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The nervous system controls all activity of the body. It is quicker than other control system in the body. The nervous system is divided into 2. They are:

1. Central Nervous System
2. Peripheral Nervous System

The central nervous system includes the brain and the spinal cord. Nervous pathways of sensations are called the sensory pathways. These pathways carry the impulses from receptors in different parts of the body to centers in brain.

Sensory pathways are of two types:

1. Pathways of somatosensory system
2. Pathways of viscerosensory system.

Pathways of somatosensory system convey the information from sensory receptors in skin, skeletal muscles and joints. Pathways of this system are constituted by somatic nerve fibers called somatic afferent nerve fibers.

Groups of nerve fibers passing through spinal cord are known as tracts of the spinal cord. The spinal tracts are divided into two main groups. They are:

1. Short tracts
2. Long tracts.

SHORT TRACTS

Fibers of the short tracts connect different parts of spinal cord itself. Short tracts are of two types:

1. Association or intrinsic tracts, which connect adjacent segments of spinal cord on the same side
2. Commissural tracts, which connect opposite halves of same segment of spinal cord.

LONG TRACTS

Long tracts of spinal cord, which are also called projection tracts, connect the spinal cord with other parts of central nervous system. Long tracts are of two types:

1. Ascending tracts, which carry sensory impulses from the spinal cord to brain
2. Descending tracts, which carry motor impulses from brain to the spinal cord. „

ASCENDING TRACTS OF SPINAL CORD

Ascending tracts of spinal cord carry the impulses of various sensations to the brain. Pathway for each sensation is formed by two or three groups of neurons, which are:

1. First order neurons
2. Second order neurons
3. Third order neurons.

First Order Neurons:

First order neurons receive sensory impulses from the receptors and send them to sensory neurons present in the posterior gray horn of spinal cord through their fibers. Nerve cell bodies of these neurons are located in the posterior nerve root ganglion

Second Order Neurons

Second order neurons are the sensory neurons present in the posterior gray horn. Fibers from these neurons form the ascending tracts of spinal cord. These fibers carry sensory impulses from spinal cord to different brain areas below cerebral cortex (subcortical areas) such as thalamus. All the ascending tracts are formed by fibers of second order neurons of the sensory pathways except the ascending tracts in the posterior white funiculus, which are formed by the fibers of first order neurons.

Third Order Neurons

Third order neurons are in the subcortical areas. Fibers of these neurons carry the sensory impulses from subcortical areas to cerebral cortex.

1. ANTERIOR SPINOTHALAMIC TRACT

Anterior spinothalamic tract is formed by the fibers of second order neurons of the pathway for crude touch sensation. Anterior spinothalamic tract carries impulses of crude touch (protopathic) sensation.

Effect of Lesion:

Bilateral lesion of this tract leads to loss of crude touch sensation and loss of sensations like itching and tickling. Unilateral lesion of this tract causes loss of crude touch sensation in opposite side below the level of lesion (because fibers of this tract cross to the opposite side in spinal cord).

1. LATERAL SPINOTHALAMIC TRACT

Lateral spinothalamic tract is formed by the fibers from second order neurons of the pathway for the sensations of pain and temperature. Fibers of lateral spinothalamic tract carry impulses of pain and temperature sensations. Fibers arising from this marginal nucleus transmit impulses of fast pain sensation while fibers arising from substantia gelatinosa of Rolando transmit impulses of slow pain and temperature sensations.

Effect of Lesion:

Bilateral lesion of this tract leads to total loss of pain and temperature sensations on both sides below the level of lesion. Unilateral lesion or sectioning of the lateral spinothalamic tract causes loss of pain (analgesia) and temperature (thermoanesthesia) below the level of lesion in the opposite side.

1. VENTRAL SPINOCEREBELLAR TRACT

Ventral spinocerebellar tract is also known as Gower tract, indirect spinocerebellar tract or anterior spinocerebellar tract. It is constituted by the fibers of second order neurons of the pathway for subconscious kinesthetic sensation. Kinesthetic senses are involved in our physical activities like walking, running, swimming, driving, and anything that requires body movement.

Ventral spinocerebellar tract carries the impulses of subconscious kinesthetic sensation (proprioceptive impulses from muscles, tendons and joints). Impulses of subconscious kinesthetic sensation are also called non-sensory impulses.

Effect of Lesion: Lesion of this tract leads to loss of subconscious kinesthetic sensation in the opposite side.

1. DORSAL SPINOCEREBELLAR TRACT

Dorsal spinocerebellar tract is otherwise called Flechsig tract, direct spinocerebellar tract or posterior spinocerebellar tract. Like the ventral spinocerebellar tract, this tract is also constituted by the second order neuron fibers of the pathway for subconscious kinesthetic sensation. The first order neurons are in the posterior nerve root ganglia. But, the fibers of this tract are uncrossed

Along with ventral spinocerebellar tract, the dorsal spinocerebellar tract carries the impulses of subconscious kinesthetic sensation, which are known as non-sensory impulses.

Effect of Lesion: Unilateral loss of the subconscious kinesthetic sensation occurs in lesion of this tract on the same side, as this tract has uncrossed fibers.

1. SPINOTECTAL TRACT

Spinotectal tract is considered as a component of anterior spinothalamic tract. It is constituted by the fibers of second order neurons.

Spinotectal tract is concerned with spinovisual reflex

1. FASCICULUS DORSOLATERALIS

Fasciculus dorsolateralis is otherwise called tract of Lissauer. It is considered as a component of lateral spinothalamic tract. And, it is constituted by the fibers of first order neurons.

Fibers of the dorsolateral fasciculus carry impulses of pain and thermal sensations.

1. SPINORETICULAR TRACT

Spinoreticular tract is formed by the fibers of second order neurons.

Fibers of the spinoreticular tract are the components of ascending reticular activating system and are concerned with consciousness and awareness.

1. SPINO­OLIVARY TRACT

Spino-olivary tract is situated in anterolateral part of white column. Origin of the fibers of this tract is not specific. However, the fibers terminate in olivary nucleus of medulla oblongata. From here, the neurons project into cerebellum. This tract is concerned with proprioception.

Proprioception refers to the body’s ability to perceive its own position in space. Examples of proprioceptive sensations include: knowing whether feet are on soft grass or hard cement without looking, balancing on one leg, etc.

1. SPINOVESTIBULAR TRACT

Spinovestibular tract is situated in the lateral white column of the spinal cord. Fibers of this tract arise from all the segments of spinal cord and terminate on the lateral vestibular nucleus. This tract is also concerned with proprioception.

1. FASCICULUS GRACILIS (TRACT OF GOLL) and
2. FASCICULUS CUNEATUS (TRACT OF BURDACH)

Fasciculus gracilis and fasciculus cuneatus are together called ascending posterior column tracts. These tracts are formed by the fibers from posterior root ganglia. Thus, both the tracts are constituted by the fibers of first order neurons of sensory pathway.

Tracts of the posterior white column convey impulses of following sensations:

1. Fine (epicritic) tactile sensation
2. Tactile localization: ability to locate the area of skin where the tactile stimulus is applied with closed eyes
3. Tactile discrimination or two point discrimination: ability to recognize the two stimuli applied over the skin simultaneously with closed eyes
4. Sensation of vibration: ability to perceive the vibrations from a vibrating tuning fork placed over bony prominence conducted to deep tissues through skin. It is the synthetic sense produced by combination of touch and pressure sensations.
5. Conscious kinesthetic sensation: sensation or awareness of various muscular activities in different parts of the body
6. Stereognosis: ability to recognize the known objects by touch with closed eyes. It is also a synthetic sense produced by combination of touch and pressure sensations.

Effect of Lesion:

Lesion of nerve fibers in tracts of Goll and Burdach or lesion in the posterior white column leads to the following symptoms on the same side below the lesion:

1. Loss of fine tactile sensation; however, crude touch sensation is normal
2. Loss of tactile localization
3. Loss of two-point discrimination
4. Loss of sensation of vibration
5. Astereognosis (inability to recognize known objects by touch while closing the eyes)
6. Lack of ability to differentiate the weight of different objects
7. Loss of proprioception (inability to appreciate the position and movement of different parts of the body)
8. Sensory ataxia or posterior column ataxia (condition characterized by uncoordinated, slow and clumsy voluntary movements because of the loss of proprioception).
9. COMMA TRACT OF SCHULTZE

Comma tract of schultze is also called fasciculus interfascicularis. It is situated in between tracts of Goll and Burdach. This tract is formed by the short descending fibers, arising from the medial division of posterior nerve root. These fibers are also considered as the descending branches of the tracts of Goll and Burdach. Function of this tract is to establish intersegmental communications and to form short reflex arc.