

# *Gastric motility & vomiting*

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# **Types of movements of the stomach**



- **Anatomy.**

Functionally stomach is divided into:

**Proximal motor unit**

- formed of fundus & body.
- thin wall
- reservoir for food

**Distal motor unit**

- Antrum & pylorus.
- thick wall.
- mixes & empties food.

# Tonic gastric waves

- Regular weak contractions (3 waves/min) which take place **mainly in the fundus**
- Its main function to maintain the intragastric pressure

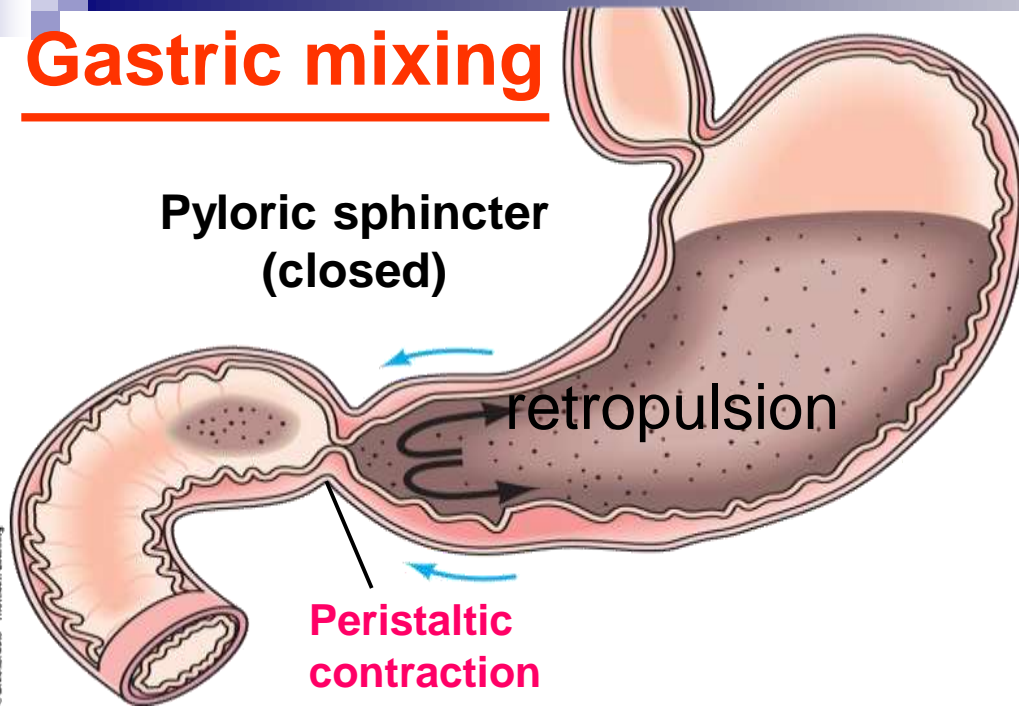
# Receptive relaxation

- ❑ It is a reflex relaxation of **the fundus and body** to receive the bolus of food.
- ❑ Initiated by **vagal reflexes** that is triggered by movements of the pharynx & esophagus
- ❑ Such relaxation is associated with little increase in the intra-gastric pressure due to the increase in the stomach radius with food entry into it.

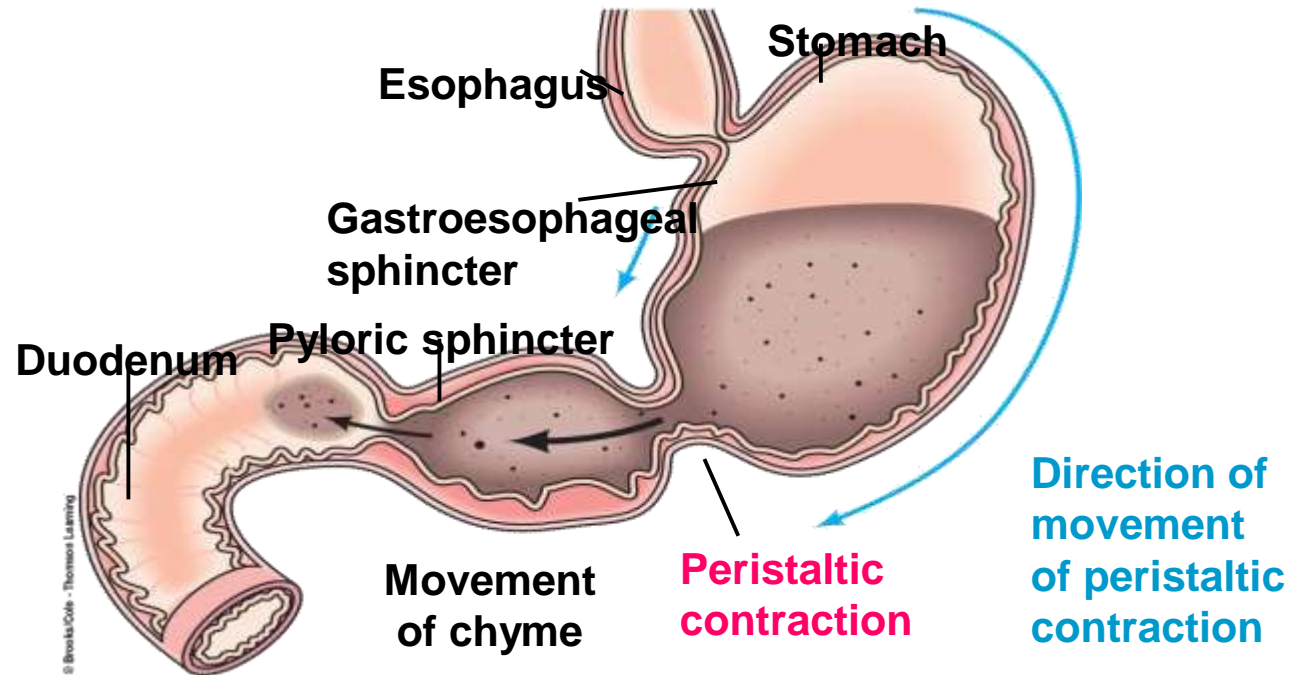
# Peristaltic movement

- 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

- These are strong **rhythmic peristaltic** contraction that occur in **the body of the stomach** when it is empty for several hours.
- Fasting  $\xrightarrow{12\ h}$  hypoglycemia  $\rightarrow$  activation of the feeding center in hypothalamus  $\rightarrow$  hunger sensation.
- Hypothalamus  $\rightarrow$  Sends impulse to **vagal nucleus in the medulla oblongata**  $\rightarrow$  painful hunger contraction.
- They start slowly, then increase  $\rightarrow$  **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  $\downarrow$  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 (parasympathetic)***

- 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 reflexes, local enteric reflexes 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 through 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, morphine, alcohol drinking, Pregnancy ,motion sickness , metabolic causes ( uremia & diabetic ketoacidosis) and certain nervous diseases (meningitis, migraine , increased intra-cranial tension →

**Central vomiting**

## Causes of vomiting:

### ■ *Central vomiting*

Through stimulation of CTZ

### ■ *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 .
- **Afferents** : according to site of stimuli.
- **Center** : Direct on vomiting center.

## **Efferent** :

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

**Response** : ■ → vomiting

# Mechanism of vomiting

## ■ 1-Nausea


Excess salivation,  $\uparrow$  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.

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- 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  $\uparrow$  alkaline tide in plasma.*
- *Alkalaemia  $\rightarrow$   $\downarrow$  ionized  $\text{Ca}^{+2}$   $\rightarrow$  tetany.*



  
*Thanks*

