

PHYSIOLOGY

Q14 – Corticospinal Tract

Ans : 14 – Answer

Introduction

The corticospinal tract is the most important descending motor pathway in the central nervous system responsible for voluntary movements of the body. It plays a critical role in initiating, modulating, and controlling skeletal muscle activity, particularly skilled and precise movements of distal limb muscles. The development of the corticospinal tract is closely associated with the evolution of fine motor control in humans, allowing complex activities such as writing, tool handling, and coordinated finger movements.

Definition

The corticospinal tract is defined as a descending pyramidal tract that originates from the cerebral cortex and terminates on spinal motor neurons, either directly or through interneurons, to bring about voluntary control of skeletal muscles.

Origin of Corticospinal Tract

The corticospinal tract arises predominantly from the primary motor cortex (Brodmann area 4). Additional fibers originate from the premotor cortex (area 6), supplementary motor area, and parts of the somatosensory cortex. The neurons of origin are pyramidal cells, including large Betz cells, which have fast conduction velocity and are essential for rapid and precise motor responses.

Course of Corticospinal Tract

Fibers from the motor cortex descend through the corona radiata and converge into the posterior limb of the internal capsule, where lesions can cause severe motor deficits. In the midbrain, the fibers occupy the middle third of the cerebral peduncle. In the pons, they are separated into bundles by pontine nuclei but continue their downward course. In the medulla oblongata, the fibers form distinct elevations known as pyramids, giving the tract its alternative name as the pyramidal tract.

Decussation and Termination

At the lower end of the medulla oblongata, most corticospinal fibers undergo pyramidal decussation. Approximately 85–90% of fibers cross to the opposite side and descend as the lateral corticospinal tract, while 10–15% of fibers remain uncrossed as the anterior corticospinal tract. These fibers terminate in the spinal cord by synapsing with interneurons and lower motor neurons in the anterior horn.

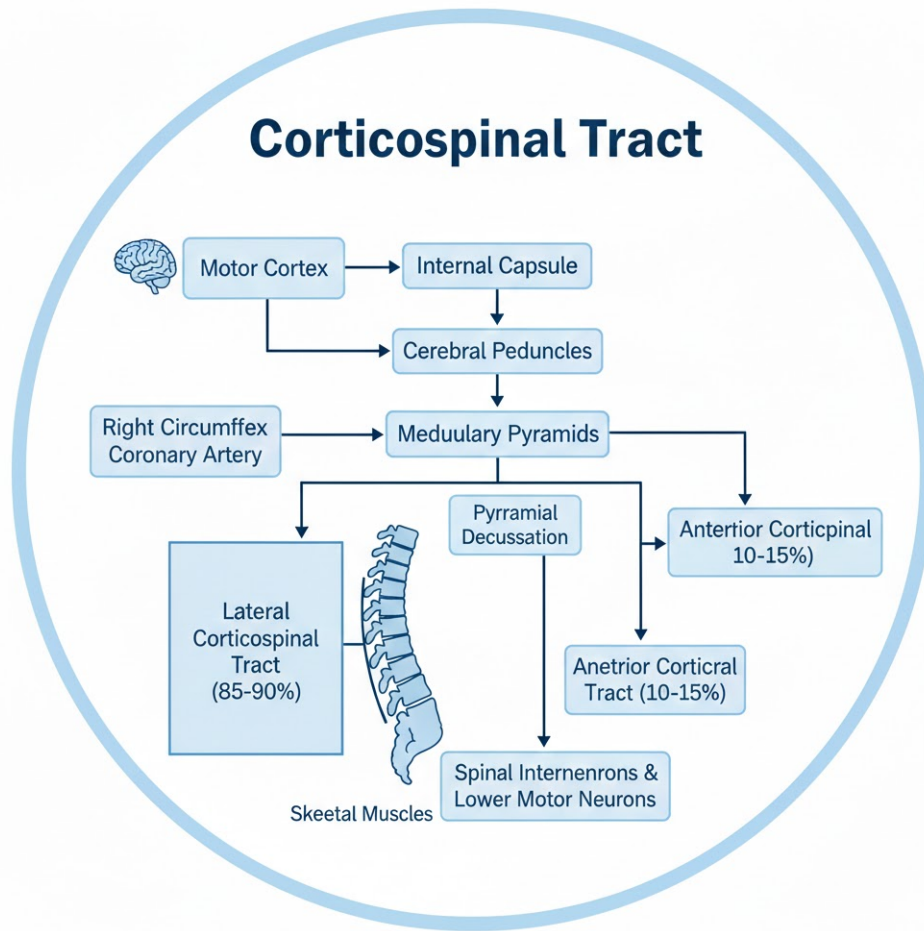
Functions

The corticospinal tract initiates voluntary movements, controls fine motor activity, regulates muscle tone, inhibits unwanted spinal reflexes, and coordinates complex motor patterns. It is especially important for independent finger movements and precision tasks.

Clinical Importance

Damage to the corticospinal tract results in upper motor neuron lesions characterized by spastic paralysis, increased muscle tone, exaggerated deep tendon reflexes, clonus, and a positive Babinski sign. Lesions above the decussation produce contralateral paralysis, while lesions below the decussation produce ipsilateral paralysis.

Diagram – Corticospinal Tract



Conclusion

The corticospinal tract is the principal pathway for voluntary motor control in humans. By connecting the cerebral cortex with spinal motor neurons, it enables precise, skilled, and coordinated movements of skeletal muscles. Integrity of this tract is essential for normal motor function, and its damage produces characteristic upper motor neuron signs.