

Inorganic Pharmaceutical Chemistry

Antacids , Protective Adsorbents and Laxatives

Lecture 5

- **Antacids products:**

1. Sodium containing antacids.
2. Aluminium containing antacids.
3. Calcium containing antacids.
4. Magnesium containing antacids.

1. Sodium containing antacids:

- Sodium Bicarbonate as an antacid
- It can cause a sharp increase in gastric pH up to or above pH 7
- Because of the evolution of carbon dioxide in the presence of acid, sodium bicarbonate can cause belching and flatulence



- It is readily absorbed and sodium retention can result with continued use
- It will inhibit the absorption of tetracycline from the GIT

2. Aluminium containing antacids:

- The aluminum containing antacids are widely used (Aluminum Hydroxide, Aluminum Phosphate)
- They are non systemic
- Buffering range in pH (3 – 5)
- They tend to be constipating because of liberation of astringent aluminum cations

3- Calcium containing antacids:

- They differ from the aluminum antacids in that their action is dependent upon their basic properties and not on any amphoteric effect
- Studies show that calcium antacids raise the stomach pH to nearly 7
- Calcium containing antacids particularly calcium carbonate are considered by some the antacids of choice

- Uncommon serious side effect is the milk alkali syndrome (Burnett's Syndrome) caused by taking too much of sodium bicarbonate or calcium carbonate together with large amounts of milk. It is characterised by severe hypercalcaemia, irreversible renal failure, and phosphate retention. The patient is treated by withdrawal of excessive calcium and alkali intake. This may result in some improvement, but the patient generally requires dialysis or renal transplantation
- The calcium antacids tend to be constipating and are usually found in combination with the magnesium antacids

Calcium Carbonate:

- is official as precipitated calcium carbonate
- Because of its fast action, calcium carbonate is one of the most popular antacids
- Its action is limited by the amount of salt that will go into solution thus as gastric HCl consumes the solubilized calcium carbonate more goes into solution
- Because of calcium constipation effect, most calcium carbonate preparation will be found in combination with a magnesium antacid

Tribasic calcium phosphate:

- It is occasionally used as antacid
- The principle of its action is that the phosphate ion reacts with the water present in stomach liberating hydroxide which then reacts with the gastric hydrochloric acid

4. Magnesium containing antacids:

- There are a large number of official antacids containing magnesium
- With the possible exception of magnesium trisilicate, they all function in the same manner
- They are poorly soluble salts which only go into solution as acid consumes the small amount of anion already in solution

- The magnesium cation causes this group of antacids to be laxative for this reason, they are usually found in combination with aluminum and calcium antacids in an attempt to equalize the constipated and laxative actions

- Although the magnesium antacids are considered non systemic and most of the magnesium is excreted in the feces as insoluble magnesium salts, small amounts of magnesium cation may be absorbed
- Since the absorbed magnesium is excreted by the kidneys, the magnesium containing antacids contraindicated in patients with impaired renal function, otherwise magnesium retention can occur, leading to magnesium poisoning

Magnesium Carbonate :

- consist of a hydrated mixture of magnesium carbonate MgCO_3 and magnesium hydroxide $\text{Mg}(\text{OH})_2$ and is assayed in term of magnesium oxide MgO
- The antacid properties of magnesium carbonate are due to carbonate and hydroxide anions reacting with the gastric HCl

Other magnesium containing antacids:

1. Magnesium citrate solution.
2. Magnesium hydroxide.
3. Magnesium oxide.
4. Magnesium phosphate.
5. Magnesium trisilicate.

Combination antacid preparations:

- Because no single antacid meets all the criteria for an ideal antacid, several products are on the market containing mixtures of antacids
- Most of these combination products are an attempt to balance the constipation effect of calcium and aluminum with the laxative effect of magnesium
- Some of these products are also mixture of an antacid with rapid onset of action and one with a longer duration of action

Examples:

- Calcium carbonate can be found in combination with aluminum hydroxide gel to yield products that have rapid onset with prolonged action
- It can also be found with magnesium containing antacids in an attempt to balance the constipation effect of calcium with the laxative effect of magnesium.

H.W. Other examples for antacids combinations with reasons.

Protectives and Adsorbents:

- This group of gastrointestinal agents is commonly used for the treatment of diarrhea (i.e) type of antidiarrheal agents

Causes of Diarrhea

1- Acute Diarrhea :

- Bacterial
- Viral
- Protozoal
- Drug induced
- Nutritional

2- Chronic Diarrhea :

- Tumors
- Diabetes
- Addison's disease
- Hyperthyroidism
- Irritable bowel syndrome

- The antidiarrheal agents will only treat the symptoms and sometimes the cause, but they will not treat the complications.
- Most products for the treatment of diarrhea will consist of an adsorbent protective, an antispasmodic and possibly an antibacterial agent
- The adsorbent protectives adsorb toxins, bacteria, and viruses along with providing a protective coating of the intestinal mucosa. They include bismuth salts, special clays, and activated charcoal.

Mechanism of action of Adsorbents

- Coat the walls of the GI tract
- Bind to the causative bacteria or toxin, which is then eliminated through the stool
- Examples: bismuth subsalicylate, kaolinpectin, activated charcoal, (Kaopectate)

Side Effects of Adsorbents :

- Increased bleeding time
- Constipation,
- Dark stools
- Confusion,
- Twitching
- Hearing loss, tinnitus,
- Metallic taste

Adsorbents - Drugs Interactions:

- Adsorbents decrease the absorption of many drugs, including digoxin, clindamycin, quinidine, and hypoglycemic agents
- Adsorbents cause increased bleeding time when given with anticoagulants

Laxatives:

- Constipation includes abnormally infrequent and difficult passage of feces through the lower GIT
- Symptom, not a disease
- Disorder of movement through the colon and /or rectum
- Can be caused by a variety of diseases or drugs

Mechanism of Action of Laxatives:

1- Bulk forming:

- High fiber
- Absorbs water to increase bulk
- Swells bowel (intestine) to initiate reflex bowel activity
- Examples:
 - psyllium (Metamucil)
 - methylcellulose (Citrucel)
 - Polycarbophil (FiberCon)

2- Emollient

- Stool softeners and lubricants
- Promote more water and fat in the stools
- Lubricate the fecal material and intestinal walls
- Examples:
 - **Stool softeners**: docusate salts (the main medical use of docusate sodium is to treat constipation, acting as a laxative and stool softener. In painful anorectal conditions such as hemorrhoid and anal fissures, it can help avoid pain caused by straining during bowel movements.

– Lubricants: mineral oil

- work by keeping water in the stool and intestines.
- increase bowel movements by coating the bowel and the stool with a waterproof film that helps to retain moisture in the stool.
- Examples:
 - Monobasic Sodium Phosphate Monohydrate

3- Hyperosmotic Laxatives

- Increase faecal water content
- withdrawing water into the bowel from the surrounding body tissues. This provides a soft stool mass and increased bowel movements

Examples:

- polyethylene glycol
- sorbitol (increases fluid movement into intestine)
- glycerin
- lactulose

4-Saline laxatives:

They work by absorbing water into the intestine, which softens the stool. This increases pressure in the intestine and makes bowel movements more frequent.

Examples:

- magnesium sulfate
- magnesium hydroxide
- magnesium citrate
- sodium phosphate

5- Stimulant Laxatives:

- Increases peristalsis via intestinal nerve stimulation (i.e) increasing the contraction of muscles in the intestine

*Peristalsis is the involuntary contraction and relaxation of longitudinal and circular muscles throughout the digestive tract, allowing for the propulsion of contents beginning in the pharynx and ending in the anus

- Examples:
 - castor oil
 - senna
 - cascara

Side Effects of laxatives:

- Bulk forming

- Impaction
- Fluid overload

- Emollient

- Skin rashes
- Decreased absorption of vitamins

- Hyperosmotic

- Abdominal bloating
- Rectal irritation

- Saline Laxatives:

- Magnesium toxicity (with renal insufficiency)
- Cramping
- Diarrhea
- Increased thirst

- Stimulant laxatives:

- Nutrient malabsorption
- Skin rashes
- Gastric irritation
- Rectal irritation