Pharmacology of Digestive System

INTRODUCTION

The pharmacologically treatable disorders of impairments of normal motility, digestion, absorption, secretions of the gastrointestinal tract include peptic ulcer, reflux esophagitis, Zollinger-Ellison syndrome, gastroparesis, constipation, diarrhea, inflammatory diseases and infections.

Digestive system:

A group of organs designed to take in foods; initially process foods, digest the foods, and eliminate unused materials of food items. It is a hollow tubular system from one end of the body to the other end.

Agents used to treatment of digestive system disorders include:

A- Gastric acid neutralizers (Antacids) :

Antacids are alkaline substances (weak bases) that neutralize gastric acid (hydrochloric acid) . They react with hydrochloric acid in the stomach to produce neutral or less acidic or poorly absorbed salts and raise the **PH** of stomach secretion, and above PH of 4, pepsin is inactive, and are indicated in ulcer therapy, minor stomach irritations, and other conditions depending on the type of antacid prescribed.

Sodium Bicarbonate (NaHCO3).

- It is used as a gastric antacid, urinary alkalizing agent, and an agent used to counteract the lowering of the pH of the blood in heart failure.
- Side effects associated with this agent include systemic alkalization (raising the pH of the blood) and acid rebound. The patient receiving sodium bicarbonate for antacid purposes should be told that it should not be used frequently and that it should not be used for prolonged periods.
- Sodium bicarbonate is available in tablets of various strengths and in powder form.

Magnesium Hydroxide (Milk of Magnesia).

- it is used both as an antacid and as a cathartic (laxative).
- Patients taking this product should be cautioned that they can obtain the laxative effect if they take too large a dose or if they take the antacid dose too often.
- A side effect associated with magnesium hydroxide is diarrhea.

Aluminum Hydroxide and Magnesium Hydroxide (Maalox®).

- Maalox® is used as a gastric antacid and as an agent in ulcer therapy.
- This product is available in both a suspension form (225 milligrams of aluminum hydroxide and 200 milligrams of magnesium hydroxide per teaspoonful) and in tablet form (200 milligrams of aluminum hydroxide and 200 milligrams of magnesium hydroxide per tablet).
- Depending on the amount of the preparation taken, diarrhea and constipation are side effects associated with the drug.

B- Emetics:

- Chemical agent that will cause the patient to vomit (i.e., to produce emesis).
- The clinician may administer an emetic to a patient who has ingested a certain type of chemical substance.
- Emetics are not indicated for all poisonings.
- Emetics can divided in to two classes according to the mechanism of action; they are:

1- ***Central emetics:*** agents which stimulates the vomiting center in the medulla oblongata directly or indirectly through stimulation of the CTZ. Like Apomorphine.

2- ***Peripheral emetics:*** the agents that stimulate the sensory nerve ending of the vagal nerves in the stomach, duodenum and other organs. Like Ipecacuanha, a plant alkaloid produces emesis with in 15 – 30 min.

C- Antiemetics: agents which prevent or alleviate nausea and vomiting. Anti-emetics are typically used to treat motion sickness and the side effects of opioid analgesics, general anesthetics and chemotherapy directed against cancer.

Antiemetics include:

- **5-HT_3 receptor antagonists** - these block serotonin receptors in the central nervous system and gastrointestinal tract. As such, they can be used to treat post-operative and cytotoxic drug nausea & vomiting. Examples (Dolasetron, Granisetron, Ondansetron, Tropisetron and Palonosetron (Aloxi, a new 5HT3 antagonist)
- **Dopamine antagonists** act in the brain and are used to treat nausea and vomiting associated with neoplastic disease, radiation sickness, opioids, cytotoxic drugs and general anaesthetics.

Droperidol, haloperidol, chlorpromazine, promethazine, prochlorperazine. Some of these drugs are limited in their usefullness by their extra-pyramidal and sedative side-effects.

Metoclopramide (Reglan) also acts on the GI tract as a pro-kinetic, and is thus useful in gastrointestinal disease; however, it is poor in cytotoxic or post-operative vomiting.

- **Antiacetylcholine drugs:** like: hyoscin or hyosciamin.
- **Antihistamine drugs:** (H_1 histamine receptor antagonists), effective in many conditions, including motion sickness and severe morning sickness in pregnancy. Examples: promethazine and diphenhydramine.

D- The purgatives (Laxatives): are foods, compounds, or drugs taken to induce bowel movements or to loosen the stool, most often taken to treat constipation.

- Certain stimulant, lubricant, and saline laxatives are used to evacuate the colon for rectal and bowel examinations, and may be supplemented by enemas in that circumstance.
- Sufficiently high doses of laxatives will cause diarrhea.
- Laxatives only work to hasten the elimination of undigested remains of food in the large intestine and colon.

Laxatives and cathartics are used:

1. To relieve constipation – bulk – forming .
2. To prevent straining – stool softeners .
3. To empty the bowel in preparation for bowel surgery or diagnostic procedures (saline or stimulant) .
4. To accelerate elimination of potentially toxic substances from the GI tract (saline or stimulant) .
5. To accelerate excretion of parasite after anthelmintic drugs (saline or stimulant) have been administered.

Types of the purgatives:

there are several kinds of purgatives as listed below:

- **Vegetables and foods:** Some vegetables and foods can be eaten to cure constipation and act as laxatives, although the effectiveness may vary. Like: Aloe Vera, dates, chocolate, coffee, banana and orange.

- **Bulk – producing agents**: they act on the intestine generally, these include dietary fiber. Bulk-producing agents cause the stool to be bulkier and to retain more water, as well as forming an emollient gel, making it easier for peristaltic action to move it along. They should be taken with plenty of water. Bulk-producing agents have the gentlest of effects among laxatives and can be taken just for maintaining regular bowel movements.

- **Lubricants (Emollients):** they act on the large intestine (in particular on the colon) simply make the stool slippery, so that it slides through the intestine more easily. An example is mineral oils like paraffin, which also retards colonic absorption of water, softening the stool. Mineral oil may decrease the absorption of fat-soluble vitamins and minerals.

- **Stimulants (Irritants):** act on colon too, Stimulant laxatives act on the intestinal mucosa, or nerve plexus; they also alter water and electrolyte secretion. They are the most severe among laxatives and should be used only in extreme conditions. Castor oil may be preferred when more complete evacuation is required. Other agents include; senna and bisacodyl.

5- Antidiarrheal agents: is any medication which provides symptomatic relief for diarrhea.and they are several types like:-

- Electrolyte solutions are used to replace lost fluids and salts in acute cases.
- Bulking agents like methylcellulose, guar gum or plant fiber (bran) are used for diarrhea in functional bowel disease.
- Absorbents absorb toxic substances that cause infective diarrhea; methylcellulose is an absorbent as well.
- Opioids classical use besides pain relief is use as an anti-diarrhea drug. Opioids have agonist actions on the intestinal opioid receptors, which when activated cause constipation, drugs such as morphine or codeine can be used to relief of diarrhea this way. A notable opioid for the purpose of relief of diarrhea is Loperamide which only is an agonist of the μ opioid receptors in the large intestine and does not have opioid affects in the central nervous system as it doesn't cross the blood brain barrier in significant amounts. This enables loperamide it to be used to the same benefit as other opioid drugs but without the CNS side effects or potential for abuse.