

# High-Yield Summary: Visceral Pain, Referred Pain & Pain Control Systems



## 1. Visceral Pain – Key Features

- Viscera have fewer free nerve endings than skin; pleura and peritoneum are rich while liver parenchyma and alveoli lack receptors.
- Sensory cortex is poorly aware of visceral pain.
- Cutting viscera may cause no pain, while toxins may cause visceral pain without cutaneous pain.
- Pain is dull, aching, poorly localized.
- Carried by sympathetic, parasympathetic, or somatic afferents.
- Causes include distension, spasm, toxins, ischemia, traction on peritoneum/mesentery.
- Often accompanied by nausea, vomiting, bradycardia.

## 2. Referred Pain

Definition: Pain felt in a cutaneous area distant from the diseased visceral organ.

### Mechanisms:

- 1) Branching Dorsal Root Theory: Visceral and skin afferents enter through same dorsal root → cortex interprets as skin pain.
- 2) Convergence–Projection Theory: Visceral and skin afferents converge on same dorsal horn neuron → cortex projects pain to skin.

## 3. Pain Control Systems

## A. Analgesia System

Cascade:

- Hypothalamus →  $\beta$ -endorphin
- PAG → enkephalin
- Raphe magnus → serotonin
- PIC → spinal inhibition
- SGR interneurons → enkephalin/GABA → presynaptic inhibition
- Inhibition occurs by closing  $Ca^{++}$  channels → preventing Substance P release.

## B. Opiate System

- Body has opiate receptors:  $\mu$ ,  $\delta$ ,  $\kappa$ ,  $\sigma$ .
- Endogenous opioid peptides: enkephalins,  $\beta$ -endorphins, dynorphins.
- Cause potent pre- and post-synaptic inhibition of pain.

## 4. Gate Theory of Pain

- First gate = SGR (lamina II & III).

Pain inhibition occurs via:

- A) A-fibers activated by rubbing, pressure, acupuncture.
- B) Descending serotonin fibers activating interneurons (GABA/enkephalin).
- C) Circulating endorphins closing the pain gate.