Cerebellum Anatomy

The cerebellum is involved in several motor functions including movement, coordination, balance, and maintenance of muscle tone. There are four deep cerebellar nuclei - dentate, emboliform, globose, and fastigial. The cerebellum is connected to the brainstem via the superior, middle, and inferior cerebellar peduncles. The cerebellum receives bilateral blood supply from the superior cerebellar artery, the anterior inferior cerebellar artery, and the posterior inferior cerebellar artery.

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Functions

Movement and Coordination

Movement and Coordination

The cerebellum receives commands for joint movement from the cerebral hemisphere and joint position information from proprioceptors. The cerebellum integrates executive commands with sensory feedback. This leads to a real-time adjustment of behavior known as 'error correction' which makes the transition between multi-jointed movement smooth. Cerebellar lesions can cause intentional tremors and dysdiadochokinesia.

Balance

Balance-beam

Maintaining balance is a function of the cerebellum. The cerebellum receives input about the joint position from proprioceptors and head position from the vestibular receptors.

Muscle Tone

Muscle-meat Tones

Muscle tone is the resistance of an individual muscle to passive stretching. The myotatic, or stretch, reflex and the inverse myotatic reflex regulate tone. The cerebellum corrects and manages these reflexes. Cerebellar lesions can thus cause hypotonia.

Deep Nuclei

Dentate Nucleus

Nuclear-Nucleus with Teeth

The cerebrocerebellum is comprised of the lateral hemispheres and the dentate nuclei. It receives input from the cerebral cortex via the pontine nuclei via corticopontocerebellar fibers. It projects to the contralateral red nucleus and the ventrolateral (VL) thalamic nucleus via the dentatorubrothalamic tract. It aids in the coordination and planning of motor movements.

Emboliform Nucleus

M-Bow Nuclear-nuclei

The vermis, intermediate zone, and the interposed nuclei (emboliform + globose) form the spinocerebellum, which controls coordination of movements and maintains muscle tone. The interposed nuclei project to the contralateral red nucleus and form the rubrospinal tract.

Globose Nucleus

Globe Nuclear-nuclei

The interposed nuclei are comprised of the emboliform nucleus and the globose nucleus. The globose nucleus is the posterior interposed nucleus and lies lateral to the fastigial nucleus. It helps in bringing about coordination of movements and maintains muscle tone.

Fastigial Nucleus

Fast-girl Nuclear-Nuclei

The vestibulocerebellum is comprised of the flocculonodular lobe and fastigial nucleus. It receives input from the cerebellar afferents that carry vestibular, auditory, and visual information. It projects to the vestibular nuclei and the reticular formation. It controls the coordination of balance and saccadic ocular movements.

Cerebellar Peduncles

Superior Cerebellar Peduncle

Super Silver-bell with Petal

The superior cerebellar peduncle (SCP) carries cerebellar efferent fibers within the cerebellothalamic and cerebellorubral, which relay motor planning output signals from the cerebellum.

Middle Cerebellar Peduncle

Middle a Thicker Petal

The middle cerebellar peduncle (MCP) connects the cerebellum to the pons. It is the largest peduncle. It carries afferent tracts from the contralateral cortex via pontocerebellar mossy fibers.

Inferior Cerebellar Peduncle

In-fur Silver-bell Petal

The inferior cerebellar peduncles (ICP) connect the medulla with the cerebellum. They carry mossy afferent fibers from the spinal cord and climbing fiber afferents from the inferior olivary nucleus. They contribute Purkinje fiber efferents to the vestibular nuclei.

Blood Supply

Superior Cerebellar Artery

Super Silver-bell Archer

The superior cerebellar artery supplies the superior surface of the cerebellum, superior and middle cerebellar peduncles, and lower midbrain.

Anterior Inferior Cerebellar Artery

Anteater In-fur Silver-bell Archer

The anterior inferior cerebellar artery (AICA) arises from the basilar artery and supplies the anterior cerebellum, middle cerebellar peduncles, and inferolateral pons.

Posterior Inferior Cerebellar Artery

Post-terrier In-fur Silver-bell Archer

The posterior inferior cerebellar artery (PICA) arises from vertebral artery and supplies the lateral part of the medulla and the inferior part of the cerebellum.