Gastric motility & vomiting

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Types of movements of the stomach

- **Anatomy.**

  Functionally stomach is divided into:

Proximal motor unit	***Distal motor unit***
• formed of fundus & body.	• Antrum & pylorus.
• thin wall	• thick wall.
• reservoir for food	• mixes & empties food.

Tonic gastric waves

- Regular weak contractions (3 waves/min) which take place mainly in the fundus to maintain the intragastric pressure & mix gastric secretion with food.

Receptive relaxation

- It is a reflex relaxation of **the fundus and body** to receive the bolus of food.

- Initiated by vagal reflexes (conditioned and unconditioned).

Peristaltic movement

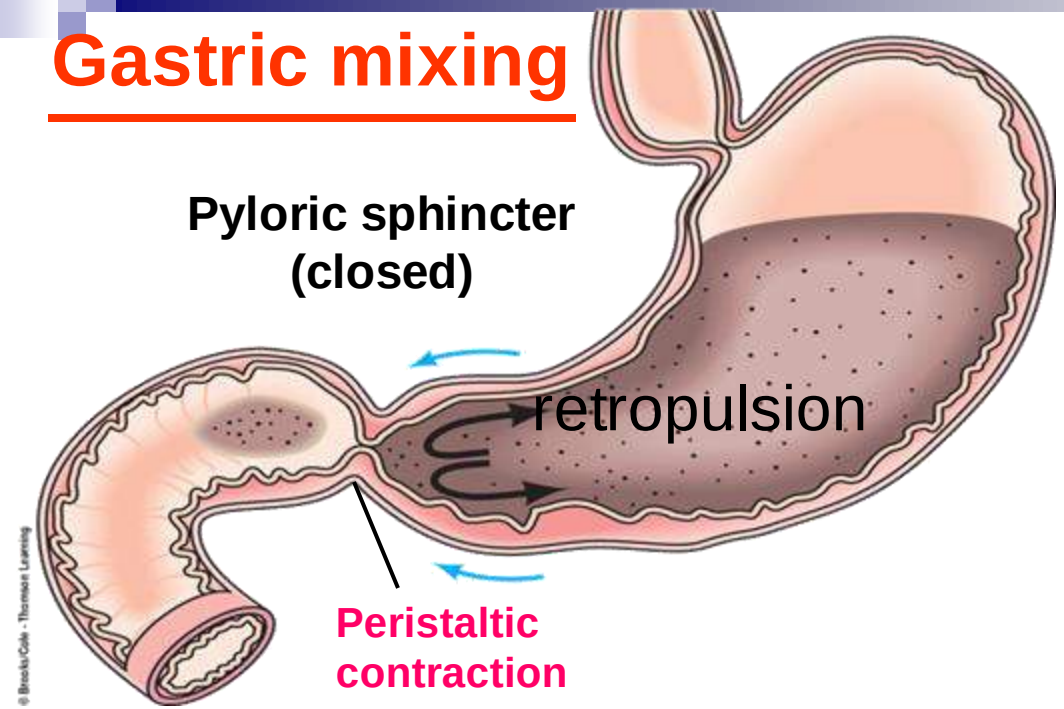
- Distension of stomach by food → stimulate stretch receptors → vago – vagal reflex peristalsis **at the middle of stomach** and proceeds **toward the pyloric antrum** with gradual increase in strength leading to:

*- Grinding of food to fine particles.

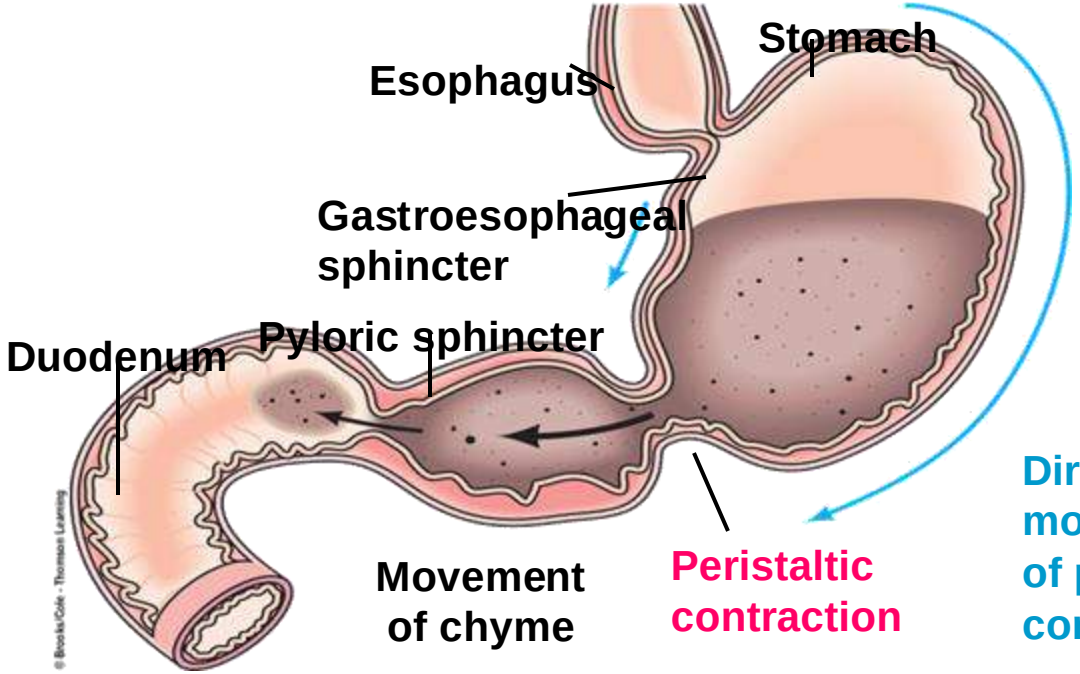
*- Emptying of fine particles into the duodenum (*propulsive movements*).

*- Peristalsis in opposite direction from pyloric antrum to fundus (Anti- peristalsis) → *pyloric mill* for mixing of food with gastric secretion.

Gastric mixing



Gastric emptying



Hunger contractions:

- Fasting $\xrightarrow{12h}$ hypoglycemia→ activation of the feeding center in hypothalamus →
- Sends impulse to cortex → hunger sensation.
- Sends impulse to **vagal nucleus** → hunger strong painful contraction **near the fundus**
- They start slowly, then increase → tetanic contraction for 2-3 minutes then disappear and reappear in the next feeding time to reach maximal intensity in 3-4 days then gradually disappear. (May due to ↓ sensitivity of feeding center to hypoglycemia).

Basic electrical rhythm (gastric slow waves) :

- 3-5 cycles/min. due to partial depolarization of circular smooth muscle cells in the stomach wall.
- Some lead to spike potential → peristalsis.
- Start at **midpoint of greater curvature** (pacemaker of the stomach).
- Vagal and gastrin →↑ spike potential rate.
- Sympathetic & secretin →↓ spike potential rate.

Nervous regulation of gastric motility

Vagal *(parasympthetic)* :

- Inhibitory purinergic to proximal unit.
- Excitatory cholinergic to distal unit.

Sympathetic:

- Inhibitory (noradrenergic) to GIT wall.

Myenteric plexus:

- Through local enteric reflexes.

Factors affecting gastric emptying :

- With a mixed meal the stomach usually empty in about 3 hours through the pyloric pump (50-70 cm.water) which regulate the rate of gastric emptying .

The rate of emptying is controlled by:

Factors in the stomach:

- **Type of food:**

  Carbohydrate is the most rapid. Then proteins followed by fats.

- **Consistency of food:**

  liquids more rapid which depends on type of food, degree of mastication and the strength of gastric peristalsis.

- **Volume of food:**

  Moderate volume of chyme →↑ emptying via vago-vagal reflex and release of gastrin hormone.

  Large volume → over distension →↓ emptying.

Emotional factors:

- *Pain*: visceral and somatic pain→ reflex inhibition of gastric emptying.

- *Depression & sudden fear*→ reflex inhibition of gastric emptying through sympathetic activation.

- *Anxiety & anger* → reflex stimulation of gastric emptying through parasympathetic activation.

Vomiting

- **Definition**
  - It is the expulsion of gastric contents througth the esophagus, pharynx and mouth.
  - It is a complex act controlled by vomiting center in the medulla oblongata and mediated by **cranial nerves** V,VII,IX,X&XII and **spinal nerves to diaphragm and abdominal muscles.**
  - It is preceded by nausea, salivation and increase respiration.

Centers:

- Vomiting center : in the medulla oblongata.

- *Chemo receptor trigger Zone (CTZ)* :

In close to vomiting center in medulla oblongata.

Its stimulation by emetic drugs, motion sickness or metabolic causes → stimulation of *(CTZ)*

Causes of vomiting:

- ***Central vomiting:***

Direct stimulation of CTZ by drugs as morphine, alcohol drinking, diabetic ketoacidosis, renal failure or early pregnancy.

- ***Reflex vomiting*:**

Stimuli:

Unconditioned:

Irritation of back of tongue.

Irritation of gastric mucosal.

Severe visceral pain (Renal colic, coronary thrombosis…).

Stimulation of semicircular canal

Conditioned:

- (cortical excitation of vomiting) Visual, olfactory and psychic (as morning sickness of pregnancy.)

- **Afferents :** according to site of stimuli.

Center : Direct on vomiting center.

Some to CTZ as semicircular canal irritation and psychic.

Efferents :

- Via cranial nerves V, VII , IX, X, XII .
- Phrenic nerve to diaphragm.
- Spinal nerves to abdominal muscles.

Response :

- → vomiting

Mechanism of vomiting :

- **1-Nausea**

with salivation, ↑ H.R, sweating, stomach wall is relaxed, and antiperistalsis may occur in duodenum.

- **2-Retching:**

intermittent contraction of diaphragm and abdominal muscles against closed L.E.S, and diaphragmatic opening is also contracted.

3- Gastric evacuation :

- The cardiac sphincter relaxes, and the stomach wall is completely relaxed (passive stomach).

- Powerful contraction of the diaphragm, abdominal muscle and pelvic floor muscle →↑ intra abdominal pressure → squeezing the relaxed stomach and expulsion its contents to the mouth.

- During vomiting the soft palate elevated, closure of glottis and inhibition of respiration to prevent the vomitus to pass to respiratory passages (as in swallowing).

- When the stomach is empty, antiperistalsis waves may drive the intestinal contents into the stomach (as bile juice).

Effect and complications of vomiting :

- *Dehydration (loss of secretion).*
- *Alkalaemia : due to loss acid and the resynthesis of acid is associated with ↑ alkaline tide in plasma.*
- *Alkalaemia →↓ ionized Ca+2 → tetany.*