



PASSION ACADEMIC TEAM



Sheet# 5

*YU - MEDICINE*

# **GASTROINTESTINAL SYSTEM**

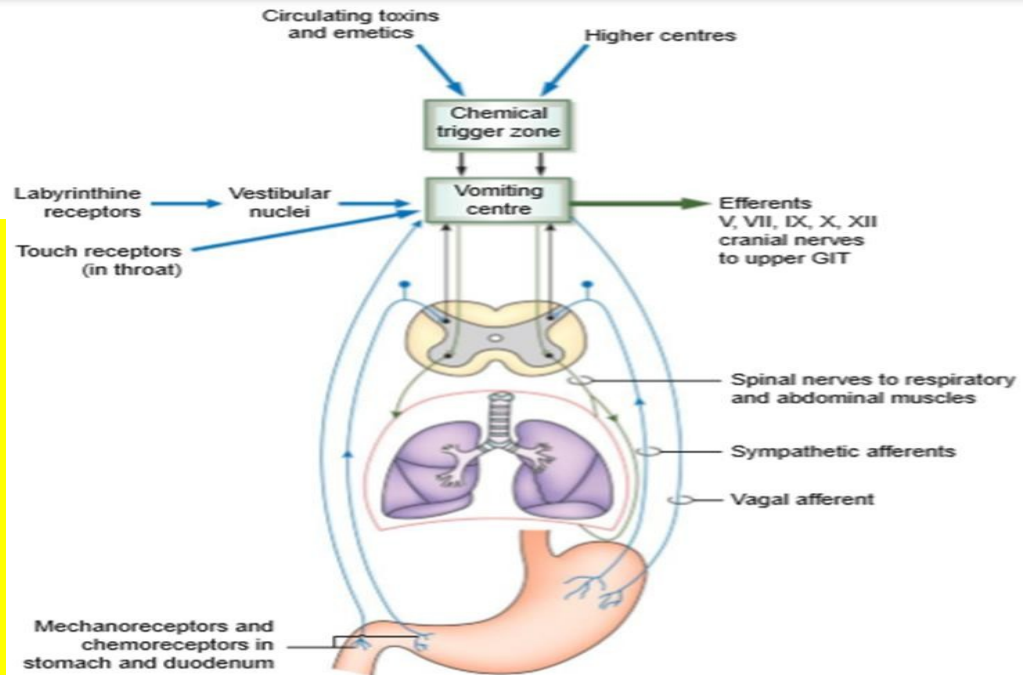
Lec. Title : Vomiting &  
Motility of Large Intestine .

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# Vomiting (Emesis)

- Vomiting can also be referred to as emesis, and consists of the following stages:
  - Nausea
  - Retching
  - Vomiting
- Vomiting serves as:
  - a **protective reflex** (acidosis and hypoxia)
  - an **important clinical symptom** (intracranial tumors).



The mechanisms of emesis can be divided into three components:

- Afferent inputs
- Central nervous system:
  - chemoreceptor trigger zone (CTZ)
  - integrative vomiting center
- Emetic efferent signals

# Sheet #1

**Vomiting** : dysmotility of small intestine

Serves as :

Protective reflex : to protect the function of other systems (ex: during hypoxia & acidosis).

Clinically relevant : vomiting is an important clinical symptoms of certain pathological condition (ex: infections, irritation of Bowel of the gut & tumors).

**Stages of vomiting** :

**Nausea** : pleasant of one thing to vomit.

**Retching** : involuntary effort to vomit (without any expulsion of gastric content) --} force effort without vomiting.

**Vomiting** : forceful expulsion of the gastric content out through the mouth.

Vomiting is a Reflux --} 3 main compartments :

Afferent signals stimulate integrative vomiting center & efferent signals.

## Sheet #2

Afferent affect 3 main areas :

1. Viscera of the stomach & small intestine to vomiting center peripheral region --} also can be triggered from throat.

2. Higher centers (diencephalon & limbic sys)

These areas are stimulated by unpleasant sites sites or smells --} afferent input to vomiting center Also stimulates this area.

3. Chemical trigger zone

Integrative vomiting center :

receives afferent signals (peripheral & central) & send messages through efferent (coordinate, analyze).

Efferent : Somatic (voluntary) & Autonomic (involuntary) at the same time

Somatic efferent : cranial or spinal nerves --} (phrenic nerve affect diaphragm) & spinal :affect abdominal muscle.

Net result : affect Abdominal & Respiratory muscle (diaphragm, intercostal,,,) )

## Sheet #3

Autonomic efferent : affect the gut (motility & tonic condition)

Somatic & Autonomic collectively initiate vomiting act.

Chemical trigger zone : chemo-sensors in Area postrema has 2 distinct characteristics:

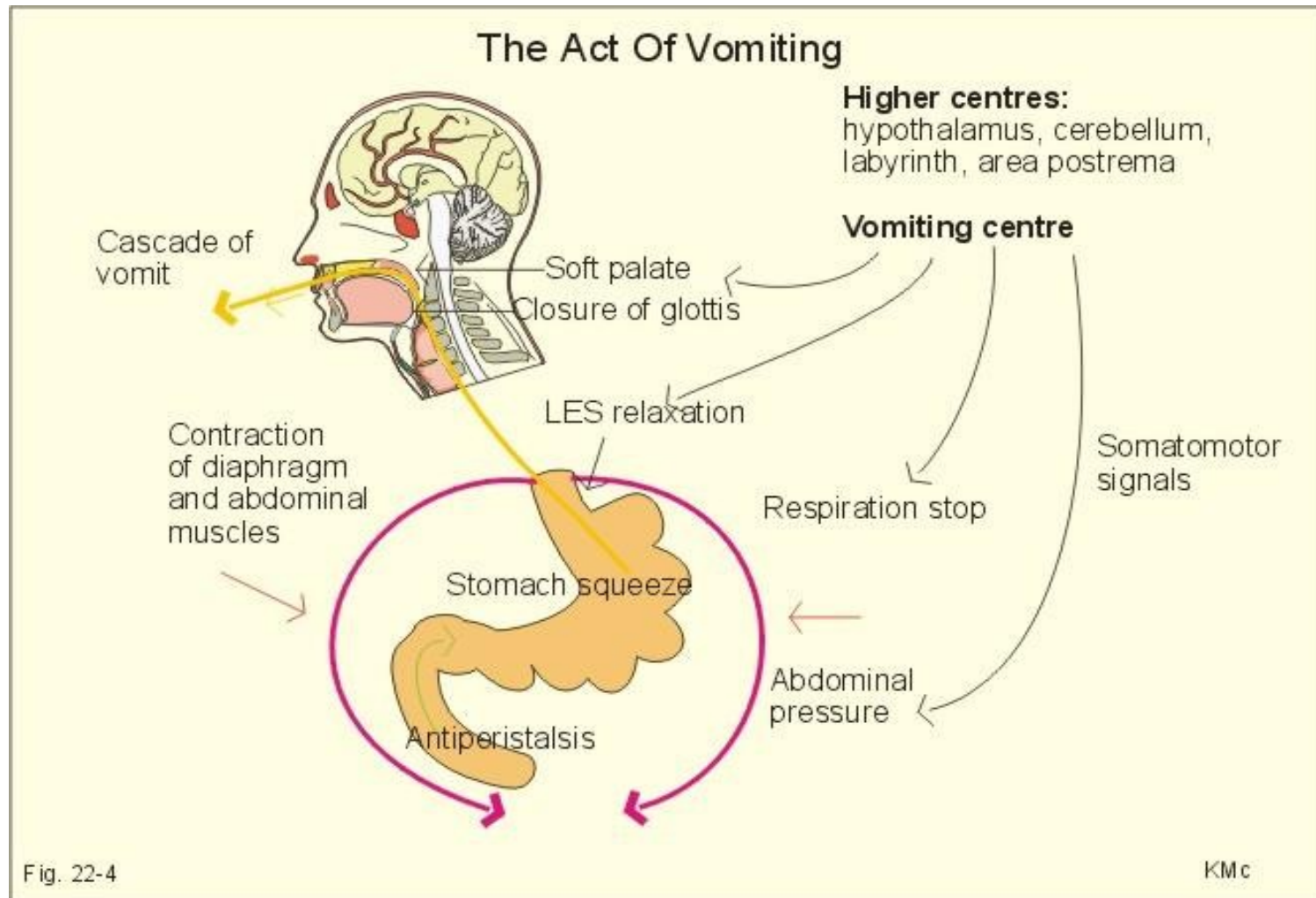
A. **Highly permeable capillaries** (on the contrary with brain capillaries) which contain BBB and tight junctions (Low permeable)

B. **Sensory neurons** : they can detect chemical messages in the blood & CSF & convert these chemical messages into neural signals --} they can detect if there is any toxins in the blood --} convert this chemical message to electrical current --} vomiting center --} Autonomic & Somatic efferent neuron --} vomiting act.

The Act of Vomiting :

Before vomiting stage (Pre ejection phase ) : Relaxation of the stomach lead to --} Anti peristalsis (retro peristalsis) : peristalsis move up the digestive tract rather than down.

# Mechanical events of vomiting



## Sheet #4

Anti peristalsis : can begin from the distal portion of ileum (all ileum contents go up to duodenum then stomach, cause distension, especially in duodenum this distension is the exciting factor that initiate vomiting act.

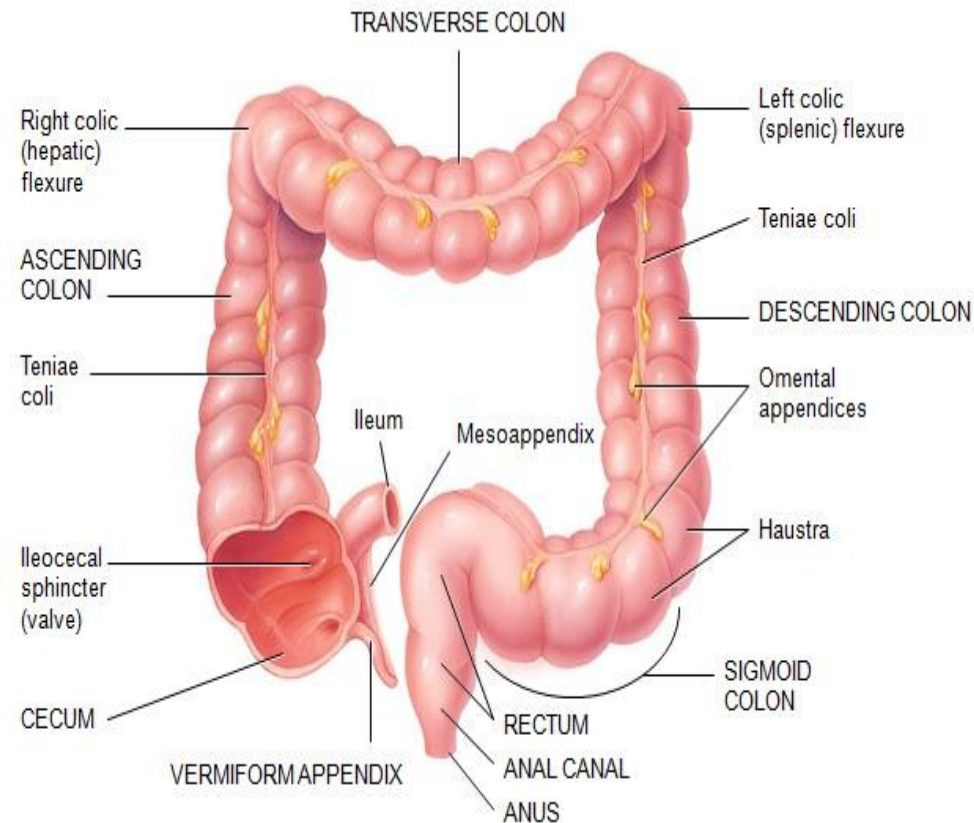
Events of vomiting act :

1. Deep Breath (somatic efferent affect diaphragm & intercostal muscle)
2. Opening of upper esophageal sphincter : due to rising in the larynx
3. Closure of the glottis : to prevent vomit flow into the lung
4. Elevation of the soft palate : close the posterior nostrils
5. Contraction of diaphragm along with all abdominal muscle --} squeezes the stomach (not contraction) --} building of high intra abdominal pressure with no vomiting
6. Finally , relaxation of LES (complete relaxation) --} expulsion of the gastric content through esophagus then mouth

So this vomit is not only gastric content, but also duodenal or ileum --} due to antiperistalsis from distal part of intestine.

# Motility of the large intestine

- The colon of an adult human receives 0.5–2.5 L of chyme per day. This consists of undigested and unabsorbed residues of food, in addition to water and electrolytes.
- The colon must reduce the volume of this intestinal chyme to about 100–200 g.
- The principal functions of the colon is absorption of water and electrolytes from the chyme to form solid feces .
- The movements can be divided into:
  - **Mixing Movements—“Haustrations.”**
  - **Propulsive Movements—“Mass Movements.”**
    - 1 to 3 times per day for 3 min.
    - Gastrocolic reflex





## Sheet #5

Motility of Large intestine :

Large intestine can be divided into 2 segments : proximal colon (cecum, ascending & proximal half of transverse colon) & distal colon (distal half of transverse colon, descending & sigmoid colon)

\*Proximal colon called absorptive colon : absorption of water, electrolytes and vitamins produced in colon

\*distal function : storage & propelling of fecal material all the way to rectum then anus, these functions (absorption and storage) do not need intestine movement --} so movement in Large intestine in comparison with small intestine is sluggish --} transient time in colon is longer

(Dr. said that there are other reasons rather than the function mentioned in previous lectures related to pacemaker cells) --} ارجعو للمعلومة }

## Sheet #6

2 types of movements :-

1. Mixing (Haustrations) :

Modified segmentation movement it's called Haustration because of the Haustra (characteristics appearance of Large intestine) --} caused by discontinuity of longitudinal muscle (taenia coli)

2. Propulsive movement

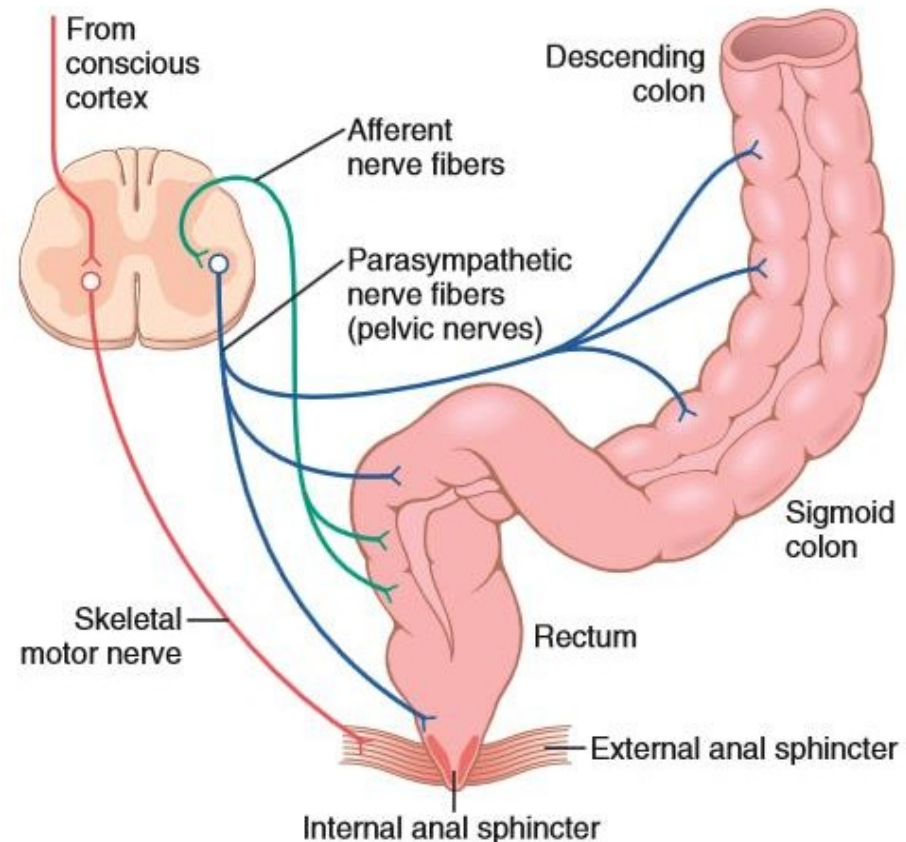
# Rectal Function and Defecation

☐ Gastrocolic reflex → Mass movement → Intrarectal pressure (18mmHg):

- ✓ stimulates the stretch receptors
- ✓ sets up defecation reflexes
- ✓ produces an urge to defecate
- ✓ external anal sphincter further contracts (new borns??)

☐ Defecation reflexes:

- ✓ Intrinsic reflex
- ✓ Parasympathetic defecation reflex
- ✓ The rectal pressure reaches to about 55 mm Hg.
- ✓ the voluntary control mechanism depending upon the convenience may or may not allow the act of defecation to occur.
- ✓ Pudendal nerve.
- ✓ Valsalva manoeuvre



## Sheet #6

Rectal function & Defecation :-

Defecation is a reflex --} what is the mechanism to initiate this reflex?

Due to filling of stomach --} Gastrocolic Reflex (once to twice daily) --} stimulate mass movement (Haustration) in transverse colon --} drives fecal material to descending colon --} sigmoidal --} Rectum --} due to presence of feces in the rectum, its pressure will increase to 18mmHg --} stimulate stretching receptors & setting up defecation reflex (2 reflex : intrinsic & extrinsic : parasympathetic defecation reflex)

Afferent signals spread through myenteric plexus --} interneuron --} A. efferent neuron to descending colon & sigmoid colon --} peristaltic wave --} contraction of smooth muscle --}

More fecal material to rectum --} more pressure again (more than 18mmHg) --} Due to myenteric stimulation : B. relaxation of internal anal sphincter (releasing of VIP). So this is intrinsic reflex, but its weak alone & can't induce defecation, so it need to be fortified . (to have supporting reflex) which is extrinsic defecation reflex or (parasympathetic) .

## Sheet #7

After stretching of rectum --} stimulation of mechanical receptor --} stimulate nerve ending (afferent nerve fibers) --} transmit to spinal cord --} then go back to descending colon, sigmoid colon & rectum. These nerve ending are parasympathetic specifically pelvic nerve from sacral region of spinal cord --} peristaltic contraction --} more fecal material into rectum (pressure - 55mmHg) --} more relaxation in internal anal sphincter.

In this case : weak intrinsic defecation reflex is converted to powerful process & defecation.

Once all these mechanism are obtained, voluntary control mechanism begin (external anal sphincter). Is the defecation convenient or not? Is it proper time? If the defecation is not convenient : voluntary (external anal sphincter) still contracted & internal anal sphincter (which was relaxed) closes --} contract & rectum relax to accommodate fecal material --} pressure will fall down --} defecation reflex die out.

## Sheet #8

\*contraction of abdominal muscle & diaphragm --} expiration against closed glottis, this process is called : valsalva maneuver

\*external sphincter in children is not working well (not mature yet). So when there is urge of defecation due to gastrocolic reflux --} Direct defecation (after meals) no matter it is convenient or not.