FUNCTIONS OF DIENCEPHALON (Thalamus, Epithalamus, Subthalamus)

Learning objectives

• Parts of diencephalon.
• Functions of thalamus.
• Lesions of thalamus
• Functions of hypothalamus
• Lesion of hypothalamus.
• Functions of epithalamus

Diencephalon

• **Paired** structure
• Located between the **brain stem** and the **cerebral hemisphere**
• Continuous with the rostral part of the **midbrain**
• Forms the lateral wall of the **3rd ventricle**

• Almost entirely surrounded by the cerebral
hemispheres

• A little part seen externally on the base of the brain caudal to optic chiasma, includes:
  • Infundibulum
  • Tuber cinerium
  • Mamillary bodies

DIENCEPHALON

• It consists of:
• Thalamus :- the large oval mass of grey matter
• Subthalamus:- it lies directly above midbrain
• hypothalamus : lies infront of subthalamus
• Metathalamus : formed by lateral & medial geniculate body
• Epithalamus: Formed of pineal body, 2 habenular nuclei & commissures & posterior commissure.

The thalamus : Is the main sensory relay station on the pathway of all sensations (except smell) to the cerebral cortex.

Diencephalon
Thalamus

• Large mass of grey matter, in shape and size,
resembles small hen’s egg

- Forms the lateral wall of the 3rd ventricle
- Separated from hypothalamus by hypothalamic sulcus
- May be connected to opposite thalamus by interthalamic adhesion (massa intermedia)

Functions of the thalamus

- Receives and analyses all the sensory information (except olfactory) from the body
- Having extensive connections with the basal ganglia and the motor cortices, it plays a pivot role in voluntary motor activity.
- Connections with the limbic system makes it important in the control of mood, emotional and sexual behavior, and memory
- Anterior thalamic nuclei are concerned with Emotional tone, mechanism of recent memory

Functions of the thalamus

- Ventral lateral nuclei influence motor activity of motor cortex.
• Ventral posteriomedial nuclei relays common sensations to consciousness.
• Intralaminar nuclei influence levels of consciousness and alertness.
• Medial geniculate body is concerned with Hearing.
• Lateral geniculate body is concerned with vision

**Thalamic Lesions**

• Cerebrovascular lesions or tumors of thalamus lead to:
  ❖ Loss of sensation in the contralateral side of face and body followed by distressing discomfort, & burning and diffuse pain in the anaesthetic areas (thalamic pain)
  ❖ **Thalamic syndrome**: Abnormal voluntary movements (chorea or hemiballismus) with hemisensory disturbance
  ❖ Thalamic hand; The contralateral hand is held in an abnormal posture in some patients

**Hypothalamus function**

• Feeding reflexes—licking, swallowing, etc.
• Subconscious skeletal muscle movements—facial expressions, sexual movements
• Autonomic center—control medulla oblongata nuclei for cardiovascular, respiration
• Secretes oxytocin that stimulates smooth muscle of uterus, mammary glands and prostate
• Regulates body temperature
• Controls pituitary gland by hormonal secretion—pituitary in turn regulates many hormonal endocrine functions

Hypothalamus function
• Produces emotions/sensations/drives: e.g. thirst, hunger (not really “sensations” from periphery)
• Coordinates autonomic response to conscious input—thought of fear produces
Lesion of Hypothalmus

- Hormonal imbalances.
- Malignant hypothermia.
- Inability to control temperature.
- Diabetes Insipidus (DI).
- Inappropriate ADH (SIADH).
- Diencephalic dysfunction: "neurogenic storms".

Epithalamus

- Relatively small part, located in most caudal and dorsal region
- Lies immediately rostral to superior colliculus
- Consists of:
Pineal gland &
Habenular nuclei

Pineal Gland
• An endocrine organ
• Synthesizes melatonin
• Controls:
  ▪ Sleep/awake cycle
  ▪ Regulation of onset of puberty

Habenular nuclei
• Located in habenular triangle (area in the posterior part of the diencephalon, just anterior to pineal gland)
• Have connections with limbic system
  • Serves autonomic function and emotional drives

SUBTHALAMUS
• It lies between the thalamus & tegmentum of the midbrain
• It contains
  1) 3 nuclei (upper end of red nucleus,
  • upper end of substantia nigra
  • subthalamic nuclei)
  2) bundles of projection fibers

Subthalamic Lesions

• The subthalamus should be regarded as one of the extrapyramidal motor nuclei and has a large connection with the globus pallidus.

• Lesion result in sudden, forceful involuntary movements in a contralateral extremity. The movement may be jerky (choreiform) or violent (ballistic)