THALAMUS

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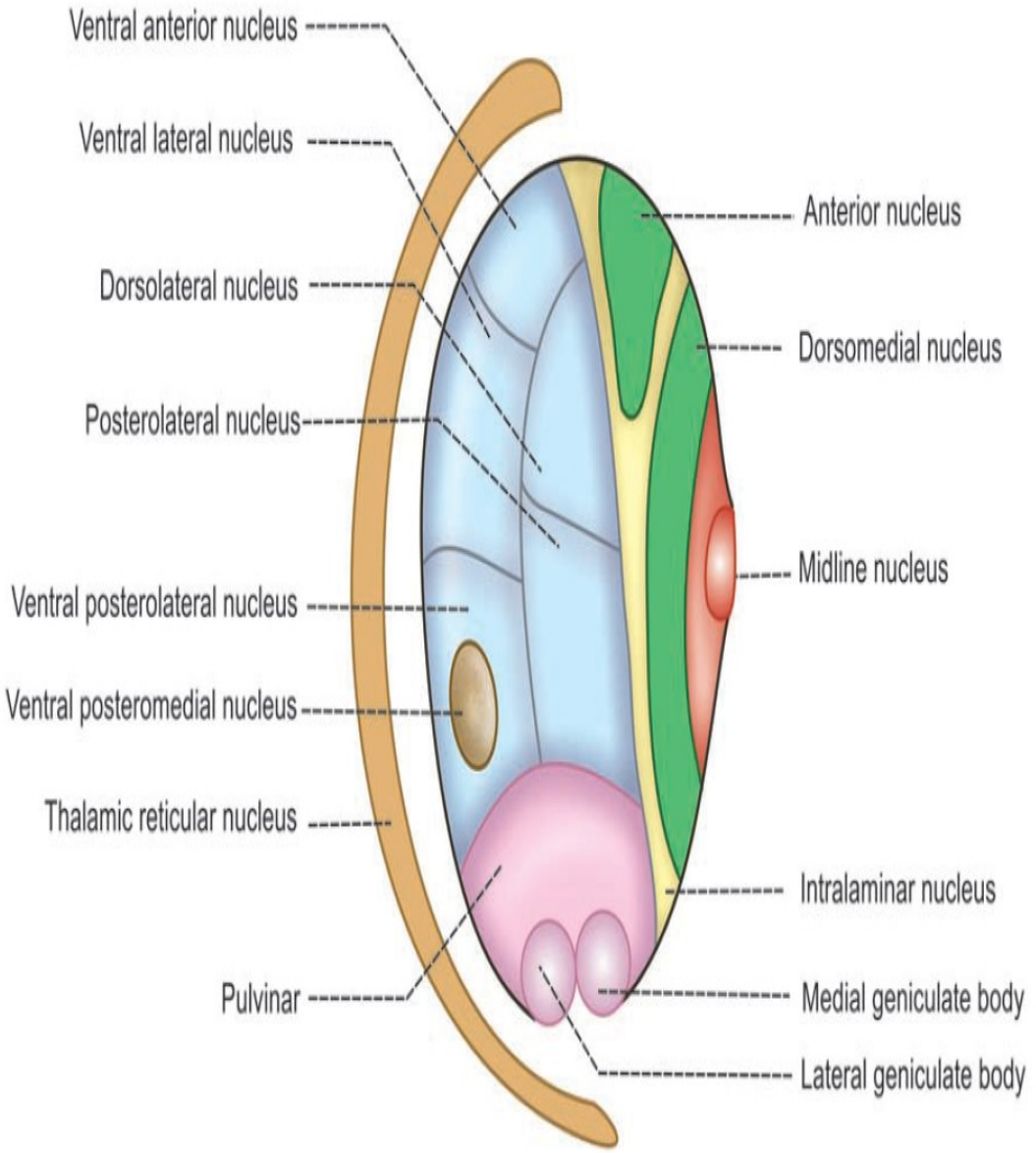
INTRODUCTION

- Thalamus is a large ovoid mass of gray matter, situated bilaterally in **diencephalon.**
- Both thalami form 80% of diencephalon.
- Thalami on both sides are connected in their rostral portions by means of an **intermediate mass.**
- Caudal portions are more widely separated by corpora quadrigemina.



THALAMIC NUCLEI

- Thalamic nuclei are classified by two methods:

A. Anatomical classification
B. Physiological classification.

ANATOMICAL CLASSIFICATION

- Thalamus on each side is divided into five main nuclear groups by 'Y'-shaped internal medullary lamina.

1. **MIDLINE NUCLEI**
2. **INTRALAMINAR NUCLEI**
3. **MEDIAL MASS OF NUCLEI**
4. **LATERAL MASS OF NUCLEI**
5. **POSTERIOR GROUP OF NUCLEI**

THALAMIC RETICULAR NUCLEUS

- Thalamus also includes thalamic reticular nucleus, which is a thin layer of neurons covering the lateral aspect of thalamus.
- It receives information from reticular formation, cerebral cortex and other thalamic and sends inhibitory signals to other thalamic nuclei.

PHYSIOLOGICAL CLASSIFICATION

- On the basis of functions and their projections, thalamic nuclei are classified into five groups.
- This type of classification is also called **Bondok classification.**
- Five groups of thalamic nuclei are:

1. **SPECIFIC SENSORY RELAY NUCLEI**
2. **SPECIFIC MOTOR NUCLEI**
3. **ASSOCIATION OR LESS SPECIFIC NUCLEI**
4. **NON-SPECIFIC NUCLEI**
5. **LIMBIC SYSTEM NUCLEI**

- Nuclei and their functions of each group are given in Table.

BONDOK CLASSIFICATION OF THALAMIC NUCLEI

Group	Nuclei	Functions
1. Specific sensory relay nuclei	i. Ventral posterior nucleus ii. Medical geniculate body iii. Lateral geniculate body	Project sensory signals to distinct (specific) areas of cerebral cortex
2. Specific nuclei	i. Ventral anterior nucleus ii. Ventral lateral nucleus	Receive signals controlling motor activities from cerebellum and corpus striatum and send these signals to motor areas in the cerebral cortex to complete the feedback system of motor control mechanism
3. Association or less specific nuclei	i. Dorsolateral nucleus ii. Posterolateral nucleus iii. Pulvinar	Send information to association areas of cerebral cortex
4. Non-specific nuclei	i. Midline nuclei ii. Intralaminar nuclei iii. Reticular nucleus	Project signals to diffused areas of cerebral cortex
5. Limbic system nuclei	i. Anterior nucleus ii. Dorsolateral nucleus	Project into limbic cortex

FUNCTIONS OF THALAMUS

- Thalamus is primarily concerned with **somatic functions** and it plays little role in the visceral functions.
- Following are the various functions of thalamus:

1. RELAY CENTER

- Thalamus forms the relay center for the sensations.
- Impulses of almost all the sensations reach the thalamic nuclei.
- After being processed in the thalamus, the impulses are carried to cerebral cortex through thalamocortical fibers.

2. CENTER FOR PROCESSING OF SENSORY INFORMATION

- Thalamus forms the major center for processing the sensory information.
- All the peripheral sensory impulses reaching thalamus are integrated and modified before being sent to specific areas of cerebral cortex.
- This function of thalamus is usually called the processing of sensory information.

3. CENTER FOR SEXUAL SENSATIONS

- Thalamus forms the center for perception of sexual sensations.

4. ROLE IN AROUSAL AND ALERTNESS REACTIONS

- Because of its connections with nuclei of reticular formation, thalamus plays an important role in arousal and alertness reactions.

5. CENTER FOR REFLEX ACTIVITY

- Since the sensory fibers relay here, thalamus forms the center for many reflex activities.

6. CENTER FOR INTEGRATION OF MOTOR ACTIVITY

- Through the connections with cerebellum and basal ganglia, thalamus serves as a center for integration of motor functions.

APPLIED PHYSIOLOGY

THALAMIC LESION

- Thalamic lesion occurs mainly because of blockage (due to thrombosis) in thalamogeniculate branch of posterior cerebral artery.
- Mostly, posteroventral nuclei of thalamus are affected because the thalamogeniculate branch of posterior cerebral artery supplies this part of thalamus.
- Lesion of thalamus leads to a condition called thalamic syndrome.

THALAMIC SYNDROME

Thalamic syndrome is the neurological disease and It is a rare disease which caused by infarction of posteroventral part of thalamus.

Following are the symptoms of thalamic syndrome:

1. Loss of Sensations

- Loss of all sensations **(anesthesia)** occurs as the sensory relay system in thalamus is affected.

2. Astereognosis

- Astereognosis is the loss of ability to recognize a known object by touch with closed eyes.
- It is due to the loss of tactile and kinesthetic sensations in thalamic syndrome.

3. Ataxia

- Ataxia refers to incoordination of voluntary movements.
- It occurs due to loss of kinesthetic sensation. This type of ataxia due to loss of sensation is called **sensory ataxia.** It is very common in thalamic syndrome.

4. Thalamic Phantom Limb

- The patient is unable to locate the position of a limb with closed eyes.
- The patient may search for the limb in air or may have the illusion that the limb is lost.
- This is called thalamic phantom limb.

5. Anosognosia

- Anosognosia is the lack of awareness or denial of existance of a neurological defect or general illness or any disability.

6. Spontaneous Pain and Thalamic Over-reaction

- Spontaneous pain occurs often. Pain stimulus is felt more acutely than in normal conditions **(hyperalgesia).**

7. Involuntary Movements

- Thalamic syndrome is always associated with some involuntary motor movements.

Athetosis

- Athetosis means slow writhing and twisting movements.

Chorea

- Chorea means quick, jerky, involuntary movements.

Intention tremor

- Tremor is defined as rapid alternate rhythmic and involuntary movement of flexion and extension in the joints of fingers and wrist or elbow.
- Intention tremor is the tremor that develops while attempting to do any voluntary act. Intention tremor is the common feature of thalamic syndrome.

8. Thalamic Hand or Athetoid Hand

- Athetoid hand is the abnormal attitude of hand in thalamic lesion.
- It is characterized by moderate flexion at wrist and hyperextension of all fingers.