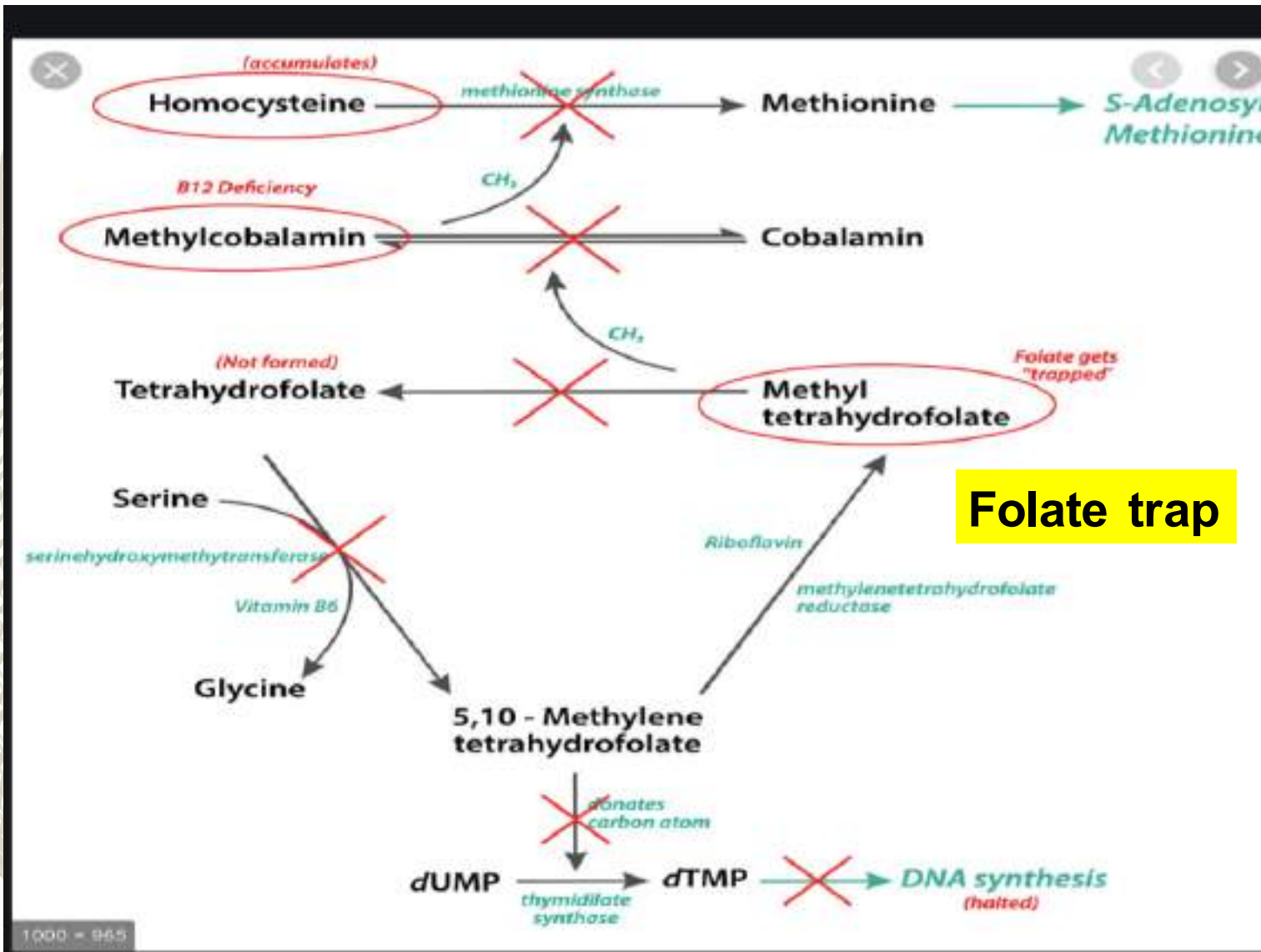
Deoxy
adenosyl
Cobalamin

Methyl-malonyl-coA
(potentially toxic)

Faulty f.a synthesis, cell
membrane incorporation

Peripheral neuropathy,
dementia, loss of reflexes

Affects myelin synthesis
(Nerves, CNS)





Giving folate in B12 deficiency

- Folate helps to refill the tetrahydrofolate pool, to -----
- Partially or fully corrects the anemia
- But exogenous folate CANNOT CORRECT the NEUROLOGIC defects due to B12 deficiency.
- Anemia may improve, but neurologic signs worsen !!!

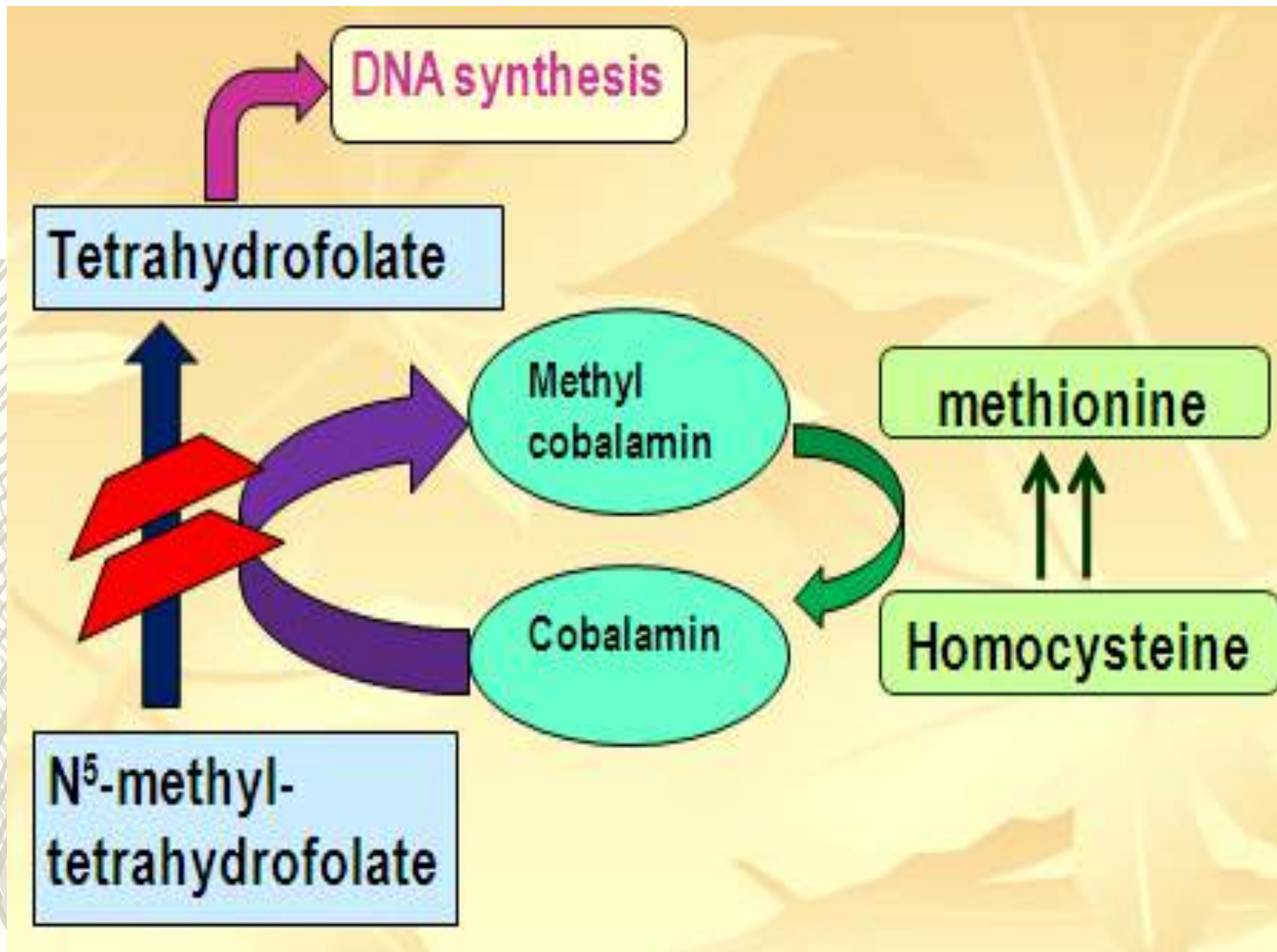


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Folic acid

- **Deficiency: Megaloblastic anemia**
 - **Pregnancy: Neural tube defects**
 - **Interconvertible forms:**
 - **5-THF (folinic acid), 10-formyl THF, 5,10 methylene THF**
 - **Serve as carbon donor in various 1-carbon-transfer reactions by carrying a methyl group as adduct**
 - **oxidation, DNA synthesis**
 - **Remember – Link between folate & B12**
 - **Methyltetrahydrofolate → tetrahydrofolate**
-





Folic acid – mild 1-5 mg/day, severe 5-10 mg /day

– Indications –

- Megaloblastic anemia due to dietary deficiency
- Malabsorption states
- Pregnancy, lactation
- Liver disease, dialysis
- Methotrexate toxicity – treat and prevent
- Phenytoin toxicity
- Chronic alcohol ingestion

PABA + dihydropteridine



Sulfa, sulfones, sulfonyleureas,
furosemide, thiazides, acetazolamide

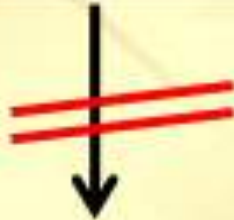
Dihydropteroic acid

Dihydropteroic acid + glutamate



Dihydrofolic acid (DHF)

Drug interactions



Trimethoprim, methotrexate, phenytoin
pyrimethamine, chloroquine, primaquine,
proguanil

Tetrahydrofolic acid (THF)



Folinic /leucovorin rescue / citrovorum rescue

- **Preventing toxicity of high dose Mtx**
- IV methotrexate
- Then within ½- 1 hour –
- Folinic acid (5 formyl THFA) 1-3 mg IV
- **Rescue the NORMAL Cells of the body.**



Haemopoietic growth factors

Notable features --

All hematopoietic growth factors are –

Proteins with MW > 15,000.

Oral administration not possible

Their peptide bonds are destroyed by gastric acid and digestive enzymes.

- **1. Erythropoietin (Epoetin)(r Hu Epo)
(recombinant Human Epoetin)**
- **2. Granulocyte colony stimulating factor (G-CSF)
(r Hu G-CSF) (Filgrastim)**
- **3. Granulocyte-Macrophage colony stimulating
factor (GM-CSF) - r Hu GM-CSF (Sargramostim)**
- **4. Megakaryocyte growth factor (Interleukin -
11): Oprelvekin**



Hemopoietic
growth
factors

No effect on RBC life span

MOA :-

EPO receptor on RBC progenitors and stimulates RBC production and Hb formation

Dose dependent induction of erythropoiesis

Erythropoietin

MW 34000

Peritubular cells of kidney

In response to hypoxia
and anaemia

Essential for normal
erythropoiesis



Hemopoietic growth factors

1. Erythropoietin (Epoetin)(r Hu Epo)

(recombinant Human Epoetin). EPO alpha and EPO beta

Primary indication –

Chronic renal failure—to increase the haemoglobin concentration. Reduces need for blood transfusions

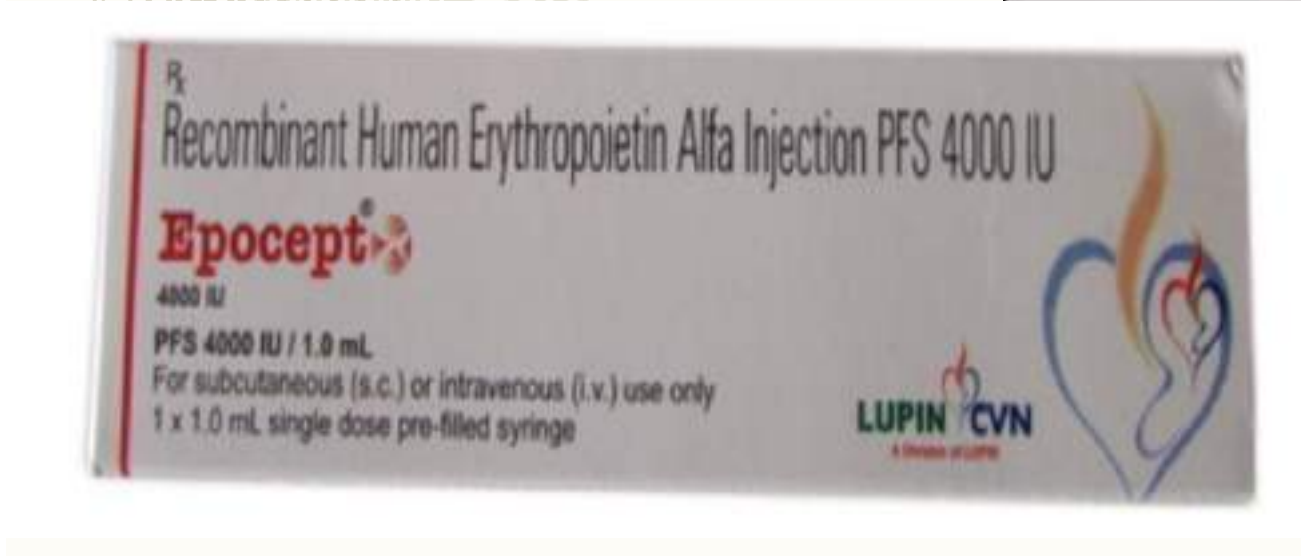
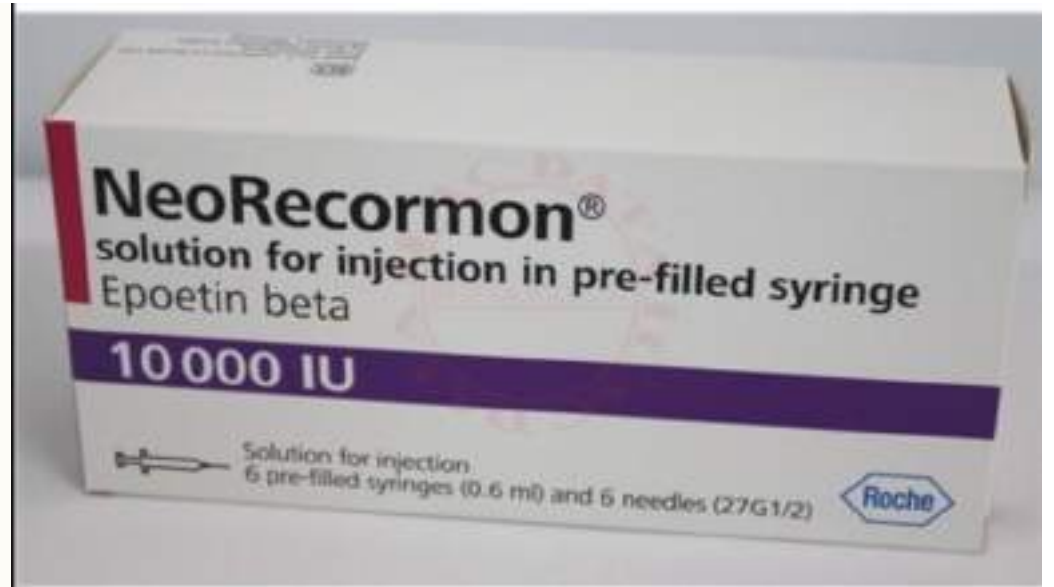
(50-150 IU per kg subcutaneously 3 times a week—EPO alpha
max dose 600 IU/kg/wk)

EPO beta long half life —to be given once in 2-4 wks

Other indications--

Aplastic anemia, multiple myeloma

AIDS, cancers, zidovudin-induced anaemia





Adverse effects

nonimmunogenic

Sudden rise in haematocrit

Blood viscosity

Hypertensive episodes

Sudden clot formations in AV shunts



Hemopoietic growth factors

- 2. Granulocyte colony stimulating factor (G-CSF) (r Hu G-CSF) (Filgrastim)

- 3. Granulocyte-Macrophage colony stimulating factor (GM-CSF) - r Hu GM-CSF (Sargramostim)
- **Cancer chemotherapy-induced neutropenia, aplastic anemia, stem cell transplantation, bone marrow transplantation**
- *GM-CSF is more toxic than G-CSF.*



Hemopoietic growth factors

- **4. Megakaryocyte growth factor (Interleukin -11): Oprelvekin**
- **Thrombocytopenia: Treatment & prevention**
- **(cancer chemotherapy induced thrombocytopenia)**



Pharmacotherapy of peptic ulcer

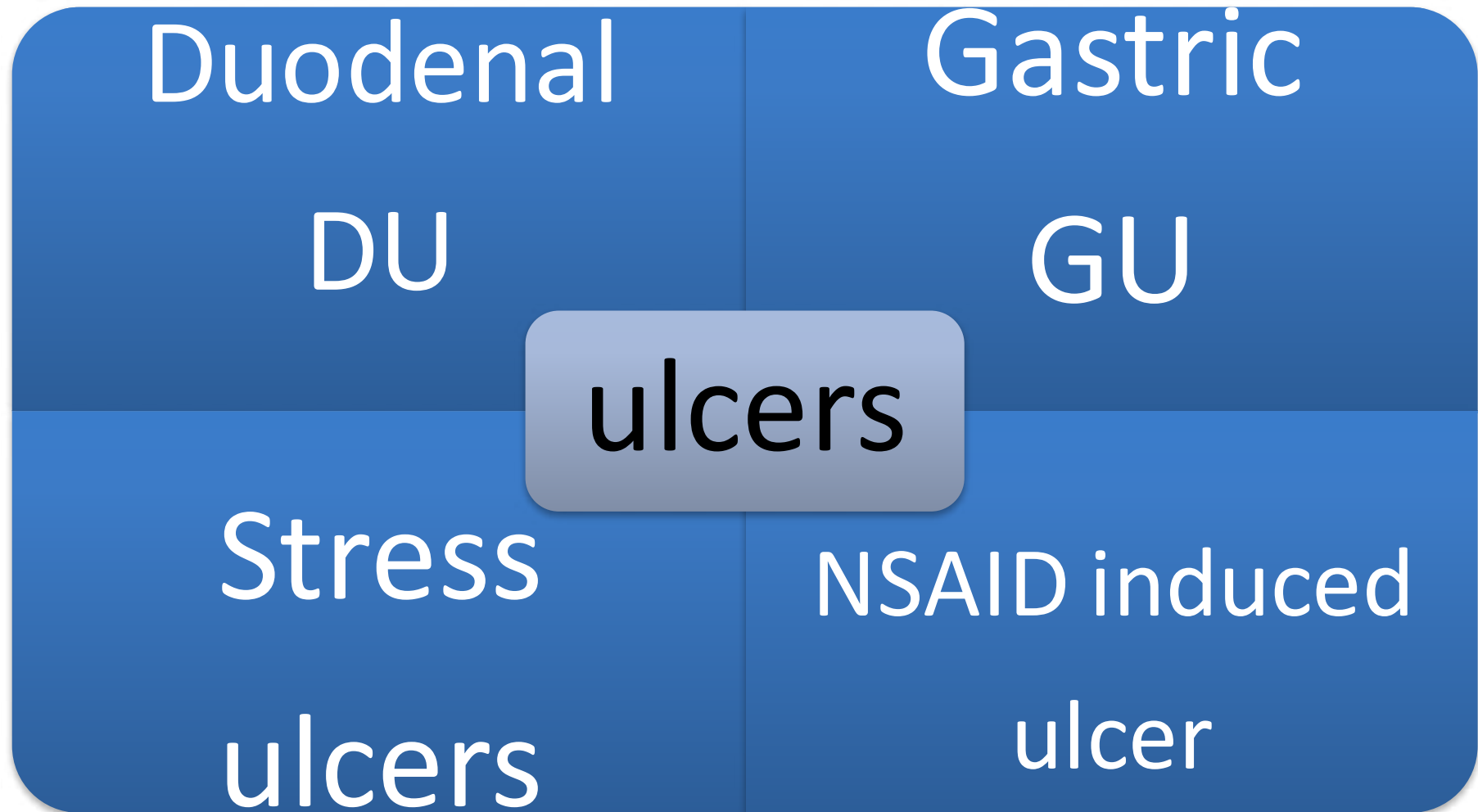
INTERNATIONAL
WOMEN'S DAY

DR PRADNYA ROTITHOR

Factors protecting gastric and duodenal mucosa

- **Mucus**
- **Bicarbonate**
- **Removal of acid by rich mucosal blood flow**
- **PG E**
- **Competent pyloric sphinctor**

Common forms of peptic ulcer



AETIOLOGY

- Aggressive factors

- Acid

- Pepsin

- **H pylori**

- Psychomotor/humoral/
• vascular derangements

- Defensive mechanism

- Gastric mucus

- Bicarbonate

- PG

- Nitric oxide

- Mucosal cells' innate resistance

Principles of peptic ulcer therapy

To ↓ gastric acidity and hyper motility and promote ulcer healing

Treatment of *H pylori* infection

Prevention of recurrence and complication

Elimination of exogenous factors –

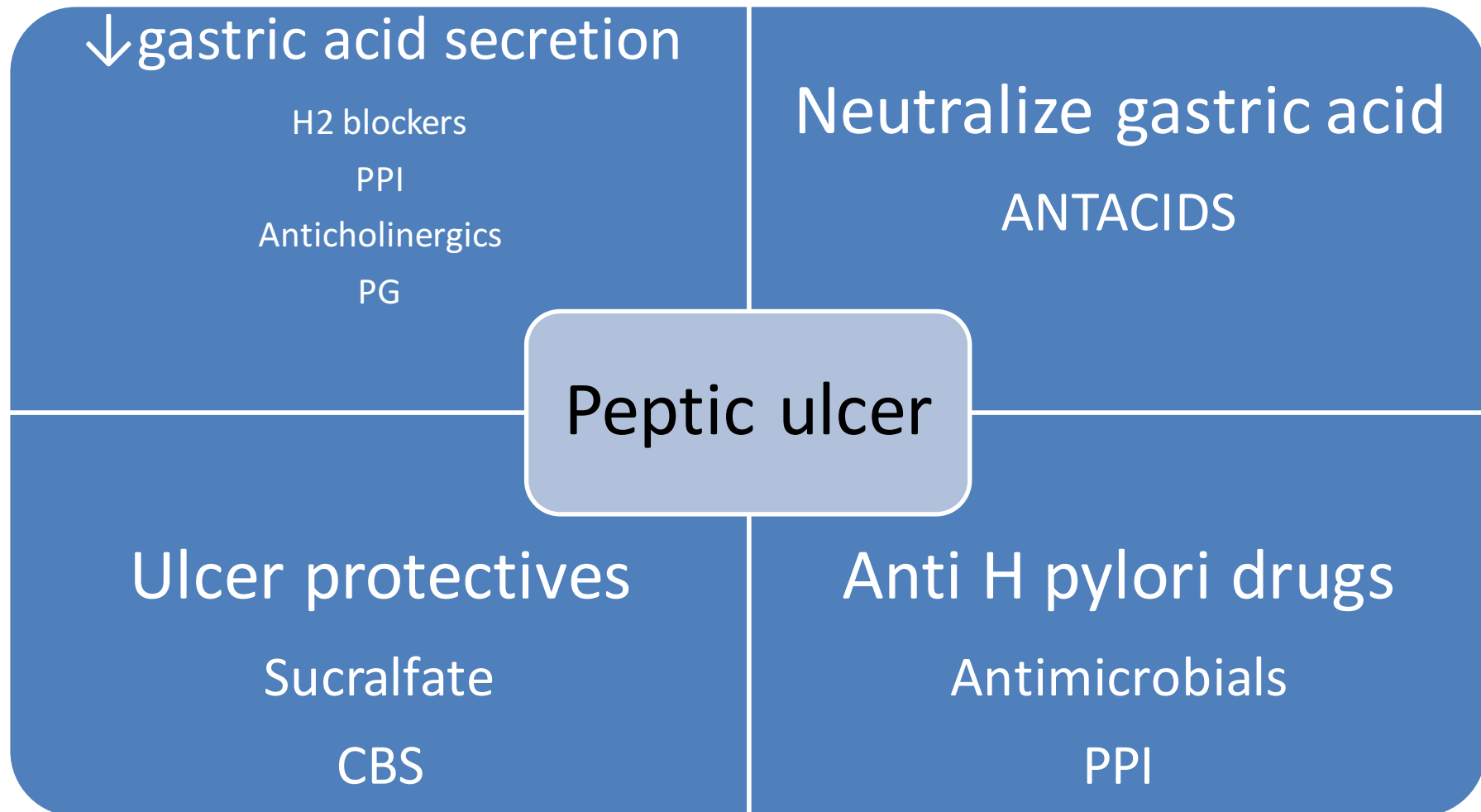
smoking

steroids

alcohol

NSAIDs

CLASSIFICATION OF DRUGS



ANTI ULCER DRUGS

1) <u>Anti H pylori drug— antimicrobials</u>	Amoxicillin, tetracycline Clarithromycin	Metronidazole tinidazole	PPIs Bismuth salts
2) <u>↓Acid secretion</u> H2 R blockers Cimetidine Ranitidine famotidine	PPIs Omeprazole Pantoprazole rabeprazole	Anticholinergics Proprantheline Pirenzepine oxyphenonium	PG analogues misoprostol
3) <u>Antacids</u>	systemic	nonsystemic	Aluminium hydroxide gel
	Sodium bicarbonate Sodium citrate	Magnesium hydroxide	Magnesium trisilicate
4) <u>Ulcer protectives</u>	Sucralfate	Colloidal bismuth subcitrate	
5) <u>ULCER HEALING DRUGS:</u>	Carbenoxolone sodium		

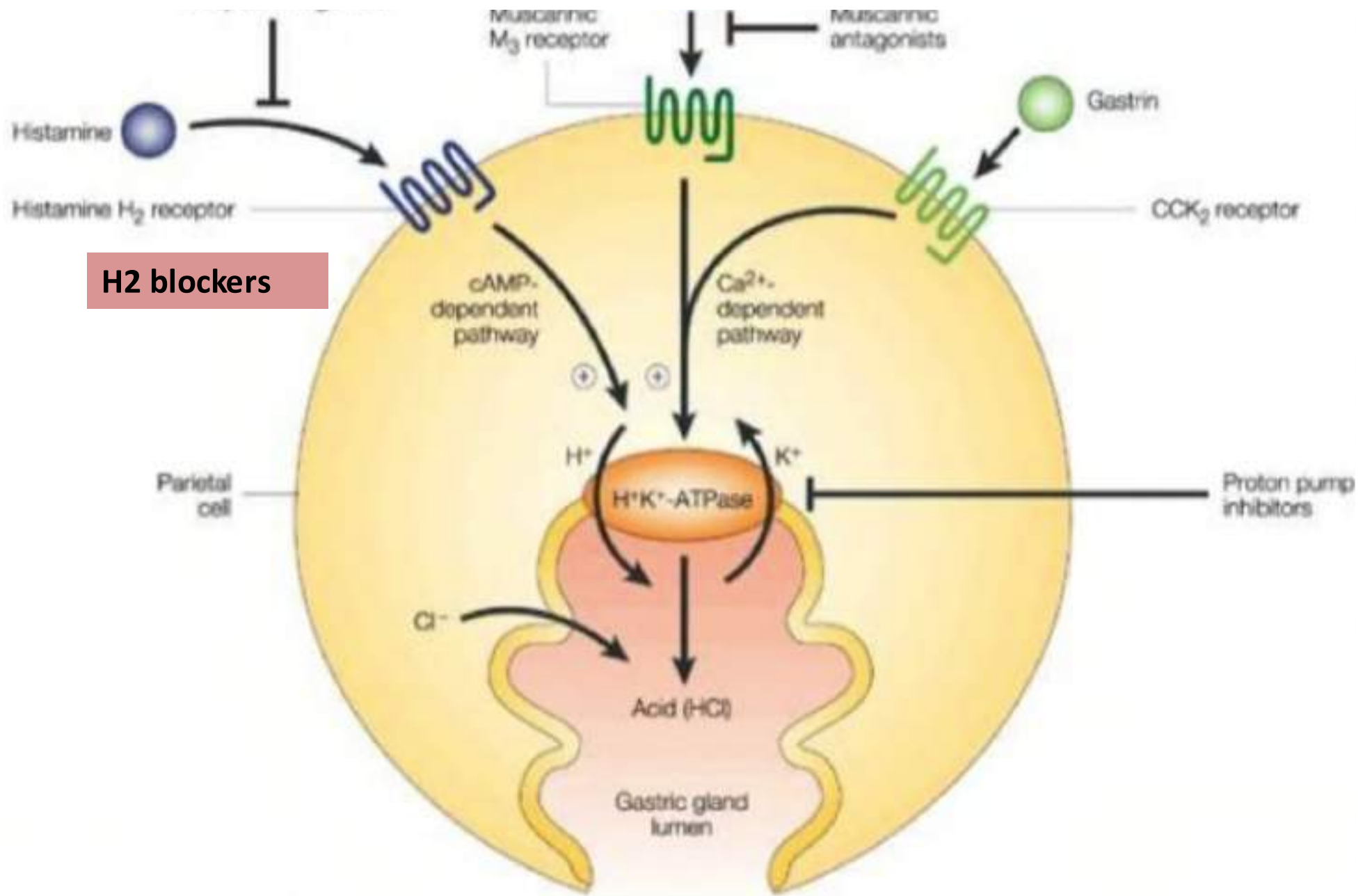
H₂ ANTAGONISTS--MOA

Competitive Blockers of parietal cell
H₂ receptors

Preventing histamine release

Inhibit all phases of gastric acid
secretion

(basal/psychic/neurogenic/gastric



H2 blockers

Proton Pump Inhibitor

Cimetidine - prototype

–older, less potent, short duration

inhibition of CP 450 → Interactions

**binds to androgen receptor – gynecomastia,
galactorrhea, impotence, decreased sperm count,
sterility in females**

CNS adverse effects

Alcohol intolerance

Newer H2 blockers

- More potent
- Long-acting
- No H2S inhibition
- No anti-androgenic A/E
- Infrequent CNS A/E – but DO INHIBIT alcohol metabolism.
- **Examples--**
- **Ranitidine (150 bid/Hs)**
- **Famotidine(40 bid/Hs)**
- **Nizatidine(300 bid/Hs)**

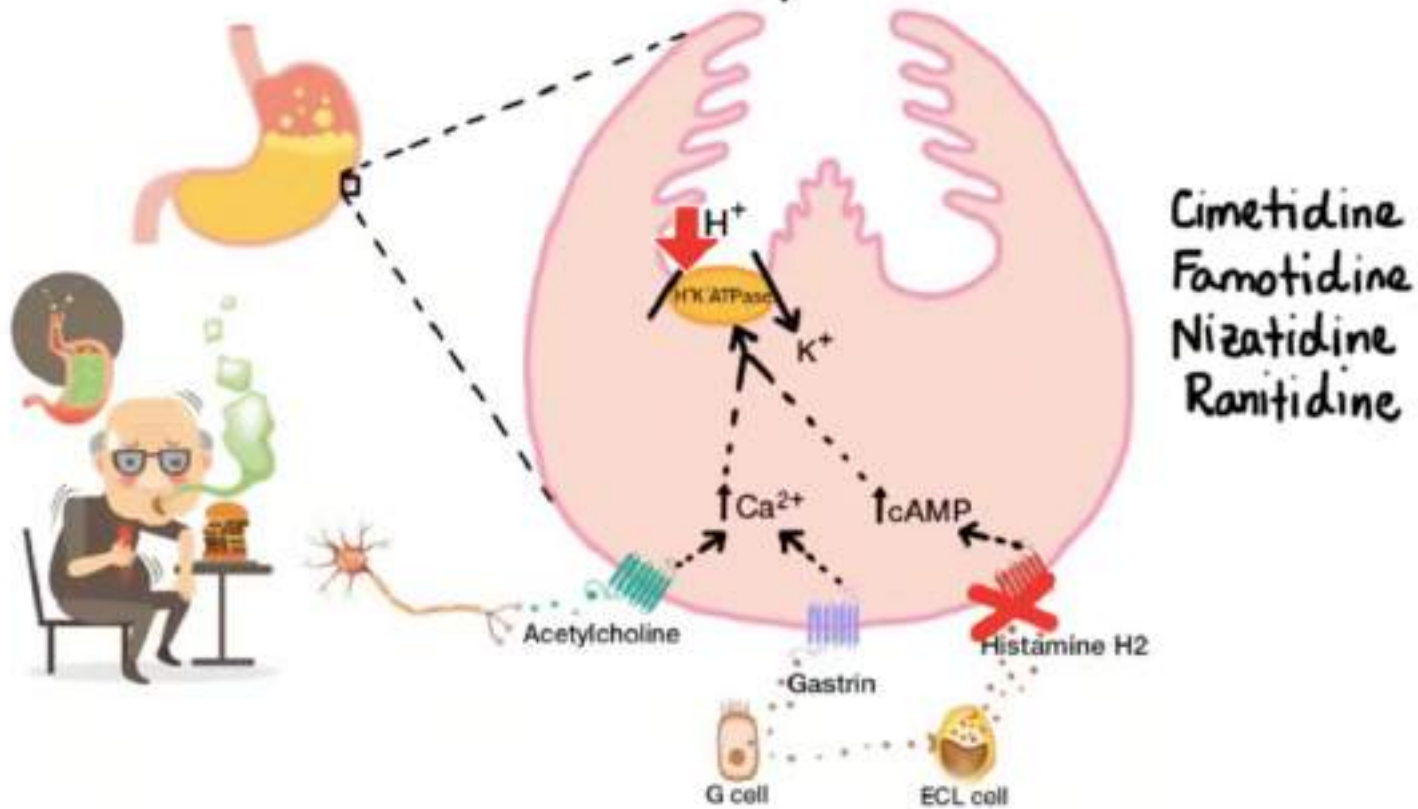
RANITIDINE

- 5 times more potent than **cimetidine**
- No anti androgenic action
- Does not ↑ prl
- Does not inhibit cytochrome 450 and thus less drug interactions
- 150 mg 12 hrly
- or 300mg HS
- Oral IM IV preparations

FAMOTIDINE

- 5 times more potent than **ranitidine**
- No anti androgenic action
- Does not ↑ prl
- Does not inhibit cytochrome 450 and thus less drug interactions
- DU -40 mg HS for 8 wks
- 20 mg to prevent relapse
- Oral IM IV preparations

H2 Receptor Blockers



CLINICAL USES OF H2 BLOCKERS

1) duodenal ulcer

2) gastric ulcer

3) stress ulcers and NSAIDs gastritis

4) Zollinger Ellison syndrome

5) GERD

**6) prophylaxis of aspiration
pneumonia**

Proton pump inhibitors

: ↓ **H⁺K⁺ ATPase**

Decrease availability of **hydrogen** ions

Inhibit final step in gastric acid secretion

Powerful inhibitor of gastric acid

+ anti-H pylori action: direct: minor

Raise intragastric pH: lower MIC of
anti-H.pylori antibiotics

Proton pump inhibitors

Superior to H2 blockers

Inactive at neutral PH

Enteric coated form –acid labile

30 min before breakfast

Omeprazole as prototype

Mechanism of action of PPI

Inactivates H K ATPase irreversibly

Acid secretion can resume only when new enzyme molecules are formed

Should be taken on empty stomach

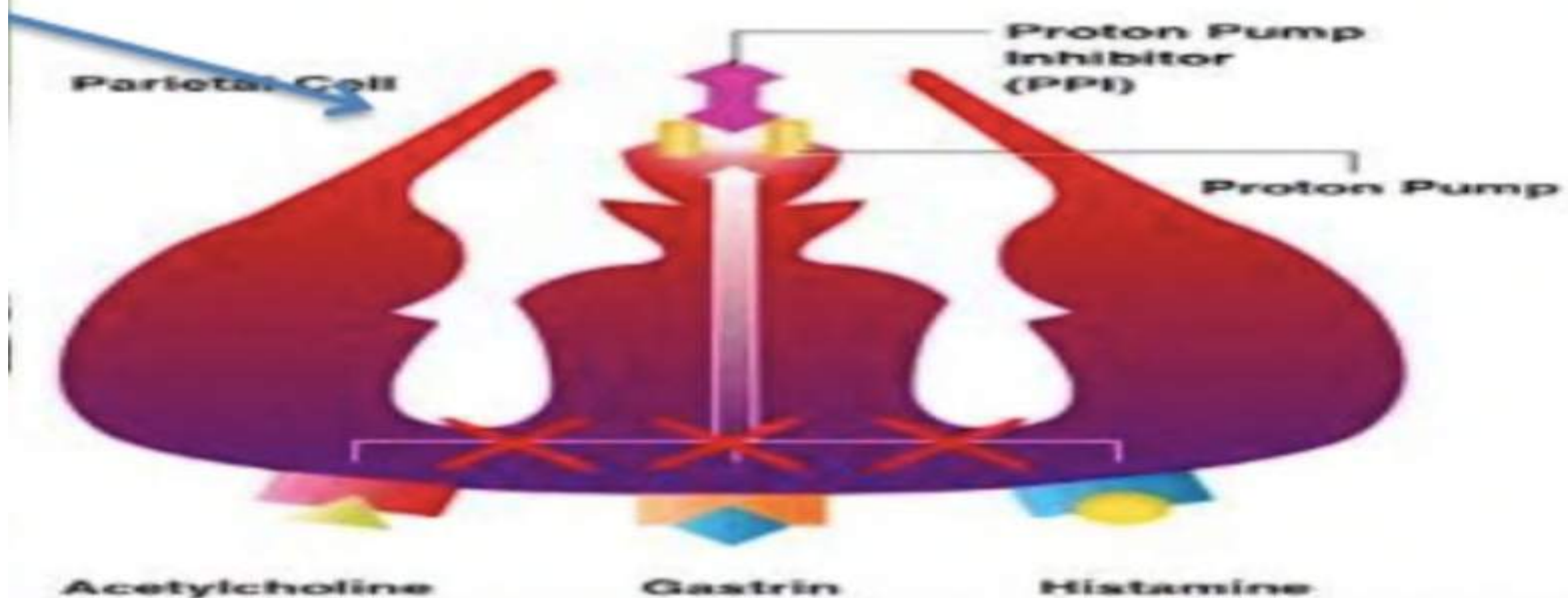
Action occurs within 1 hr –

max action at 2 hrs

lasts for 3 days

parietal cells of the stomach.

- ❖ “pumps” proton into the stomach.
- ❖ By using **ATP**, an acidic **hydrogen ion** replaces a non-acidic **potassium ion**.



HOW PROTON PUMP INHIBITORS WORK

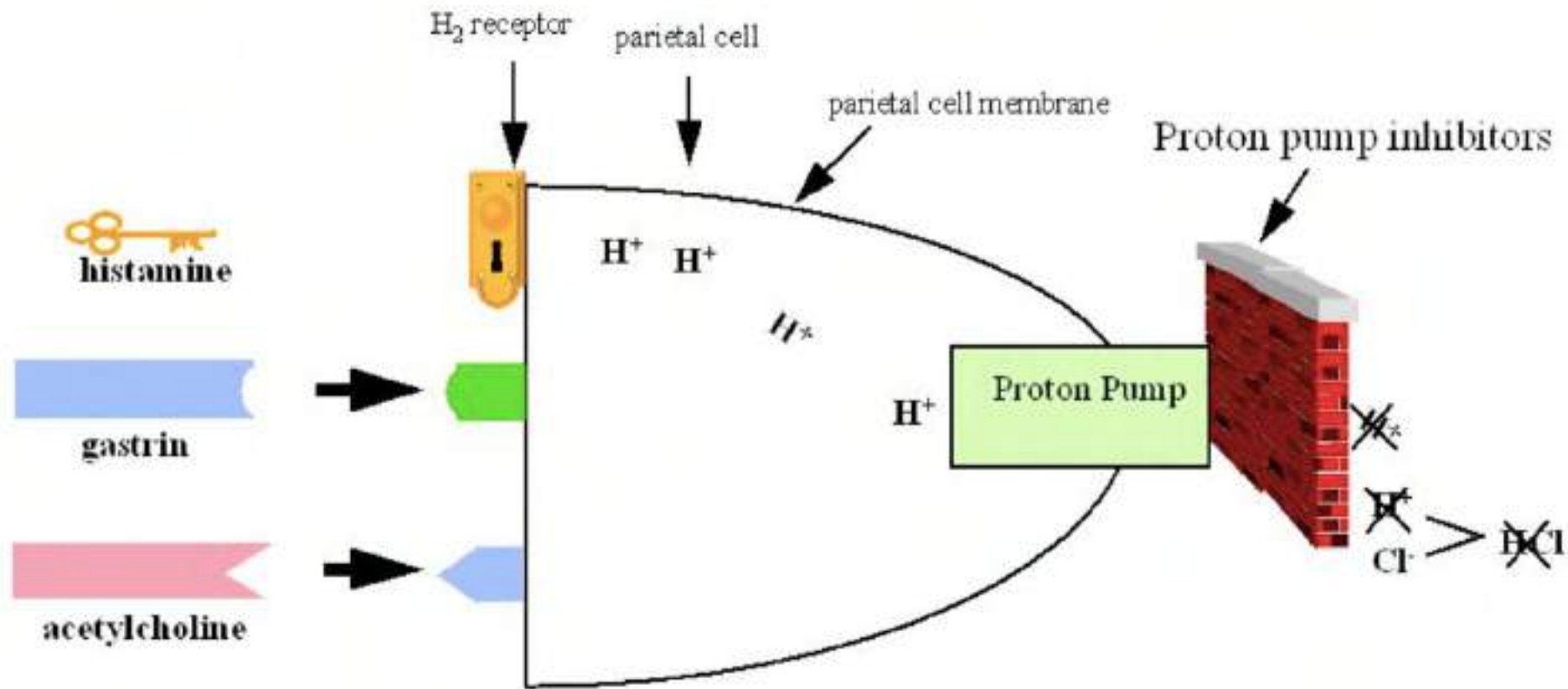


Figure 1-5 Proton Pump Inhibitor Mechanism of Action

Anti-H.Pylori drugs

Omeprazole, pantoprazole, lansoprazole, rabeprazole

Adverse effects-

Omeprazole – CP450 Inhibitor – drug interactions +

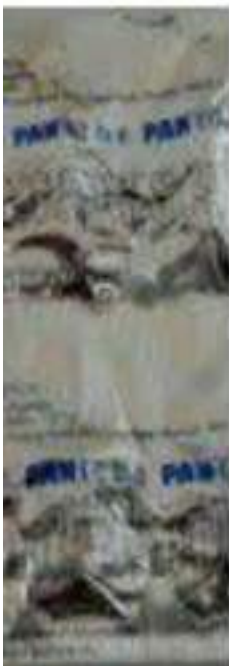
Headache, abd pain

Diarrhea, Cl difficile infection,

Respiratory infections

Decreased B12 absorption

Hypochlorhydria, hypergastrinemia



600 x 600 - sastasund

DR PRADNYA ROTITHOR

Therapeutic Uses of PPI

1) Peptic ulcer -

a) rapid relief from pain

Duodenal ulcers heal within 2 to 4 wks

Gastric ulcer 4 to 8 wks

b) integral component of **anti H pylori** treatment

c) drug of choice for **NSAID induced ulcers**

d) help control **bleeding from peptic ulcer**

-inj pantoprazole iv

Uses

2) GERD –

Rapid symptomatic relief

Drug of choice for GERD stage 2 and 3 where there is oesophagitis and erosion

3) Zollinger Ellison syndrome –

gastrin secreting tumor leading to peptic ulcers

ANTICHOLINERGICS

Atropinic drugs **reduce gastric acid secretion** but produce anti muscarinic side effects

Delay gastric emptying –
stay of antacid in stomach increases

But

Prolongs contact of acid with ulcer

Pirenzepine –selective antiM1 used in Europe

Others – propantheline, methantheline, oxyphenonium bromide

Are replaced by H2 blockers and PPIs

Gastric mucosa --PGE2 PGI2

cytoprotective role

--↓acid and gastrin secretion

↑mucus ↑ HCO₃

poor for pain relief

Poor acceptability by patient due to **frequent dosing**

Expensive Contraindicated in pregnancy **XXX**

A/E: diarrhea, abd cramps, uterine bleeding/abortion

PG analogs

Misoprostol – 800 mcg,

Rioprostil – 600 mcg

Enprostil – 70-140 mcg

- ALL IN 2-4 divided doses

Prevention of NSAID-induced ulcers in high-risk patients

PPIs are preferred now

ANTACIDS

Neutralize acid raise pH

Do not ↓ acid production

Require **frequent** administration

Symptomatic relief of pain

Reduces reflux oesophagitis

Popular OTC drug

Acid rebound --↑ pH → gastrin release → more acid secretion

Antacids -MOA

–act as weak bases and neutralise gastric HCl

Raise pH above 4

Forms protective coating to ulcer crater

Liquid preparations are superior to tablets

Potency –ANC = acid neutralizing capacity

No of mEq of 1N HCl brought to Ph 3.5 in 15 min by a unit dose

Classification-SAQ

Systemic ---absorbed may cause alkalosis

Non systemic ---non absorbable

Systemic antacids –



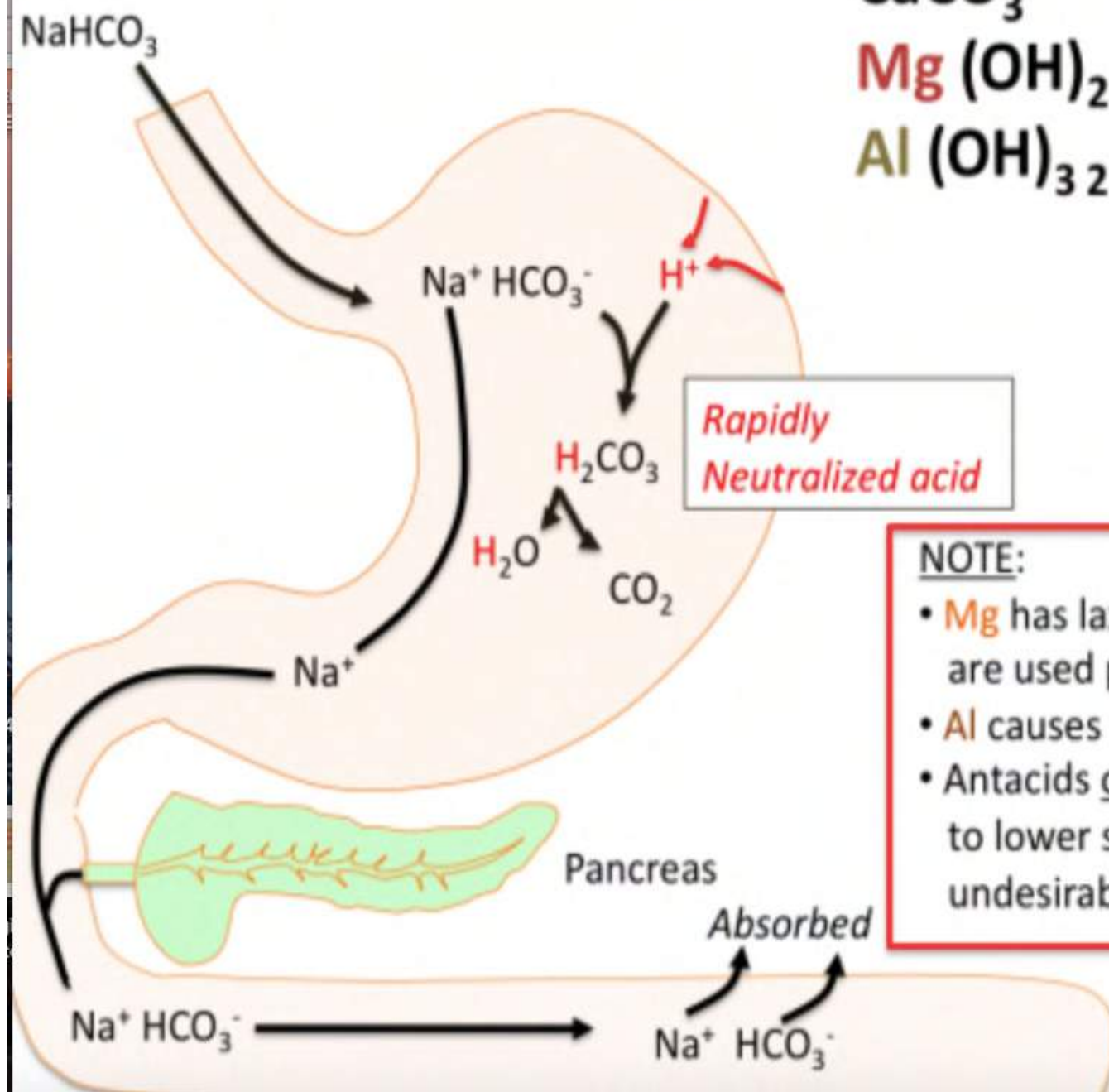
This NaCl is readily absorbed

Net addition of sodium ions ---

Systemic alkalosis

NaHCO₃ –potent, short acting --household medicine

Na Bicarbonate



Other Antacids.

CaCO_3 (H^+ binds w/ CO_3^{2-})

$\text{Mg}(\text{OH})_2$ (H^+ binds w/ OH^-)

$\text{Al}(\text{OH})_3$ (H^+ binds w/ OH^-)

NOTE:

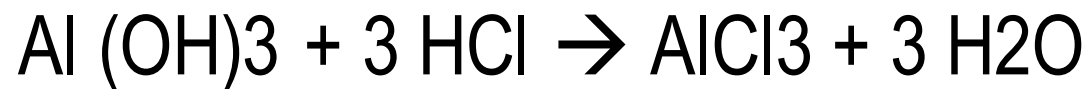
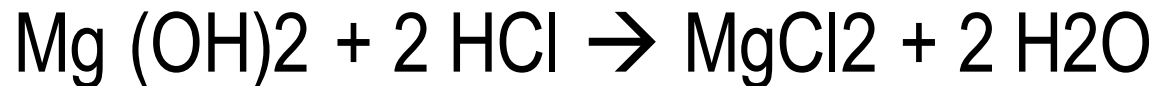
- **Mg** has laxative effects (laxatives w/ Mg are used prior to endoscopy)
- **Al** causes constipation
- Antacids combining Al & Mg are used to lower stomach acid w/o producing undesirable constipation or diarrhea

Non-systemic antacids

Non soluble poorly absorbed bases of Mg⁺⁺ Al⁺⁺⁺

Form corresponding chloride salt

Chloride salts react with intestinal bicarbonate and regenerate original salt



No net gain or loss of H⁺ OR HCO₃⁻

Systemic alkalosis is thus avoided

SAQ –Antacid combinations

MgOH₂ , magnesium tri silicate ,Mg carbonate

Aluminium hydroxide gel Calcium carbonate

Combinations are superior as—Viva Q

1)Mg –fast Al –slow

Hence combination yields prompt and sustained action

2)Mg –laxative Alu –constipating

Hence combination annul actions and bowel movement is least affected

3)Al delays and Mg/Ca salts hasten gastric emptying – hence net effect is no change in gastric emptying time

4)Individual dose reduction reduces systemic toxicity on fractional absorption

Combinations of antacids

Digene –dried aluminium hydroxide gel 300mg
mag alu silicate 50 mg
mag hydroxide 25 mg
methylpolysilox 10 mg

Gelusil --

Mucaine –contains oxethazaine- local anaesthetic agent ,prompt relief from pain of peptic ulcer

Combination antacid
Mg + Al





ESTHETIC ANTACID GEL

Mucaine® Gel



Sugar Free

200 ml

Orange Flavour

**Antacid with
local anaesthetic**

Drug interactions of antacids

Raised pH

Forms **non absorbable complexes**

leads to **↓absorption** of many drugs

Tetracyclines ,iron salts , H2 blockers , INH etc

Should be administered in staggered manner

USES OF ANTACIDS

No longer used alone for ulcer healing

--- large and frequent doses

--- acid rebound

---- little nocturnal protection

-----poor patient acceptability

V useful in day to day practice specially to combat drug induced hyperacidity (not ulcer)

Ulcer protectives- sucralfate, CBS

SUCRALFATE

Aluminium salt of sulfated sucrose – is a disaccharide

Tablet (1 g) 1 g 1 h before meals and HS x 4-8 wks

Astringent – precipitates superficial proteins, combines with dietary proteins

Physical barrier/coating

Adheres to ulcer base – long stay > 6 h

Delays gastric emptying

Stimulates PG synthesis – offers cytoprotection

Simpler drugs are now available

Hence not used nowadays

Sucralfate - interaction

Why do H₂ blockers, antacids, proton pump inhibitors antagonize the action of sucralfate ???–

by increasing the pH

Polymerization needs **low pH.**

Sucralfate is a disaccharide

has to polymerize, to bind to the ulcerated tissue



CBS

Colloidal bismuth subcitrate or bismuth subsalicylate

ULCER PROTECTIVE + detaches and kills H. pylori

Increases mucus and bicarbonate

Tablet 120 mg – ½ h before meals and also at bedtime

4-8 weeks

Ulcer healing agent

CARBENOXOLONE SODIUM

Increases mucus secretion


Increases life span of epithelial cells

Promotes healing

A/E: steroid like, Na water retention, edema, can aggravate hypertension, also decreases K

Glycerrheic acid derivative

Capsule 100 mg tid x 4-6 wks, then 50 tid

A collage of various pharmaceutical blister packs. The packs are arranged in an overlapping, diagonal pattern. The colors of the blister packs include red, orange, yellow, white, and blue. The pills and capsules inside are also diverse in color and shape, including round tablets, oval tablets, and capsules. The background is a light, neutral color.

carbenoxolone

H PYLORI

Helicobacter pylori
gram negative bacillus

Survives hostile environment of acidic stomach

Attaches to surface epithelium

High urease activity

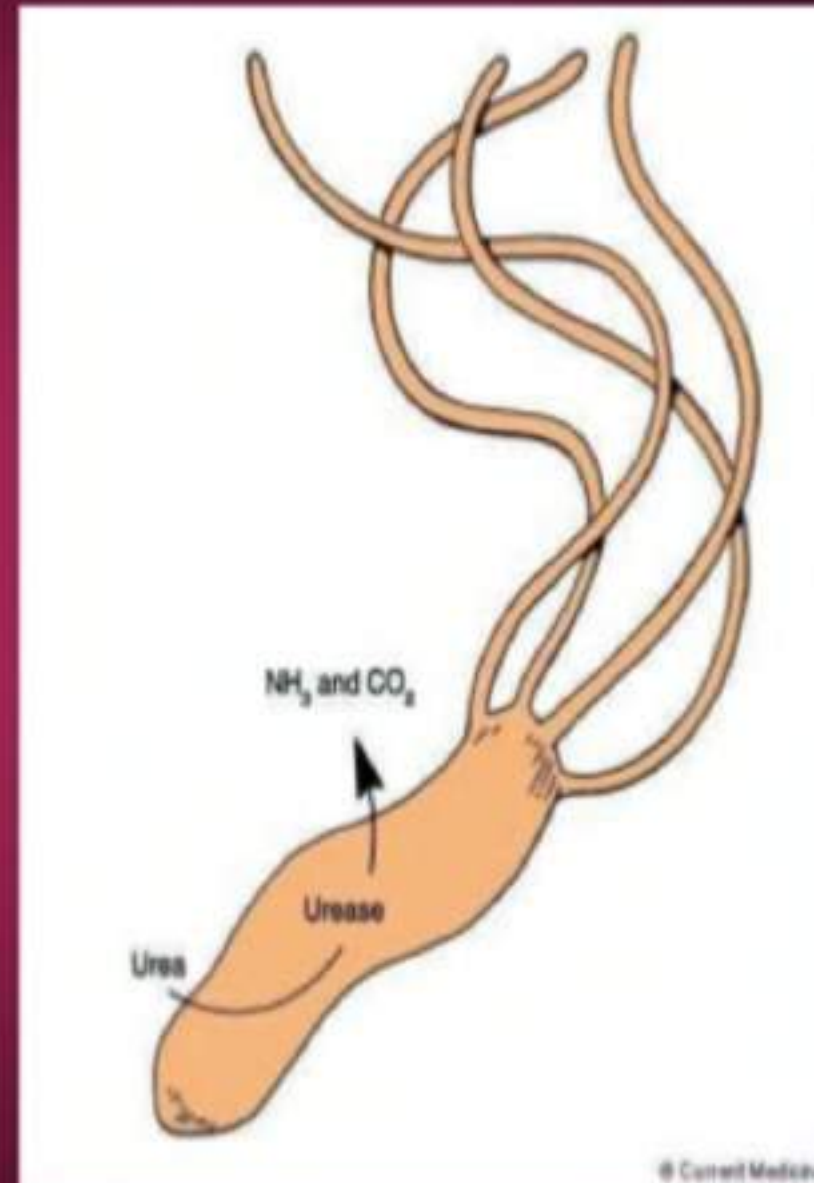
Promotes back diffusion of H⁺ IONS

**Important contributor to the causation of gastritis
,ulcer(90%) and carcinoma**

Causes dyspepsia ----

H. pylori

- Gram (-) rod
- Associated with gastritis, gastric & duodenal ulcers, gastric adenocarcinoma
- Transmission route fecal-oral
- Secretes urease → convert urea to ammonia
- Produces alkaline environment enabling survival in stomach
- Higher prevalence in Low SES



Anti H pylori therapy

Recommended for-

- 1) all ulcer patients who test positive for H pylori
- 2) All other cases where conventional treatment has failed
- 3) Relapse cases

H Pylori

Once eradicated long term maintenance anti secretory treatment is not required

Less than 10% ulcers recur

Recurrence usually is precipitated by use of NSAIDs

Efficacy of H pylori treatment is tested by negative urea breath test

Antimicrobials for H pylori

Amoxicillin

clarithromycin

tetracycline

Metronidazole /tinidazole

PPI are added

Single drug therapy –ineffective

Resistance develops rapidly to metronidazole

**Two week three drug regimen -60-96%
eradication**

1-week regime with PPI for total 4 weeks

1. Tablet **Pantoprazole** 40 mg = 7

Take one tablet once daily before lunch 1 week

(Pantoprazole is to be continued in the same dose for **total period of 4 weeks**)

2. Tablet **Metronidazole** 400 mg = 21

Take 1 tablet every 8 hours after meals for **1 week**

3. Capsule **Amoxicillin** 500 mg = 21

Take 1 tablet every 8 hours after meals for **1 week**

2-week regime with PPI for total 4 weeks.

Should include **1 PPI + Clarithromycin / Metronidazole + Amoxicillin**

1. One Proton Pump Inhibitor (**PPI**) given **twice a day** before meals for **total 4 weeks**

(Omeprazole 20 mg or Rabeprazole 20 mg or Lansoprazole 30 mg or Esomeprazole 30 mg or Pantoprazole 40 mg)

1. **Clarithromycin** 500 mg **twice a day** for 2 weeks or **Metronidazole** 500 mg **twice a day** for 2 weeks

2. **Amoxicillin** 1000 mg **twice a day** for 2 weeks

Or if already not included, then Metronidazole 500 mg twice a day for 2 weeks

All drugs in BID dose

T R I P L E T H E R A P Y



PREVACID® AMOXICILLIN CLARITHROMYCIN

Contains Medication for 7 Days
of Therapy

Mylan

Hp-PAC

Eradication of *Helicobacter pylori*
This card contains one day of therapy.

1. **PREVACID 30 mg**
(Lansoprazole Delayed-Release Capsules) Two pink and black capsules, each containing 30 mg of lansoprazole as enteric-coated granules.
2. **BIAXIN BID 500 mg**
(Clarithromycin Tablets USP Film-Coated) Two pale yellow, oval, film-coated tablets, each containing 500 mg of clarithromycin.
3. **AMOXICILLIN 500 mg**
(Amoxicillin Trihydrate Capsules) Four scarlet and yellow capsules, each containing amoxicillin trihydrate equivalent to 500 mg of amoxicillin.

Eradication de *Helicobacter pylori*
Cette plaquette contient les médicaments d'une journée.

1. **PREVACID à 30 mg**
(Lansoprazole, capsules à libération prolongée) Deux capsules rose et noir contiennent chacune 30 mg de lansoprazole, sous forme de granules à libération prolongée.
2. **BIAXIN (BID) à 500 mg**
(Clarithromycine en comprimés USP, filmés) Deux comprimés jaune pâle, ovales et de forme ovale contiennent chacun 500 mg de clarithromycine.
3. **AMOXICILLINE à 500 mg**
(Trihydrate d'amoxicilline, capsules) Quatre capsules écarlate et jaune contiennent chacune du trihydrate d'amoxicilline équivalent à 500 mg d'amoxicilline.

Morning Dose
Dose du matin

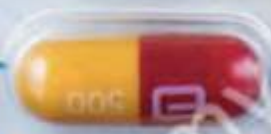
1



2



3



Evening Dose
Dose du soir

1



2



3



MUHS QUESTIONS

JULY 2005

Why non systemic antacids are preferred over systemic antacids in the treatment of peptic ulcer ?

SAQ 2014 NOV

Enumerate advantages of combination of antacids with suitable examples

SAQ NOV2013

Enumerate PPIs and their 2 imp uses

SAQ 2013 MAY

Ranitidine –indications and adverse effects

May 2009 SAQ

Why sucralfate should not be used with omeprazole ?

June 2006 SAQ –

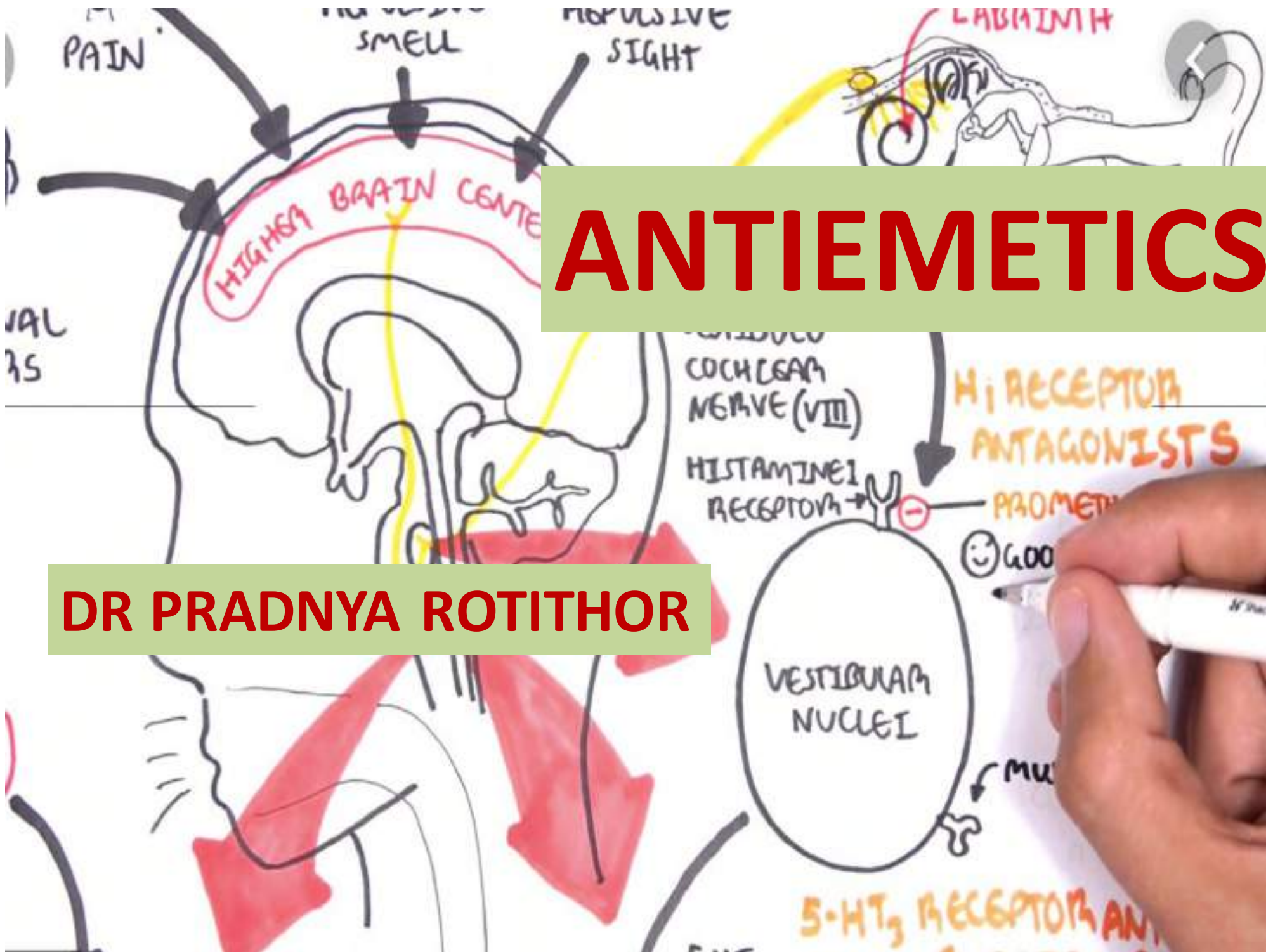
Mention two gr of drugs with one ex each to treat acid peptic disease , explain mech of action and indications



Thank You

ANTIEMETICS

DR PRADNYA ROTITHOR



Aetiology of vomiting

Life saving valuable physiological response to the ingested toxic substances.

Unwanted side effect of cancer chemotherapy and radiation .

Migraine

Motion sickness

Morning sickness

ADR of many drugs

Others –emotions ,bad smell etc

MECHANISM OF VOMITING

Fundus and body of stomach ,oesophageal sphinctor and oesophagus relax

While –

Duodenum and pyloric stomach contract in retrograde manner

And--

Rhythmic contractions of diaphragm and abdominal muscles compress the stomach and evacuate its content via mouth .

**Higher
Neurological
Centres**

5HT
Dopamine

ACh
H₁
5HT

VC

CTZ

5HT
Dopamine

Toxins
Drugs
Electrolytes
Hormones

GI Tract



EMESIS

Centres for Mechanism of emesis-

Vomiting centre –medulla oblongata

Relay areas for afferent signals –CTZ NTS cerebellum and brain cortex

Afferent impulses come from –GIT throat ,other viscera

Additional impulses to CTZ –from blood as CTZ is unprotected by BBB

Mediators of impulse –5 HT from enterochromaffin cells in GIT → 5HT₃ receptors on vagal afferents →CTZ/NTS

EMETIC RECEPTORS

GIT - 5HT₃

5HT₄—pro kinetic

CTZ—H₁ D₂ 5HT₃ M OPIOID μ

NTS —5HT₃ M H₁

CEREBELLUM —M H₁

These receptors are the targets of antiemetic drugs

Emetic inducers –

GIT --cytotoxic drugs radiation ,other GIT irritants

Cortex –smell pain sight psychogenic stimuli

Vestibular apparatus –disturbed equilibrium, rotational movements ,ototoxic drugs

Pharmacotherapy of vomiting

- Anti emetics –

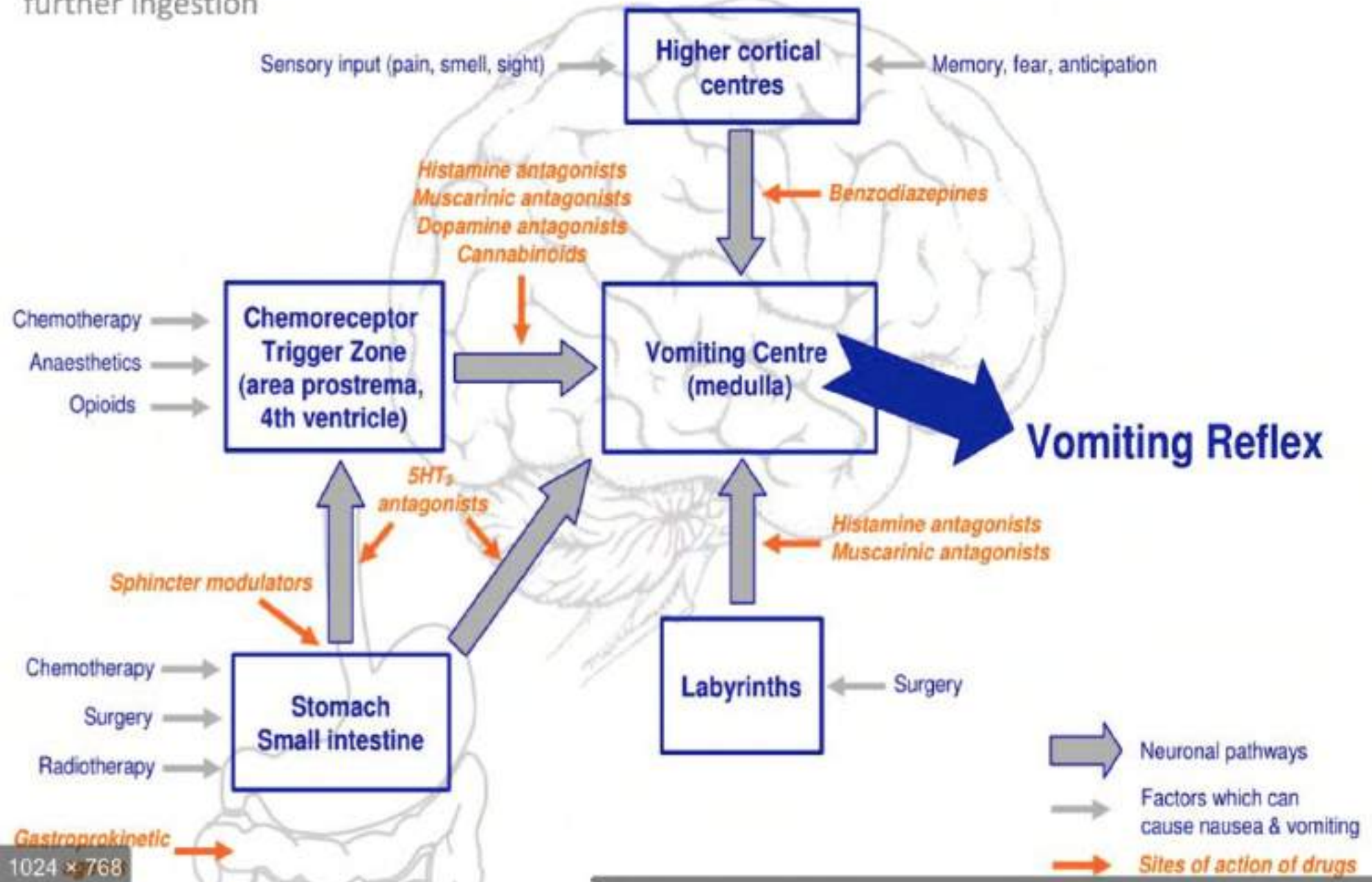
**Drugs which specifically
prevent or relieve
nausea and vomiting**

Classification of Anti emetics

- 1) D₂ antagonists D₂R- CTZ
Prokinetic and Anti dopaminergic –
Metoclopramide, Domperidone
- 2)Antihistaminic H₁ –
Cyclizine , Meclizine , Promethazine , doxylamine
Dimenhydrinate ,
- 3) Anti 5 HT₃ –
Ondansetron (ginger) , Granisetron
- 4)Antimuscarinic/anticholinergic–
Scopolamine hyoscine
- 5)Chlorpromazine ,prochlorperazine
- 6)Others –
NK, antagonist steroids benzodiazepines

Antiemetics

Vomiting :The act of vomiting and the sensation of nausea that accompanies it are protective reflexes that serve to rid the stomach and intestine of toxic substances and prevent their further ingestion



metoclopramide

D₂ R blocker at CTZ ----antiemetic action

5 HT₃ R Antagonist Ach ↑ prokinetic

5HT₄ Agonist Ach ↑

Prokinetic action contributes towards antiemetic effect of metoclopramide

PROKINETIC METOCLOPRAMIDE

- ↑gastric peristalsis
- Relaxes pylorus and first part of duodenum
- Thus **speeds up gastric emptying.**
- Also ↓gastro-oesophageal reflux
- **No action on colon**
- Blocks D2 receptors in CTZ
- As dopamine acts as inhibitory transmitter in GIT ,D2blocking contributes to gastrokinetics
- **5HT4 AGONIST**
- Blocks 5 HT3 receptors at higher dosage

PHARMACOKINETICS

- **Well absorbed orally PERINORM/reglan**
- **Crosses BBB Placental barrier and is secreted in milk**
- **T_{1/2} = 3 to 6 hrs**
- **Action seen within 30 min on oral**
 - 10 min on IM**
 - 2 min on iv inj**

DRUG INTERACTIONS AND ADVERSE EFFECTS

Hastens absorption of aspirin diazepam

↓ digoxin absorption

Abolishes therapeutic effect of levodopa by blocking DA receptors in basal ganglia

Adverse effects –

Well tolerated drug

Sedation dizziness diarrhoea

Muscle dystonias esp in children

Long term use can cause –

parkinsonism , gynaecomastia , galactorrhoea

CLINICAL INDICATIONS

1) Antiemetic for all causes (except motion sickness)

Widely used for vomiting of Cancer chemotherapy

2) Gastrokinetic –to accelerate gastric emptying during emergency GA if pt has taken food 4hrs prior to surgery

To relieve post vagotomy or DM associated gastric stasis

To facilitate duodenum intubation

3) dyspepsia

GERD-only symptomatic relief in milder cases



D2 antagonist 5HT4agonist prokinetic





DOMPERIDONE

Selective D2 antagonist

Similar to metoclopramide

But has lower antiemetic and prokinetic action

Crosses BBB poorly thus has ↓ extrapyramidal side effects

Useful antiemetic for levodopa induced vomiting as

----does not block therapeutic effect of levodopa

But CTZ is not protected by BBB so has good antiemetic effects

Can cause ↑PRL

Oral dose = 10-20mg tid DOMSTAL

High first pass metabolism

D2 antagonist

Domperidone Tablets

DOMITAB

10x10 Tablets

0 x 319 - exportersindia.com

DOMC LIC

Domperidone
Paediatric Suspension

DOMC LIC

डोमकोलिक



Zydus
Cadila



METOCLOPRAMIDE

- D2 antagonist antiemetic
- Acts on CTZ
- 5HT4 agonist
- Releases Ach to enhance prokinetic action
- Action blocked by atropine
- Crosses BBB barrier
- Abolishes therapeutic effects of levodopa
- Extrapiramidal side effects+
- Highly effective antiemetic
- PRL rises
- Uses –antiemetic ,gastric emptying ,GERD

DOMPERIDONE

- D2 antagonist antiemetic
- acts on CTZ
- No action on 5HT4
- Does not release Ach
- Not blocked by atropine
- Crosses BBB poorly
- Does not abolish
- Less likely
- Lower efficacy
- Low rise
- Uses --antiemetic

5HT3 ANTAGONISTS

ONDANSETRON

- Blocks emetogenic impulses both at their peripheral origin and their central relay
- **Highly effective drug**
- Originally developed to ↓ chemo and radiotherapy induced vomiting in anticancer treatment
- later found v useful for all other causes of vomiting -- MCQ
- **V well tolerated** drug with only headache as common side effect
- Granisetron –10 times more potent , longer acting , more effective in repeat cycle of chemotherapy



5HT3 Antagonist



netmeds



Ondansetron Inj
Emeset 2
FOR IV / IM USE

Each ml contains
Ondansetron Hydrochloride IP
equivalent to Ondansetron ... 2 mg
Water for Injections IP _____ ml

Store in a cool place.
Protect from light. Do not freeze.

Warning: To be sold by retail or
by prescription of a Registered
Medical Practitioner only

Cipla
Mfg. by CIPLA LTD.
C-7 Pally, (Narasapur Road)
Near Gandimaisamma
T Road, Hyderabad-43 INDIA

MUHS QUESTIONS

- Classify antiemetic drugs and MOA of any two ---latest exam
- MAY 2013 SAQ
- Enumerate 4 differences between metoclopramide and domperidone as antiemetics
- May 2014 nov 2011
- Compare and contrast metoclopramide and domperidone
- May 2007 Nov 2007 SAQ
- Name two antiemetic drugs and describe their mode of action

MCQs

- Cinnarazine
- 5HT3 antagonist
- Skin patch
- Pregnancy vomiting
- Abolishes action of levodopa

Antimuscarinic

Hyoscine –**motion sickness** –short journies

V effective but short acting produces sedation

Blocks vestibular signals

Not effective for other causes of vomiting

Scopolamine—available as skin patch



ANTIHISTAMINICS

Anti cholinergic anti histaminic and sedative properties help in ↓vomiting

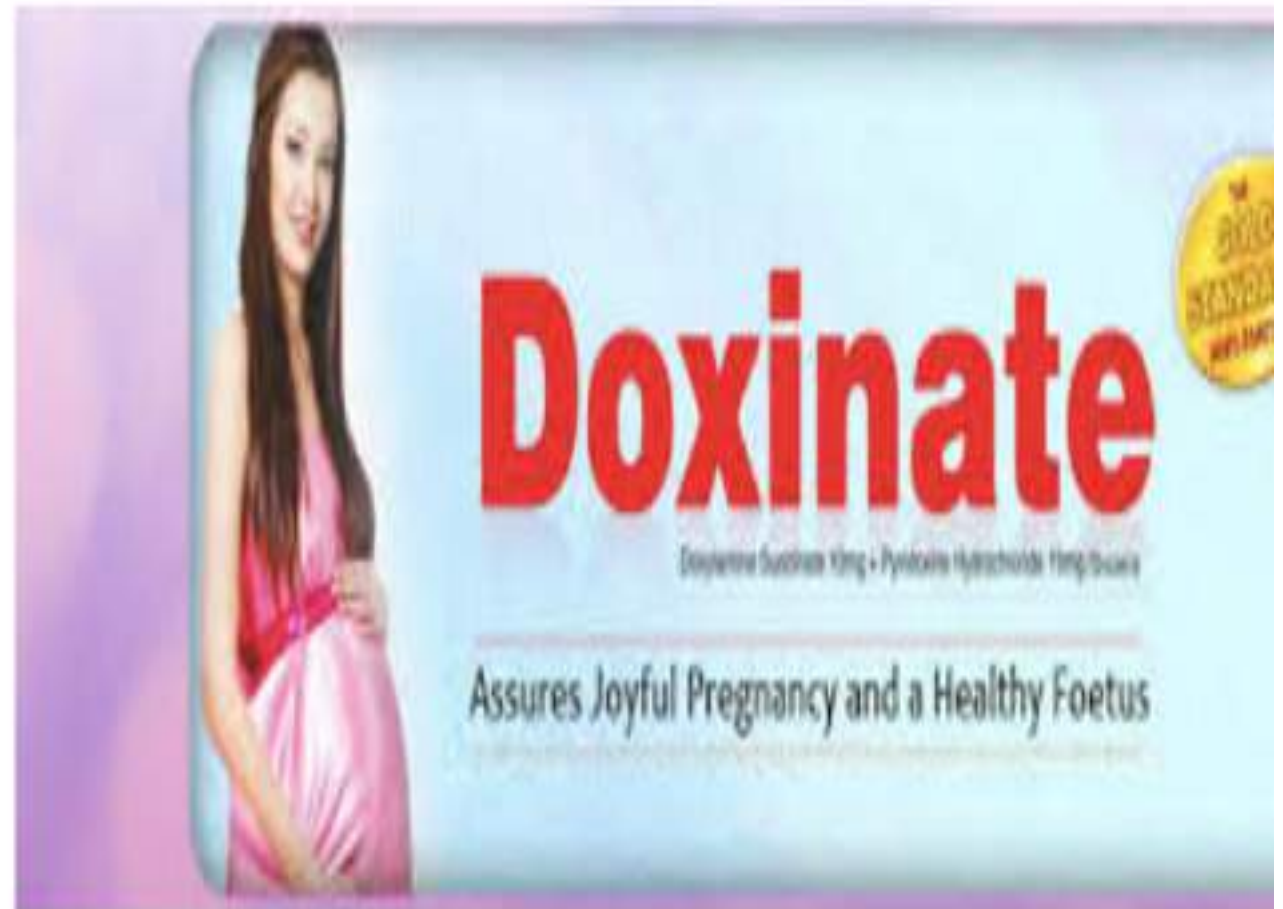
Useful mainly in motion sickness

Weak action in morning sickness postop vomiting and other reasons for vomiting

ANTI-HISTAMINIC DRUGS

- Promethazine diphenhydramine dimenhydrinate –motion sickness 4-6 hrs
- Cyclizine meclizine –sea sickness -24 hrs
- Doxylamine –with pyridoxine specially used for morning sickness
- Cinnarazine –antivertigo ,acts by inhibiting influx of Ca ++ from endolymph into vestibular sensory cells (MCQ)

Antihistaminic used for pregnancy vomiting





Antihistaminic -vertigo



Antidopaminergic

- Block D2 receptors in CTZ

Potent anti emetics with broad spectrum action

Indications –

Drug induced and post anaesthesia

Disease induced vomiting of GIT liver uraemia
migraine etc

Malignancy and chemotherapy

Radiation sickness

Hyperemesis gravidarum

Prochlorperazine –selective antivertigo antiemetic

Used for vomiting associated with vertigo



CISAPRIDE /MOSAPRIDE

- Prokinetic drug
- lacks D2 R Antagonism
- v little antiemetic property
- GIT motility actions similar to metoclopramide but has action throughout GIT including colon
- MOA -5HT4 agonism and 5HT3 antagonism
- Does not act on CTZ , no ↑prl nor muscle dystonia
- **Used restrictively due to ventricular arrhythmias like torsades de pointes --**

ADJUVANT ANTIEMETICS

- **Corticosteroids** –iv dexamethazone is given to augment action of Metoclopramide and ondansetron during chemo
- **Benzodiazepines** –given with Metoclopramide and ondansetron, they help relieve anxiety ,produce amnesia for unpleasant procedure
- **Cannabinoids** –tetrahydrocannabinol is active principle of hallucinogen cannabis indica .It has antiemetic property .
- Dronabinol is less hallucinogenic and is used in chemo for pts who cant tolerate or are less responsive to other antiemetics



LAXATIVES

Stimulant laxatives - senna, bisacodyl and sennalax, bisacodyl, glycerol sup.

- Senna - contains anthraquinone glycosides, used in
- 100 - 150 mg - 1-2 tablets 1-2 times daily for constipation
- 10 - 20 mg - 1-2 tablets 1-2 times daily for constipation
- 10 - 20 mg - 1-2 tablets 1-2 times daily for constipation
- 10 - 20 mg - 1-2 tablets 1-2 times daily for constipation



DR PRADNYA ROTITHOR

Constipation

- **Delayed passage of faeces through the intestine**
- **Straining**
- **Sensation of incomplete evacuation**
- **but**
- **the defaecation process remains normal**

- Normal defaecation ---
- empties only **descending colon**
- Purgatives –empty **entire colon**

Constipation

Factors responsible:

Inadequate fluid intake,

Inadequate fibre intake

Lack of exercise, Sedentary lifestyle

Irregular bowel habits

DEFINITION

- Drugs that **promote evacuation** of bowels
- Action is **dose** dependent
- Given drug is at --
 - Low dose –laxative/aperients
 - Large dose -purgative /cathartics

•Laxatives --

- Elimination of soft formed stool **without** griping and without much loss of water.

•Purgatives --

- passage of **fluid** stools and **griping**
- To **purge**—to clean
- Large dose purgation=catharsis—to utterly clean

CLASSIFICATION

3★ SAQ

- **1) Bulk forming** –
- **dietary fibre** (bran), psyllium, ispagol
methylcellulose ,carboxy- methyl
cellulose
- ***Mild 1-3 days***
- **2) Stool softener** –
- DOSS, liquid paraffin
- ***Mild***
- =

**Bulk
forming**



dr pradnya rotithor pune

Docosate and sena



3) Stimulant /irritant purgatives

- **A) diphenylmethanes (organic)**—phenolphthelein , **bisacodyl** (MCQ)
sodium picosulfate
- **B) anthraquinones** —(emodins)—**senna**(MCQ), cascara sagrada
- **C) 5HT 4 agonist**—prucalopride, **PG analog**-lubiprostone
- **D) fixed oil**—**castor oil** (MCQ)
- **Moderate to severe**

Dulcolax[™]
ENTERIC COATED TABLETS

Stimulant laxative ORAL

Contact laxative
Laksatif kontak

200 ENTERIC
COATED TABLETS
200 TABLET
BERSALUT ENTERIK



Perrigo[®]

NDC 0574-7050-12

Bisacodyl Suppositories, USP

10 mg

Stimulant Laxative

- ✓ Easy-open plastic packets
- ✓ Tapered shape for easy insertion

unit box 12 Suppositories

Stimulant laxative



4) osmotic purgatives

- 1) saline purgatives
- **Mg(OH)₂ (Milk of magnesia)**
MgSO₄ (epsom salt), Na₂SO₄ (Glauber salt)
Na-K tartrate (Rochelle salt),
Lactulose
- **polyethylene glycol (PEG)**
- **Glycerine suppository–laxative**
- ***Mostly severe***





dr pradnya rotithor pune

PEG

Osmotic laxative



Combination laxatives

- **Agarol**---liquid paraffin +phenolphthalein+agar
- **Cremaffin** –liquid paraffin +milk of magnesia
- **Cremaffin pink** liquid paraffin + milk of magnesia+ phenolphthalein
- **Pursennid in** –purified Senna extract + docusates

Combination laxative





Agar + phenolphthalien+liquid paraffin

Bulk /stimulant/ stool softener

Milk of magnesia + liquid paraffin

Osmotic + stool softener



cremaffin
syrup



Therapeutic uses of laxatives

SAQ

1) Functional constipation

a) Spastic constipation

(Irritable bowel)

Hard, rounded, stone-like, difficult to pass stools

Dietary fibre

Bulk laxatives -wks/months

**Stimulant purgatives
contraindicated**

b) Atonic constipation

(Sluggish bowel)

Age, debility, laxative abuse

Fluids, exercise

Bulk laxatives-

If no response -give

Bisacodyl/Senna - ow/bw

Uses--




<p>2. Bedridden patients (MI, Stroke, Fractures, Post-op) Alvimopan-paralytic ileus-abd surg- opioid peripherally acting μ antagonist--</p>	<p><u>Prevent:</u> Bulk, Lactulose, Docusates, paraffin <u>Treatment-</u> Enema, Bisacodyl, Senna,</p>
<p>3. To avoid straining at stools (Hernia ,eye surg ,cvs disorders) (Pile fissure perianal surg)</p>	<p>Bulk, Lactulose, Docusates</p>
<p>4. Preparation of bowel- surgery, colonoscopy abd Xrays</p>	<p>Saline purgatives, Bisacodyl, Senna</p>
<p>5. After certain anthelmintics (tapeworm)</p>	<p>Saline purgatives, Senna</p>
<p>6. Food and drug poisoning</p>	<p>Saline purgatives</p>

Hastens recovery
of bowel function

Given orally pre
and post surgery

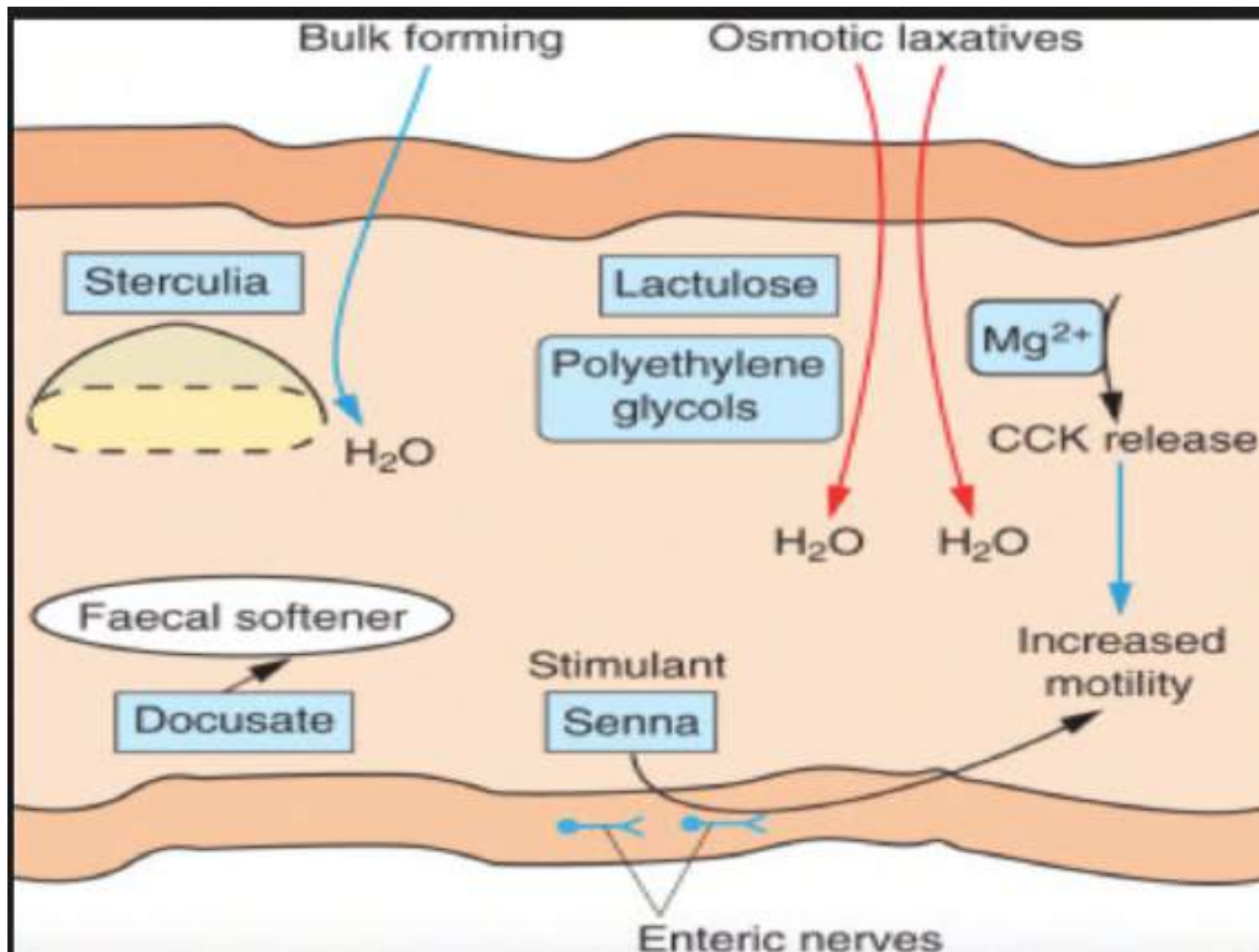


MOA –general principles

-  the water content of the faeces by –
osmotic action –**retain** water and electrolytes in the lumen
-  the net **absorption** of water
-  **propulsion** –
- allows **less transit time for re absorption** of water

Mechanism of fluid accumulation

- **1) Inhibition of Na k ATPase** in villous cells --
↓ absorption of water and electrolytes
- **2) Stimulation of adenylyl cyclase** in crypt cells
↑ secretion of water and electrolytes
- **3) Enhances PG synthesis** in mucosa and ↑ secretion
- **4) Structural injury** to absorbing mucosal cells



✕

Serotonin 5HT₄ receptor partial agonist: Tegaserod

< >

Action:

1. ↑gastric emptying and enhance small and large bowel transit (no effect on esophagus)
2. ↑ stool liquidity

Mechanism of action of tegaserod:

Serotonin 5HT₄ partial agonist. Binding to 5HT₄ receptors on the terminals of the 2nd order enteric neuron

→ ↑ release of Ach and CGRP →

↑gastric emptying and enhance small and large bowel transit (no effect on esophagus)

→ ↑ Cl secretion from the colon → ↑ stool liquidity

-bulk laxatives

Absorb water, swell
increased water content
facilitates transit

STIMULANT /IRRITANT/CONTACT LAXATIVES

Increase peristalsis –

stimulate myenteric nerve plexus

Accumulation of water and electrolytes

inhibition of Na KATPase –villous cells

↓ absorption of water and electrolytes

stimulation of adenylyl cyclase –activation of cyclic AMP –

cryptic cells -↑ secretion of water and electrolytes

Increased PG synthesis ↑

MOA

OSMOTIC

inorganic solutes -- not absorbed–
retain water osmotically –
swell and distend bowel
Peristalsis ↑indirectly

STOOL SOFTENER

DOSS

Detergent action –disrupts mucosal barrier
Emulsifies colonic content and ↑ penetration
of water into faeces

Used when straining needs to be avoided

Liquid paraffin –

Lubricates and softens hard stool

5HT4 AGONIST **prucalopride**

Activates prejunctional 5HT4 R on intrinsic enteric neurones to **release Ach**
propulsive contractions in ileum and colon

5HT4 new selective partial agonist

Tageserod

MOA

Bisacodyl Suppository –

acts by irritation of anal and rectal

mucosa –

↑ motility –

evacuation in 20 -40 min

PG analog-

lubiprostone

Increase secretions

Bulk laxatives

Unpalatable

High daily dose

Flatulence

Not useful for already formed faeces

Liquid paraffin

Unpleasant to swallow

Fat soluble vit deficiency may occur

Lipid pneumonia

Foreign body granuloma if absorbed and carried in lymph

Stimulants as a group

hypokalaemia may occur on frequent use

Malabsorption

-Contraindicated during pregnancy
-can reflexly stimulate gravid uterus due to direct action on myenteric plexuses

disadvantages

Castor oil

Violent action, -Unpalatable
-Dangerous to gravid uterus
-Dangerous in MI, CCF, hypertension
-Repeated use can produce after-constipation

pursennid ,sofsena

contraindicated in lactating mothers as amount secreted in breast milk is enough to cause purgation in suckling infants –

Bisacodyl suppository–

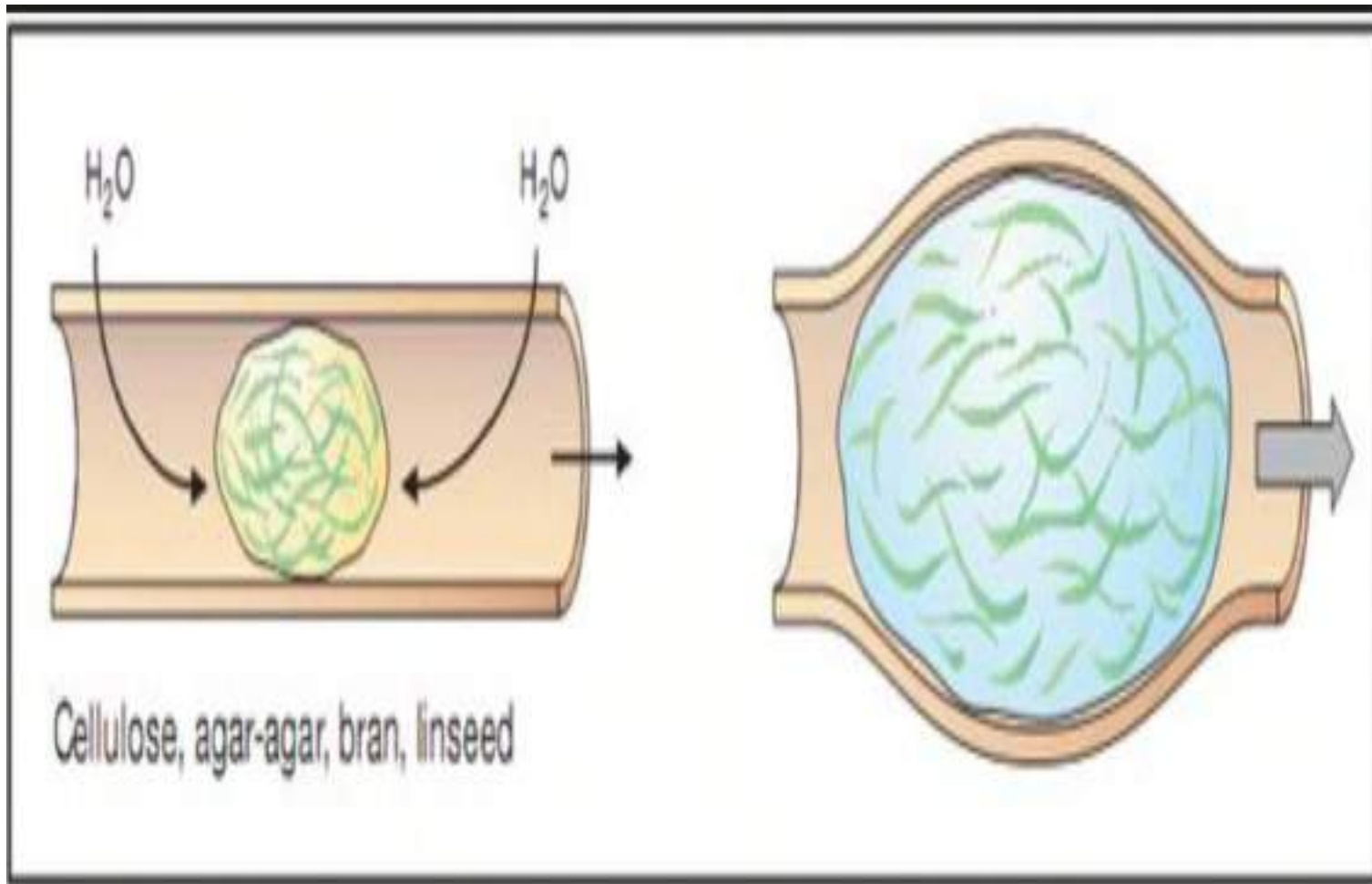
local inflammation and mucosal damage

Osmotic

Electrolyte imbalance

MOA –bulk laxatives

- **Absorb water,swell**
- **increased water content facilitates transit**
- Some like pectin and lignins bind bile acids and promote their excretion → degradation of cholesterol
- **→ lowers blood lipids**
- prolonged intake reduces recto-sigmoid pressure –IBS symptoms decrease



B. Bulk laxatives

ADVANTAGES OF FIBRES

- Stool becomes bulkier ,softer
- Straining ↓
- Useful adjuvant in treatment of –
 - Spastic colon
 - Irritable bowel syndrome
 - Colonic diverticulum
 - Piles and fissures
- May be helpful in colon cancer prevention as ↓duration of contact of locally formed carcinogens

Drawbacks of bulk laxatives

- Unpalatable
- High daily dose
- Flatulence
- Not useful for already formed faeces
- Marketed products –isogel ,fibril ,isovac

Stool softener--MOA

- Dioctyl sodium sulfosuccinate –DOSS
- **Detergent action –disrupts mucosal barrier**
- **Emulsifies colonic content and ↑ penetration of water into faeces**
- **Used when straining needs to be avoided**
- Liquid paraffin –
 - Lubricates and softens hard stool
 - used in plenty PREVIOUSLY– Currently used mostly as a constituent of combination laxative
- **Disadvantages –**
 - Unpleasant to swallow
 - Fat soluble vit deficiency may occur
 - Lipid pneumonia
 - Foreign body granuloma if absorbed and carried in lymph

Stimulant purgatives -MOA

- **Increase peristalsis** -stimulate myenteric nerve plexus
- **Accumulation of water and electrolytes** –
- inhibition of Na KATPase –villous cells
- ↓absorption of water and electrolytes
- stimulation of adenylyl cyclase –activation of cyclic AMP – cryptic cells -↑secretion of water and electrolytes
- **Increased PG synthesis** ↑
 - Intense action
 - Gripping
 - hypokalaemia may occur on frequent use
 - Contraindicated during pregnancy –can reflexly stimulate gravid uterus due to direct action on myenteric plexuses

Stimulant/irritant/contact purgatives

- Ex 1)–**phenolphthalein**
- 2) **bisacodyl** (dulcolax)
- **Suppository –acts by irritation of anal and rectal mucosa --↑ motility – evacuation in 20 -40 min**
- Disadvantage –local inflammation and mucosal damage
- 3)Sodium picosulfate –used to evacuate colon for colonoscopy and colon surgery --cremalax ,pico soft
- 4) **senna –in the colon bacteria liberate active anthral form – contraindicated in lactating mothers as amount secreted in breast milk is enough to cause purgation in suckling infants –pursennid ,sofsena**

Stimulant purgative

- **5 HT4 Agonist –prucalopride**
- Activates prejunctional 5HT4 R on intrinsic enteric neurones to **release Ach**
- propulsive contractions in ileum and colon
- **Tegaserod** –new **selective 5 HT4 receptor partial agonist** –
- withdrawn from market in many countries due to adverse CVS effects



Tegaserod – selective 5 HT4 receptor partial agonist

Castor oil (vegetable oil) (fixed oil)

● Castor oil $\xrightarrow[\text{lipase}]{\text{ricinoleic acid + glycerol}}$

- Long chain fatty acid
- Hydrolysed in ileum
- Rapid onset of action as site of action is small intestine –2-3 hrs

-Violent action, -Unpalatable

-Dangerous to gravid uterus

-Dangerous in MI, CCF, hypertension

-Repeated use can produce after-constipation

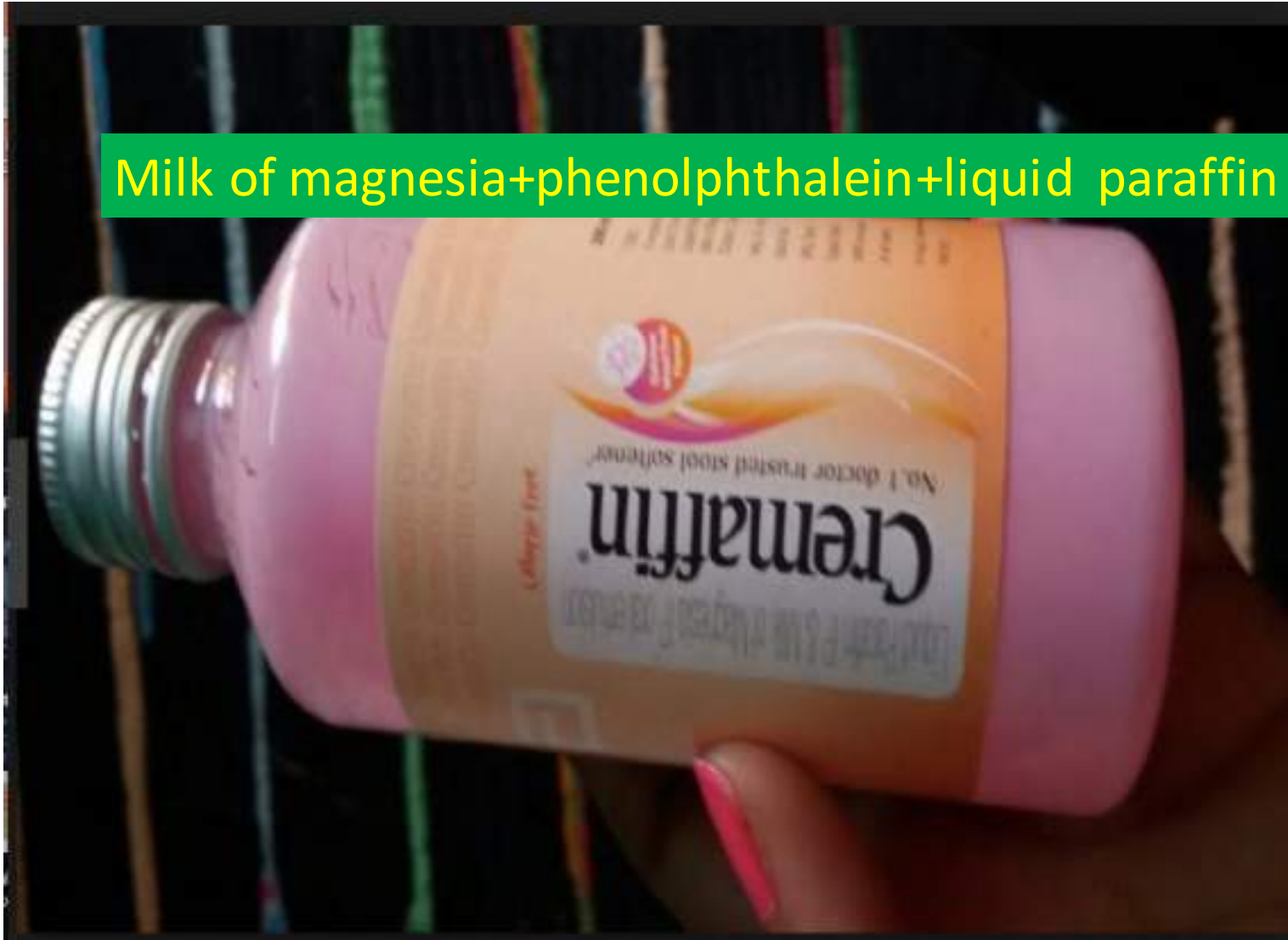
Osmotic purgatives -MOA

- Also called as saline purgatives
- **inorganic solutes -- not absorbed-- retain water osmotically –swell and distend bowel**
- Peristalsis ↑indirectly
- Strong rapid action -2-3 hrs –near complete bowel evacuation
- Indication—prep of bowel before colon surgery ,colonoscopy ,food poisoning ,after purge treatment of tapeworm infestation

LACTULOSE

- Osmotic laxative
- **Hepatic encephalopathy** –to reduce blood ammonia levels –20-30%
- --breakdown products of lactulose are acidic –reduces ph of stools ,NH₃ produced by bacteria in colon is converted to ionised
- **NH₄⁺ SALTS WHICH ARE NOT ABSORBED**
- Ex --Livoluk

Milk of magnesia+phenolphthalein+liquid paraffin





lactulose

osmotic

Reduces blood ammonia— in hepatic encephalopathy

Contraindications

Absolute contraindication in pts with

- 1) undiagnosed acute abdomen and
 - 2) intestinal obstruction –acute and subacute
 - 3) inflammatory bowel disease
-

Irritant laxatives should be avoided –

- 1) during pregnancy **XXX**
 - 2) typhoid fever
 - 3) severely ill cardiac pts
-

Constipation secondary to –hypothyroidism, cancers--treat the underlying cause

Drug induced constipation: opioids sedatives oral iron --omit the drug



Purgative abuse

- habit forming
- becomes an obsession for daily purgation

- This may lead to :-
 - Precipitation of inflammation → rupture of appendix
 - Fluid electrolyte imbalance → hypokalemia
 - Steatorrhea, malabsorption syndrome
 - Protein losing enteropathy
 - Spastic colitis

MUHS EXAM QUESTIONS

SAQ

May 2012 –again in NOV 2012

Classify purgatives .Describe their therapeutic uses

M 2004

Give 4 examples of drugs used in the treatment of constipation having different mechanism of action

MCQs—irritant purgative –castor oil ,bisacodyl

ORAL SALINE LAXATIVE

EXELYTE[®]

(FOR BOWEL LAVAGE ONLY)

एक्सेलाइट

Each 45 ml contains:
Sodium Phosphate
Sodium ClP 26.437 g
Sodium Hydrogen Phosphate
Sodium SP 1.439 g
Sodium ClP
Sodium ClP 0.275 w/v
a buffered aqueous solution.

Net weight 9.0 g

Usage / Use directed by the Physician

Net weight glass

1.407 4000000000

Lot No. 1901000100

Reg. No. CEKE 13009

Exp. Date MAR. 2013

Exp. Date AUG. 2014

Reg. No. 134.55

Reg. No. 134.55

Reg. No. 134.55

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45ml

ORAL SALINE LAXATIVE

EXELYTE

(FOR BOWEL LAVAGE ONLY)

एक्सेलाइट



2 x 45 ml

Osmotic Laxatives: Saline and PEG Laxatives



Milk of Magnesia 20-30 cc per day
Magnesium citrate 240 ml once daily as a purgative
Polyethylene glycol 17-51 grams per day

Main side effects: bloating, gas, borborygmi diarrhea. Patients with significant heart/kidney disease should use magnesium laxatives with caution



ANTIDIARRHOEALS



WHO definition of diarrhoea

- **Three or more loose or watery stools in a 24 hour period**
- Major cause of mortality and morbidity in developing countries
- More prevalent in children
- > 5 million under five age group children die
- High mortality among children under 5 in India –roughly a million
- Major cause of PEM



Pathophysiology of salt and water absorption

- Water and electrolytes are both absorbed and secreted in the intestine
- Absorption--
- Jejunum –freely permeable to salt and water
 - passive absorption
- Ileum –**Na –glucose cotransporter**
 - one Na ion is transported along with each molecule of glucose absorbed
- This mechanism **remains intact even in severe diarrhoea**
- Ileum and colon- **Na K ATPase** –active absorption of salt
 - water follows iso osmotically

Secretion

- **Adenylyl cyclase –stimulation**—raised cAMP or cGMP—
- **net loss of water and salt** by --
- Inhibition of NaCl absorption in villous cells
- And secretion of anion in cryptic cells –Na⁺ accompanies anions
- PG stimulate secretory process

All acute enteric infections produce secretory diarrhoea

- **Bacterial toxins by –cholera, ETEC ,staph aureus, salmonella**
- activate Adenylyl cyclase
- which enhances secretion
- Peak action at 3-4 hours and persists for 36 hours
- 36 hrs =nml lifecycle of mucosal cell

Principles of management

- Most diarrhoeas are **self limiting**
- **Enteropathogens are washed out due to motility or are killed by defence mechanism**
- **Fluid replacement**—ORAL by **ORS** IV fluids if needed
- Prevent or treat shock acidosis
- Nutrition maintenance
- Drug therapy —antimicrobials—specific—if the cause is established
- antimotility and antisecretory drugs--nonspecific

Rehydration –
the only treatment in majority cases

- **IV drip** –only if fluid loss is > 10% of body weight
- Or
- Rate of fluid loss is > 10 ml/kg/hr
- Or
- Unable to take enough oral fluids due to stupor weakness vomiting
- **Oral rehydration therapy**
- If the fluid loss is –
- mild (5-7%BW) or moderate (7.5-10%BW)

ORS

★SAQ

- Secreted fluid (due to toxins) lacks glucose and hence can not be reabsorbed
- **Glucose helps in absorption of sodium from ORS as well as from intestinal secretions**
- Principles:
- **Isotonic or somewhat hypotonic**
- Molar ratio of glucose = / or higher to sodium, but not more than 110 mM **Provide enough K and HCO₃**, to make up those lost in stools.
- K (15-25 mM) HCO₃ (8-12 mM)]

WHO ORS Older or standard formula	Grams/lit		Mmols/lit
Sodium chloride -	3.5	Sodium	90
Potassium chloride	1.5	Potassium chloride	20 80
Tri-Sodium citrate	2.9	citrate	10
Glucose	20	glucose	110
		Total osmolarity	310

Old formula



Composition of WHO ORS

	grams/litre		mmol/litre
Sodium chloride	2.6	Sodium	75
Glucose, anhydrous	13.5	Chloride	65
Potassium chloride	1.5	Glucose, anhydrous	75
Trisodium citrate		Potassium	20
dihydrate	2.9	Citrate	10
		Total Osmolarity	245

**ORAL
REHYDRATION
SALTS** 

New formula meets WHO requirements

Each sachet contains the equivalent of:

Sodium Chloride	2.6 g
Potassium Chloride	1.5 g
Trisodium Citrate, dehydrate	2.9 g
Glucose Anhydrous	13.5 g

DIRECTIONS

Dissolve in ONE LITER of drinking water.

To Be Taken Orally according to age or as
other wise directed under medical supervision.

Infants - over a 24 hour period.

Children - over an 8 to 24 hour period.

CAUTION: DO NOT BOIL SOLUTION.

MEDLYTE

(W.H.O. RECOMMENDED FORMULA)



Refreshing Orange Flavour

10 Sachets of 21g

21g

MEDLYTE

SORO DE REIDRATAÇÃO ORAL

(100% Free ORES Citrate Formula)
Estabelece fluxos de corpo e destrói a perda
de água e desidratação



Agua fervida



Coloque no copo



Serve 1 colher de pó dentro de 200ml
(1 copo de água quente e água)



Condições:
Dependendo da idade e quantidade de desidratação:
Infância: 1-2 xícaras (5-10 copos) dentro de um período de 24 horas
Adultos: 2-4 xícaras (10-20 copos) dentro de um período de 24 horas,
e conforme indicado por seu Médico.
Continuar o tratamento até que a diarreia pare.

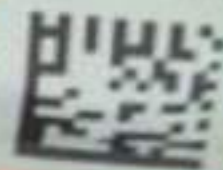
Precaução:
Use com precaução em função de restrição renal.
Fazer teste prévio para a manutenção total de umidade.
Evitar uso por mais de 24 horas.

CONSERVAR NUM LUGAR SECO Concentração em mg/ml / litera

Sódio	30.0
potássio	20.0
Cloro	80.0
Citrato	3.3
Glucose	111.0

Code No: 18UA/LL/2015

Manufactured by
SYNCOM PHARMACEUTICALS PVT LTD
CHENNAI 600 007, INDIA



Constituent	Older	New ORS (WHO ORS)
Na	90 mM	75 mM
K Cl	K – 20 mM Cl – 80 mM	K – 20 mM Cl – 65 mM
Citrate	10 mM	10 mM
Glucose	110 mM	75 mM
Total Osmolarity	310 mOsm/Lit	245 mOsm/Lit

The old formula -

Sodium Chloride 3.5 g.

Potassium Chloride 1.5 g.

Trisodium Citrate, dihydrate 2.9 g.

Glucose Anhydrous 20.0 g.

The New formula -

Sodium Chloride 2.6 g.

Potassium Chloride 1.5 g.

Trisodium Citrate, dihydrate 2.9 g.

Glucose Anhydrous 13.5 g.



Standard ORS: 310 mOsm/L

**New ORS: 245 mOsm/L (Low sodium-low glucose ORS)
(Low osmolarity ORS)**

Why NEW WHO formula ? Why NEW ORS

- 1. Max water absorption occurs with slightly hypotonic solution.**
- 2. Max water absorption occurs with glucose 60-110 mM
Higher conc → glucose appears in stools, increases stool volume.**
- 3. Improved efficacy with Glucose, Na both – 75 mM**
- 4. And osmolarity 245 mOsm/L**

Advantages of low osmolarity ORS

- Increased efficacy of ORS in non cholera diarrhoea
- Need for unscheduled supplement IV therapy in children fell by 33%.
- Stool output decreased by 20%.
- Vomiting decreased by 30%.
- Safe & effective.

1. **Acute diarrheas: K loss - substantial**
So, K supplementation crucial.
– Muscle repolarization, cardiac function
2. **Alkali loss in stools → acidosis**
So, bases added: Bicarbonate, Citrate, Lactate
May independently promote water and Na absorption.
3. **Drink ½-1 hourly interval – frequent small sips – otherwise**
volume itself stimulates peristalsis
4. **Initially, 5-7.5% Body weight equivalent volume in 2-4**
hours; may use intragastric drip if needed
5. **ORT - designed to restore and maintain hydration,**
electrolyte and pH balance (not to stop diarrhea)
6. **300 million liters consumed / year. Prevents 5 lac deaths**

Non-diarrheal uses of ORT

- **Post-surgical, post-burn and post-trauma** maintenance of nutrition and hydration
(in place of IV infusion)
- **Heat stroke**
- During **change over from parenteral to enteral** hydration

Super ORS-- Amino acids

- **May have enhanced absorption**
- **May improve diarrhea and purging rates**
- **Added actively transported amino acids: alanine, glycine (Na co-transporters)**
- **Marginal efficacy; Cost effectiveness not favorable**

Rice based ORS

- **Boiled rice powder (40-50 g/L): Rice starch is slowly hydrolyzed at brush border into glucose, and then absorbed**
- **No osmotic diarrhea** even if large quantity is given
- **Tastes better and more calories can be administered**
- **Rice has 7% proteins; gives amino acids which may facilitate salt and water absorption**
- **Reduces stool volume** by about **40%** as compared to **20%** by WHO-ORS
- **Shortens duration of diarrhoea**
- **Cheaper, easily available ,culturally acceptable**



CeraLyte[®] 70

Rice-based Oral Electrolyte

Drink Mix

to Correct and Prevent Dehydration



Sweetened with
Stevia

Added Carbohydrates

cerasport[®] plus

rice-based hydration drink mix



strawberry flavor

NET WEIGHT 1.09 OZ (31g)


Gluten Free

RICE BASED ORS

- Tastes better and provides more calories than the glucose-based ORS
- Culturally acceptable,
- Reduces stool volume (by about 40 %)
- Shortens the duration of diarrhea in both cholera and other severe diarrheal diseases.
- Starches other than rice, including wheat flour and maize, have also been shown to reduce stool volume in patients with cholera.
- Reduce diarrhea by adding more substrate to the gut lumen without increasing osmolality, thus providing additional glucose molecules for glucose-mediated absorption.

Maintain nutrition

- Patients of diarrhoea should **NOT** be starved.
- **starving** decreases brush border disaccharidase enzymes and **reduces absorption of salt, water and nutrients;**
- may lead to **malnutrition** if diarrhoea is prolonged or recurrent.

- **Feeding increases intestinal digestive enzymes and mucosal cell proliferation**
- Recommended food --
- **Boiled potato, rice, chicken soup, banana, sago**
- **Children: Breast milk or ½ strength buffalo milk**

- Drug therapy in diarrhea:

- Specific

- Nonspecific

disease	Antimicrobial used
Cholera	Tetracyclines, Cotrimoxazole, Norfloxacin/Ciprofloxacin, Ampicillin,
Campylobacter jejuni	Norfloxacin, other fluoroquinolones, Erythromycin
Clostridium difficile Pseudomembranous enterocolitis	- Metronidazole, Vancomycin
Amoebiasis, Giardiasis	Metronidazole, diloxanide furoate

Anti-microbials are of NO VALUE

viva Q

1) Viral diarrhoeas –ROTA virus and others

2) Food poisoning by Salmonella –self limiting –ciproflox given only in v severe cases

3) Other (Noninfective) causes of diarrhoea--

Irritable bowel syndrome

Coeliac disease

Pancreatic enzyme deficiency

Tropical sprue (except- secondary infection)

Thyrotoxicosis

Nonspecific drug therapy

- **Adsorbents and protectives**
- **Antisecretory**
- **Antimotility**

Adsorbents and protectives

- Isapghula, psyllium, methyl cellulose
- Bismuth salts (subcarbonate, subsalicylate)

● Antisecretory

- Sulfasalazine, mesalazine: (Ulcerative colitis, IBD)
- Bismuth subsalicylate, subcarbonate (Travellers)
- Atropine (Nervous, drug induced), Octreotide (carcinoid, AIDS)
- **Racecadotril (Acute)(children)(100 mg tds): reduces secretion without affecting motility MCQ. Highly effective in acute secretory diarrhoea**
 - Enkephalinase inhibition...
 - Prevents enkephalin breakdown (Mu agonist action) → decreases hypersecretion
- Loperamide also is antisecretory



•practo•

<p><small>Medical Practitioner only</small></p> <p>STORE AT A TEMPERATURE NOT EXCEEDING 30°C, PROTECTED FROM LIGHT AND MOISTURE. Keep out of reach of children</p> <p>R^x Racecadotril Capsules I.P. 100 mg</p> <p>ZEDOTT</p> <p>Each hard gelatin capsule contains Racecadotril I.P. 100 mg</p> <p>Approved colours used in hard gelatin capsule shell</p> <p>Dose: As directed by the Physician</p> <p>Schedule 'H' Drug Warning: To be sold by retail on the prescription of a Registered Medical Practitioner only</p> <p>STORE AT A TEMPERATURE NOT EXCEEDING 30°C, PROTECTED FROM LIGHT AND MOISTURE. Keep out of reach of children</p> <p>R^x Racecadotril Capsules I.P. 100 mg</p>	<p>Dist. Mansana, INDIA.</p> <p>A1 : Plot No.: 25A-30, Sector- 8A, IIE, SIDCUL, Rampur, Haridwar (Uttarakhand) - 249 403</p> <p>जीडोट</p> <p>ZEDOTT</p> <p>2018 31/03/2019</p> <p>torrent PHARMACEUTICALS</p> <p>Manufactured by TORRENT PHARMACEUTICALS LTD. Indrad-382 721, Dist. Mansana, INDIA.</p> <p>A1 : Plot No.: 25A-30, Sector- 8A, IIE, SIDCUL, Rampur, Haridwar (Uttarakhand) - 249 403</p> <p>जीडोट</p>	<p>B.No. 00747008 MFD. FOR 10 CAPS. M.R.P INCLUSIVE OF ALL TAXES</p> <p>EXP.</p>
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Anti-motility drugs

- **Mainly opioid drugs**
- **Increase small bowel tone, segmenting activity**
- **(Mu) reduce propulsive movements, increase absorption**
- **(delta) decrease secretion, increase absorption**

Antimotility and antisecretory agents

- **Codeine:** opium alkaloid, reduces GI motility, also have antisecretory effects.
- **Diphenoxylate:** structurally related to pethidine, combined with small doses with atropine, side effects are constipation, paralytic ileus, banned in many countries.
- **Loperamide:** opiate analogue and important antidiarrhoeal than morphine.
- Interact with μ -receptor in the gut, reduces GI motility and increase anal sphincter tone.

Anti-motility drugs

- Noninfective diarrhea, mild travellers diarrhea, only initial stages
- **Diphenoxylate 2.5 mg + atropine 0.025 mg**
- **Loperamide 2-4 mg bid/tid**

- **Codeine**

- **Atropine, Propantheline, Methantheline**

Anti-motility drugs

- **(Diphenoxylate 2.5 mg) + (atropine 0.025 mg)**
- Diphenoxylate: synthetic opioid, pethidine derivative: CNS effects, abuse liability
- Atropine: subtherapeutic dose - discourage abuse
- **Children: respiratory depression, paralytic ileus, toxic megacolon**
- **Not used in children < 6 years**



Why is atropine added to diphenoxylate ?

Viva Q

DIPHENOXYLATE (2.5mg)
+ATROPINE (0.025mg)

- It is a synthetic opioid, chemically related to pethidine pharmacologically similar to codeine.
- The antidiarrheal action is most prominent, but because it is absorbed systemically and crosses blood-brain barrier—CNS effects do occur.
- Atropine is added in subpharmacological dose to discourage abuse by taking several tablets.
- Abuse liability is rated low, and overdose will produce disturbing atropinic side effects.
- It has caused respiratory depression, paralytic ileus and toxic megacolon in children.

Anti-motility drugs: **Loperamide**

- Opiate analog: long duration of action: 12 hours (dose: 4 mg followed by 2 mg after motion)
- Major peripheral mu ago, weak antiCh, antisecretory (action on calmodulin), improves sphincter tone and continence
- **Poor water solubility, poor absorption**
- **Less in CNS, no abuse liability**
- **Abd cramps, rashes, Children: abd distension, paralytic ileus, toxic megacolon**
- **Not used in children < 4 years**
- **Children: paralytic ileus, toxic megacolon**

Why antimotility drugs are contraindicated in acute infective diarrhea?

- They decrease the clearance of the pathogen from the intestine !!
- So, If invasive organisms are present, these can be disastrous. (Shigella, EPEC, E. Histolytica)
- **C/I: Irritable bowel syndrome, ulcerative colitis, diverticulosis: They increase intraluminal pressure**

Other uses of antimotility agents

- **To produce Deliberate short-term constipation**
e.g. After anal surgery

- **To reduce the volume, fluidity, bag cleaning frequency in ileostomy / colostomy patients**

111
NDC 0054 (SEE INSIDE CARD FOR SECOND FOUR DIGITS) 24

DC 0054 9155-24 25 Tablets (Reverse Noted)

15 mg

CODEINE
Sulfate



Tablets USP

Each tablet contains Codeine Sulfate 15 mg
X mg

© 2004 Abbott Laboratories, Abbott Park, IL 60014
All other trademarks are the property of their respective owners.
Abbott Laboratories, Abbott Park, IL 60014

ORS – newer formula – WHO – 2002

low sodium – low glucose ORS

constituent	Conc g / L	Total osmolarity 245 mOsm/L
Sodium chloride	2.6	Na - 75 mM
Potassium chloride	1.5	K – 20 mM Cl – 65 mM
Tri-Sodium citrate	2.9	Citrate – 10 mM
Glucose	13.5	Glucose – 75 mM
Water	1 L	
Oretral-A, Electrobion, Electral (21 g sachet for 1000 ml) Walyte, Relyte: (4.2 g sachet for 200 ml).		



IRON

DR PRADNYA ROTITHOR

Iron Sources and requirement

Liver, egg yolk, dry beans, dry fruits, wheat germ, yeast
meat, chicken, fish, spinach, banana, apple

Daily Requirement

total iron in our body 2.5-5gm

Adult male: 1 mg.

(Hb, myoglobin, enzymes)

Adult female - Menstruation: 2 mg Pregnancy: 3-5 mg

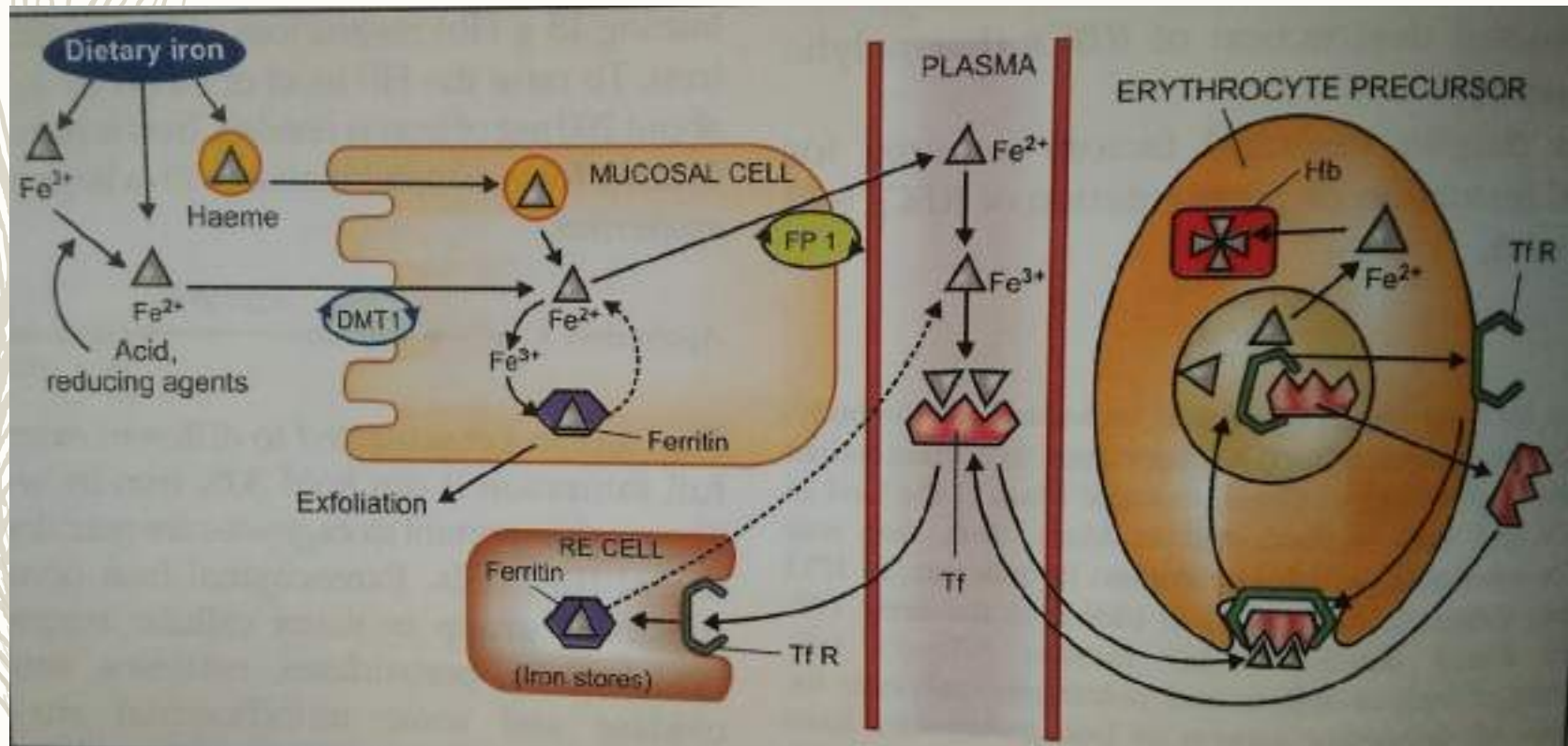
Infants: 60 mcg/kg. Children: 25 mcg/kg

Average indian diet contains 10-20 mg of iron

10% of this iron is absorbed

To raise Hb by 1 gm/dl needs 200mg of elemental iron.

Free circulating iron is highly toxic hence rapidly converted to ferric form and is bound to TF 2molecules on one TF



DR PRADNYA ROTITHOR PUNE

Factors affecting oral iron absorption

SAQ

Haem iron :- better absorbed

absorption independent of simultaneously ingested food

Inorganic iron :-relatively poorly absorbed

needs conversion from ferric to ferrous

Absorption is more in iron deficiency

Better on empty stomach but side effects



Factors affecting

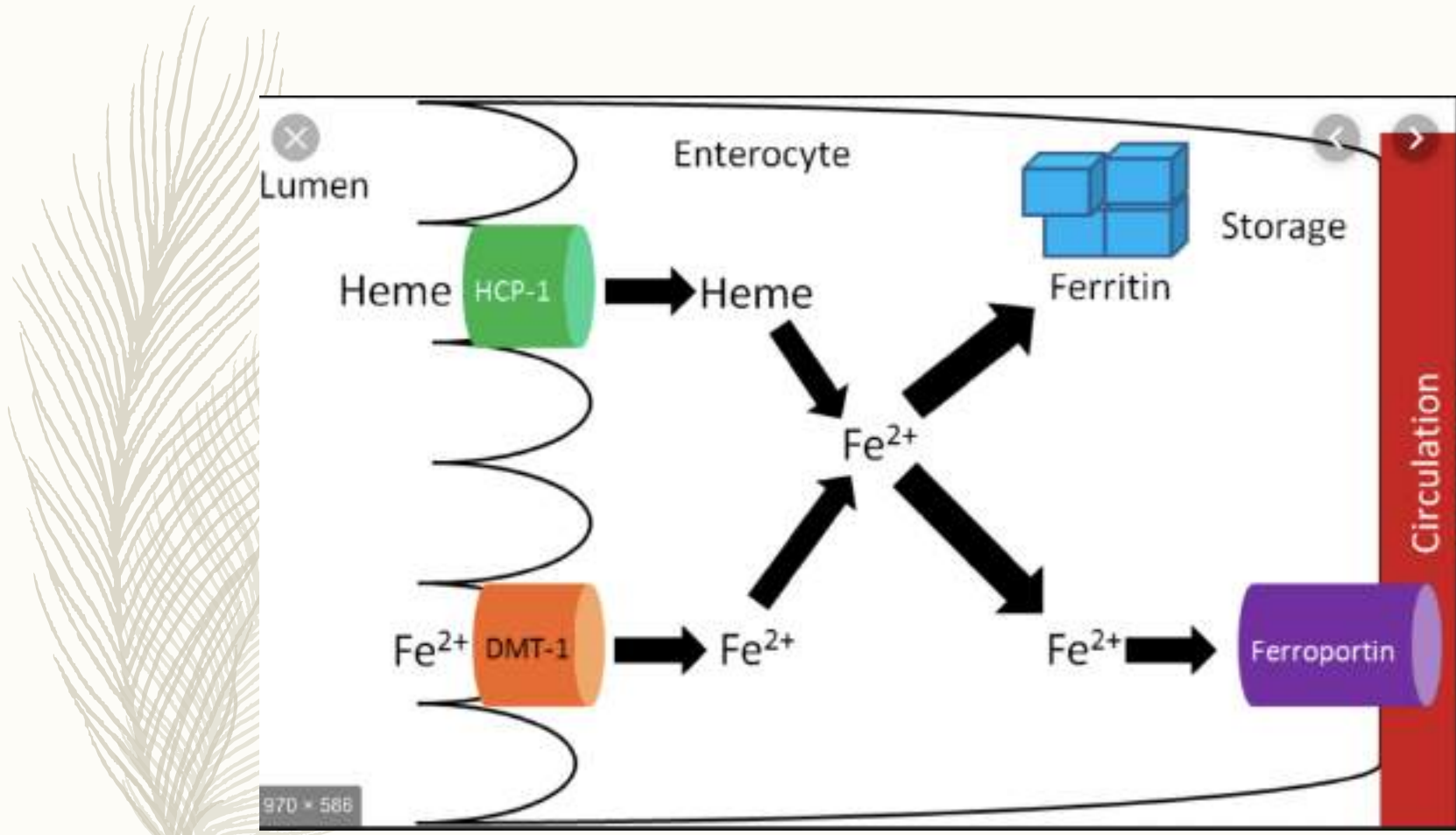
Absorption 

- 1) by weak acids [help dissolution and convert ferric to ferrous], HCl,
- 2) reducing substances (ascorbic acid/vitamin C(mcq), -SH containing aa,
- 3) meat-contains haem iron and stimulates HCl

Absorption 

- ↓ by alkalis -render iron insoluble and oppose reduction),
phosphates, phytates, tetracyclines, milk, Ca, antacids—form complex iron
Presence of other food in stomach

Pt should be instructed NOT to consume iron tab with milk



Iron transport

Absorbed iron is transported to blood by ferroportin

Ferroxidase –Fe⁺⁺ to Fe⁺⁺⁺

Taken to bone marrow for Hb synthesis by transferrin

In iron deficiency s transferrin concentration ↑

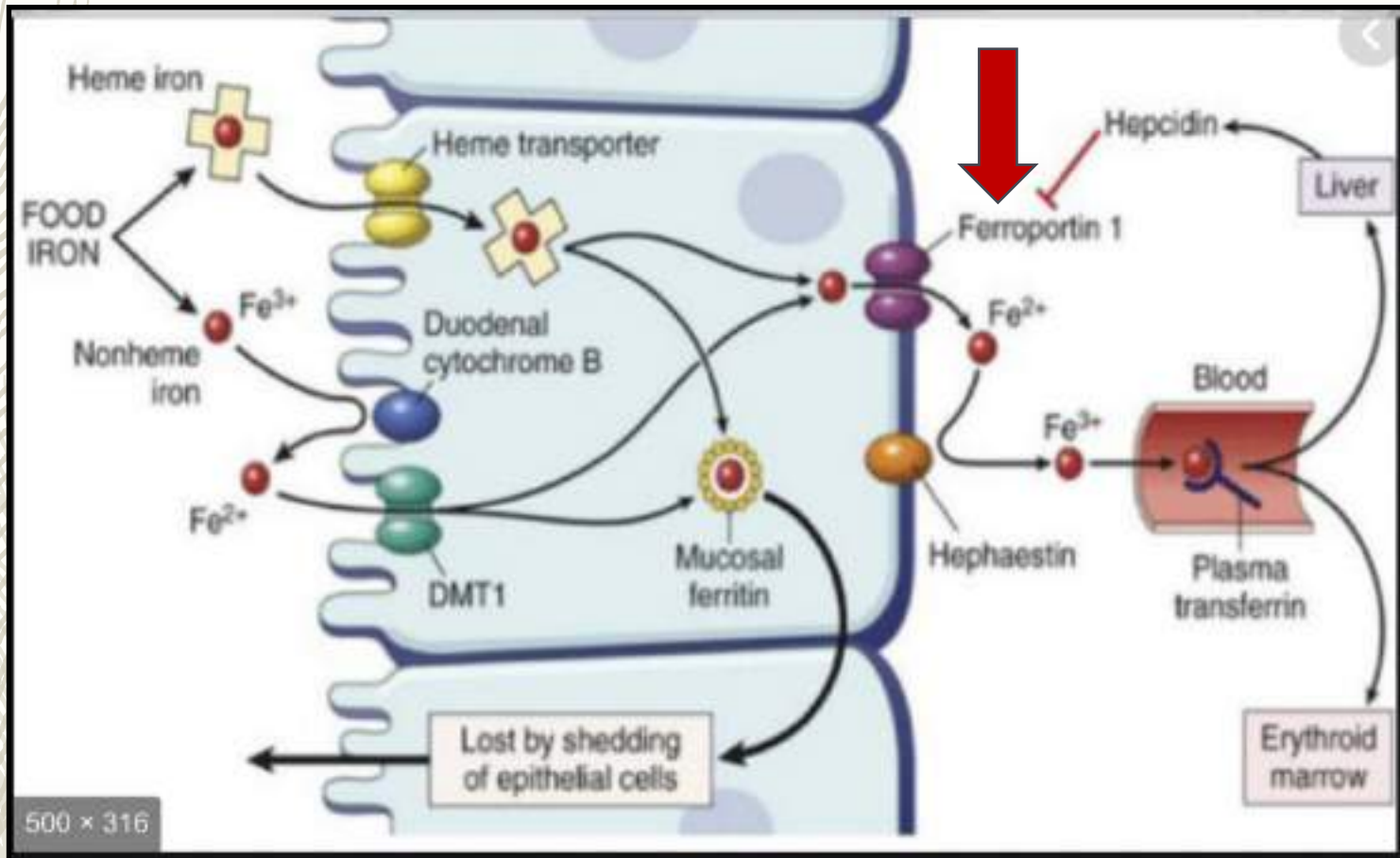
TfR –transferrin R –on all cells –selective rise of TfR in erythropoid cells during anaemia for more iron trapping

Excess iron –RE cells

stored as haemosiderin in liver, spleen, bone marrow

As ferritin in intestinal mucosa –is lost when mucosal cells shed --“ferritin curtain”

Iron absorption and transport



DR PRADNYA ROTTHOR PUNE

Oral iron therapy

Preparations:

1) Ferrous Sulphate

Most preferred
better absorbed than ferric salts
high elemental iron = (20%)
inexpensive



- | | |
|---|----|
| 2. Ferrous Fumerate | 33 |
| 3. Ferrous Succinate | 35 |
| 4. Ferrous Gluconate | 12 |
| 5. Iron choline citrate | |
| 6. Ferric ammonium citrate (scale iron) | |
| 7. Iron Ca complex | |
| 8 carbonyl iron | |

Ferrous Ascorbate & Folic Acid Tablets

Aloha-X⁷

**Elemental iron
100 mg**

Composition:

Each Film coated tablet contains:

Ferrous Ascorbate equivalent to

Elemental Iron 100 mg

Folic Acid IP 1.1 mg

Appropriate overages of vitamin added.

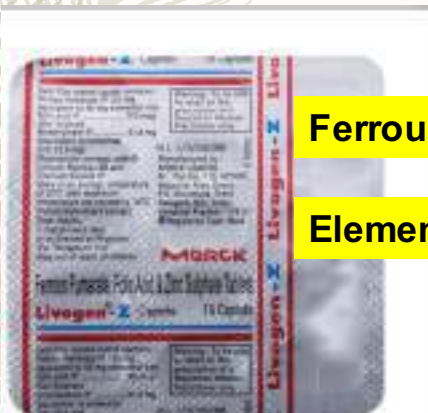
Colours : Red Oxide of Iron &

Titanium Dioxide IP

For Therapeutic use

Dosage: As directed by the physician.

Store in a cool, dry & dark place.



Ferrous fumarate

Elemental iron 50 mg

DR PRADNYA ROTTHOR PUNE

Oral iron therapy

The elemental iron content matters and not the quantity of iron compound per tablet

Ferrous sulphate (20% elemental iron)

200 mg elemental iron daily in three divided doses produces maximal haemopoietic response.

(Prophylactic dose = 30 mg daily)

= 1000 mg in 3 divided →

= 60 mg elemental iron per dose →

[0.5-1 g% per week] = rise in haemoglobin

Treatment: 1000 mg qd in 3 divided doses

Prophylaxis: 200 mg qd

Pregnancy: 700mg needed

start in 2nd trimester

To replenish stores-iron supplement should be continued for 3 months After correction of anaemia

- 
- Oral iron treatment may require 3-6 months to replenish body stores.

TABLE SHOWING SOME COMMON ORAL IRON MEDICATION.

Preparation	Tablet size	Elemental iron per tablet	Usual Adult Dosage(per tab)
Ferrous sulfate- hydrated	325mg	65mg	3 to 4
ferrous sulfate- desiccated	200mg	65mg	3 to 4
Ferrous gluconate	325mg	36mg	3 to 4
Ferrous fumarate	100mg	33mg	6 to 8
	325mg	106mg	2 to 3

Oral iron therapy

Sustained release (Expensive no extra advantage)

- Part of it released in lower intestine !
- But Most of the iron-- normally absorbed in duodenum !!
- Variable bioavailability
- **Not recommended**

Liquids – staining of teeth—
need to be put at the back of mouth at the time of swallowing

patient compliance- poor
daily dose may vary
in general less satisfactory

Oral iron therapy – adverse effects

Constipation/diarrhoea **SAQ**

Constipation(astringent effect) is more common than
diarrhoea(irritant effect)

Epigastric pain, bloating, colicky pain

Heartburn

Nausea, vomiting

Metallic taste

Staining of teeth

Black stools

–better to start with low dose and gradually increase

-- improves tolerance

Parenteral iron therapy SAQ

Rate of rise in Hb is **not faster** with parenteral iron than oral iron in optimal dose.

But iron stores are replenished quicker by parenteral iron

Indications:

- **Failure to absorb** oral iron—inflammatory bowel disorders, IBS, gastrectomy
- **Failure to tolerate** oral iron –due to side effects
- **Noncompliance** to oral iron
- **Severe deficiency** with chronic bleeding
- **Given along with erythropoietin** to meet the demands of **rapid erythropoiesis-oral absorption may fall short**

Formula

Iron requirement in mg
=4.4x body wt in kg x Hb deficit
This replenishes iron stores too

Parenteral iron therapy

1. **Iron dextran [IM]** – rarely IV.

imferon

Imferon --50mg elemental iron/ml. 2ml amp

Absorbed through lymph

2. **Iron sorbitol citric acid complex [IM]** [NOT IV]

[RAPID saturation of transferrin receptors → more free iron → iron toxicity

Absorbed directly into blood *jectofer*

3. **Iron cbh complex [IM]**

IM – Z Technique- to avoid staining, pigmentation

Painful prick---not preferred now





Newer parenteral iron preparations

ferrous sucrose –intravenous iron

Relatively safe

Easier to administer

NO CONCURRENT INTAKE OF ORAL IRON

Have replaced other forms of parenteral iron in clinical practice.

Parenteral Iron

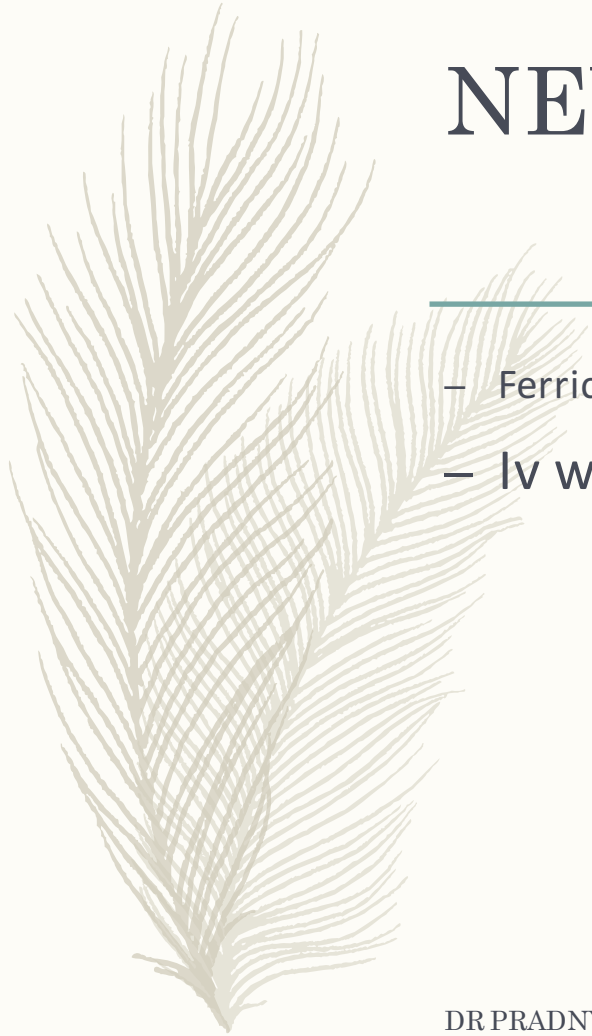
- **Iron dextran:** (IM-IV) 50 mg iron/mL
Low and high molecular weight
- **Ferric gluconate complex:** (IV)
less incidence of allergic reactions
- **Iron sucrose:** (IV) safe even with sensitivity to iron dextran
- **Ferumoxitol:** safe and effective as a rapid intravenous infusion up to 510 mg in patients with chronic kidney disease and on dialysis. transiently affect the diagnostic ability of magnetic resonance imaging.
- **Ferric carboxymaltose:** (IV) given at single doses of up to 1000 mg iron per week over of 15 minutes



IV

NEWER IV IRON

- Ferric carboxymaltose
- Iv with nml saline NOT in glucose



DR PRADNYA ROTITHOR PUNE

ADR :Parenteral iron

Pain, pigmentation, sterile abscess

Fever, headache, joint pain, flushing, giddiness, paresthesias

Tachycardia, palpitation, chest pain, dyspnea

Lymph node enlargement, Rare anaphylactoid reactions

Metallic taste (iron sorbitol)

Acute Iron Overdose: gastric lavage with sodium bicarbonate.

ANTIDOTE: DESFERRIOXAMINE: chelation: chemical antagonism

Chronic iron overload: ORAL Deferiprone: e.g. in Beta thalassemia: chelation for iron excess due to repeated blood transfusions

R_x Of Acute Iron Toxicity

Gastric lavage with soda bi carb
Desferrioxamine--antidote

Antidote for acute iron toxicity

MOA-chelation –chemical antagonist



DR PRADNYA ROTTHOR PUNE



DR PRADNYA ROTITHOR PUNE



MUHS Q

- **Indications of parenteral iron therapy**
- **Preparations and ADR of parenteral iron**

- **MCQ**
- **Ascorbic acid –factor promoting iron absorption**