CONCUSSION

3 CATEGORIES OF POST-CONCUSSION SYNDROME

PHYSIOLOGICAL

MAIN SYMPTOMS

- Sensitivity to light and sound
- Episodic dizziness
- Slowed speech
- Headaches worse with physical or mental effort
- Poor concentration
- Fatigue
- Nausea

ASSOCIATED WITH

- Heart-rate and blood-pressure changes (autonomic dysregulation)
- Neurometabolic changes (blood flow and metabolism)
- Reduced cerebral blood flow
- Disturbed mitochondrial energy metabolism
- Intolerance of physical and cognitive load

TESTING

- Neurological exam for cognitive, affective and motor problems
- Assessment of autonomic dysregulation

VESTIBULO-OCULAR

MAIN SYMPTOMS

- Dizziness
- Poor coordination when walking
- Spatial disorientation at rest
- Difficulty tracking visually
- Blurred or double vision
- Motion sensitivity (motion sickness)
- Headaches with reading
- Light sensitivity

ASSOCIATED WITH

- Vestibular dysfunction
- Oculomotor dysfunction

TESTING

- Smooth pursuit
- Saccades (fast eye movements)
- Gaze stability
- Vestibular and visual motion tests
- Balance
- Eye-movement coordination

CERVICOGENIC

MAIN SYMPTOMS

- Headaches from neck overload
- Reduced range of motion and stiffness

ASSOCIATED WITH

- Cervical spine dysfunction
- Muscle tension and poor posture

TESTING

- Neurological exam
- Manual assessment
- Neck movement testing

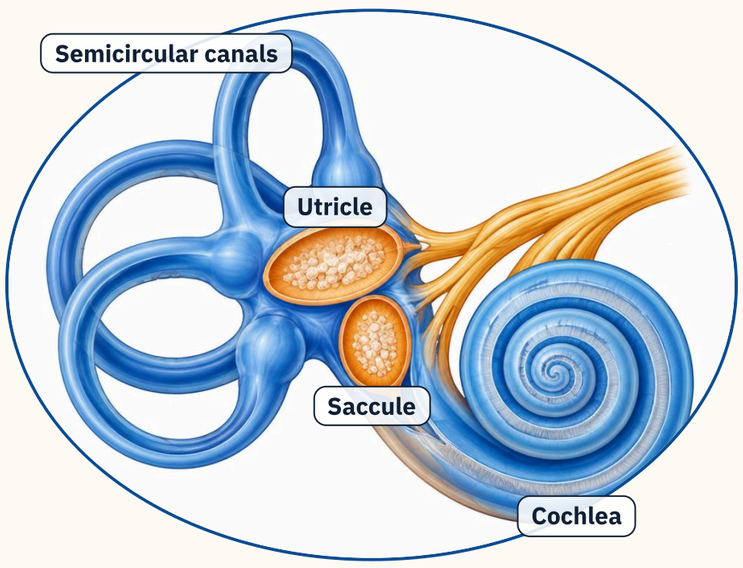
CT and MRI are often normal in post-concussion symptoms.

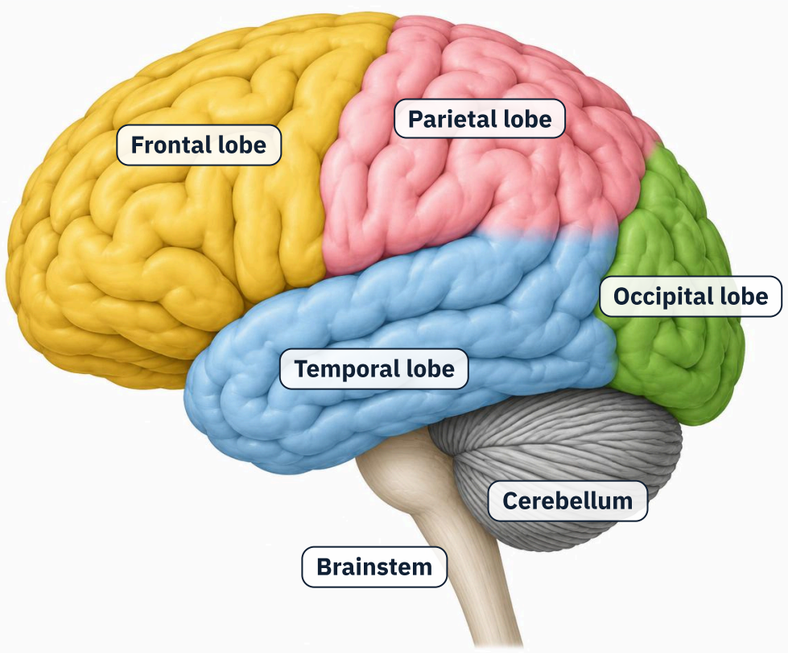
QEEG and LORETA show promise in diagnosing and managing concussion.

The vestibulospinal tracts (medial and lateral) link the vestibular nuclei with the spinal cord and coordinate head, trunk and limbs. Vestibular trauma disturbs central coordination, neck and postural reflexes, causing imbalance and poor coordination.

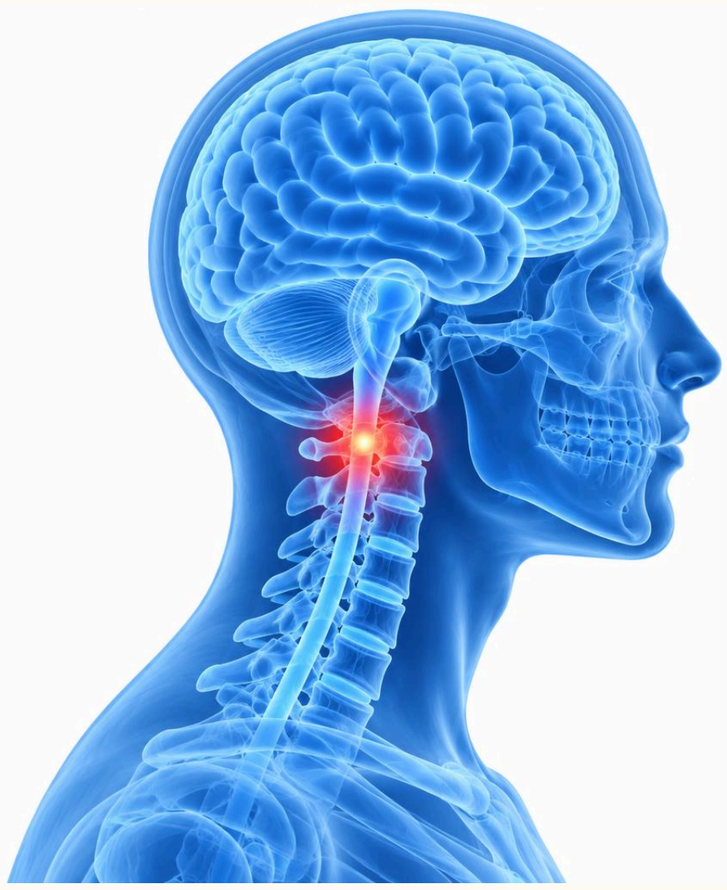
HEMISPHERIC INJURY AFFECTING VESTIBULAR PROCESSING

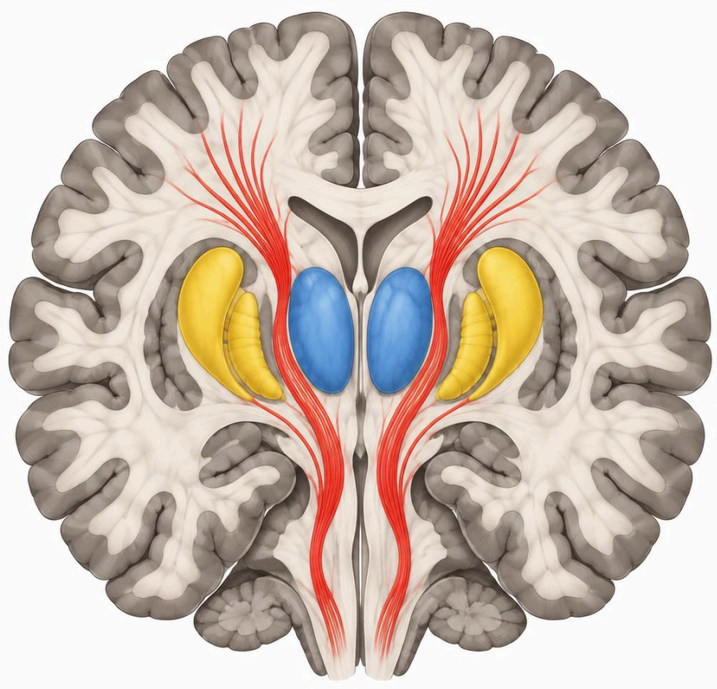
- Impaired sense of position and motion
- Vestibular dysfunction
- Head and trunk tilt
- Nystagmus
- Poor visuomotor coordination





VESTIBULAR NUCLEI





DEEP (BASAL) GANGLIA LINKED TO INJURY

- Motor, cognitive and limbic circuits (behaviour, emotion)
- Motor and association pathways (skills, coordination)
- Sensory gating: hypersensitivity or reduced sensitivity
- Autonomic dysregulation

PROJECTIONS OF THE DEEP GANGLIA ALSO INCLUDE

- Motor, behavioural and emotional pathways
- Social behaviour (frontal cortex)
- Visual and striatal pathways (visual control)
- Motor pathways (globus pallidus)

Damage to projection pathways to the cerebellum and brainstem disturbs vestibular and postural function.

SECONDARY CORTICAL PATHWAY INVOLVEMENT

Seen in cortex (frontal, paracentral, parietal) and subcortex (thalamus, basal ganglia). It may show as:

- Disturbed gut motility
- Hyperexcitability
- Poor neuromuscular control
- Vestibular dysfunction
- Altered visceral sensitivity
- Altered visual processing
- Increased blood–brain barrier permeability (within 6 h)

Injury areas and related symptoms

FRONTAL LOBE

- Fewer voluntary eye movements
- Attention problems
- Impulsivity
- Loss of behaviour control
- Apathy
- Increased aggression

CEREBELLUM

- Poor coordination
- Poor balance
- Nystagmus
- Slurred speech
- Dyscoordination

MIDBRAIN

- Poor upright posture and optokinetic nystagmus
- Tremor
- Hyperkinesia, dyskinesia
- Reduced pupil reaction
- Altered consciousness (confusion to coma)
- Increased muscle tone (spasticity)