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NURSING SCIENCE

17/MHS02/037

PHYSIOLOGY OF BALANCE

Balance is mediated by the vestibular nuclei in the brain stem; the labyrinth (a part of the inner ear), is a major organ of our vestibular.

- Balance is achieved and maintained by a complex set of sensorimotor control systems that include sensory input from vision (sight), proprioception (touch), and the vestibular system (motion, equilibrium, spatial orientation); integration of that sensory input; and motor output to the eye and body muscles. Injury, disease, certain drugs, or the aging process can affect one or more of these components. In addition to the contribution of sensory information, there may also be psychological factors that impair our sense of balance.
- The vestibular system is the sensory apparatus of the inner ear that helps the body maintain its postural equilibrium. The information furnished by the vestibular system is also essential for coordinating the position of the head and the movement of the eyes.
- The vestibular system, the region of the inner ear where three semicircular canals converge, works with the visual system to keep objects in focus when the head is moving. This is called the vestibulo-ocular reflex (VOR).
- The balance system works with the visual and skeletal systems (the muscles and joints and their sensors) to maintain orientation or balance. Visual signals sent to the brain about the body's position in relation to its surroundings are processed by the brain and compared

to information from the vestibular and skeletal systems.

- There are two sets of end organs in the inner ear, or labyrinth: the semicircular canals, which respond to rotational movements (angular acceleration); and the utricle and saccule within the vestibule, which respond to changes in the position of the head with respect to gravity (linear acceleration).
- The information these organs deliver is proprioceptive in character, dealing with events within the body itself, rather than exteroceptive, dealing with events outside the body, as in the case of the responses of the cochlea to sound. Functionally these organs are closely related to the cerebellum and to the reflex centres of the spinal cord and brainstem that govern the movements of the eyes, neck, and limbs.
- When the sense of balance is interrupted it causes dizziness, disorientation and nausea. Balance can be upset by Ménière's disease, superior canal dehiscence syndrome, an inner ear infection, by a bad common cold affecting the head or a number of other medical conditions including but not limited to vertigo. It can also be temporarily disturbed by quick or prolonged acceleration, for example riding on a merry-go-round.
- Blows can also affect equilibrioreception, especially those to the side of the head or directly to the ear.Most astronauts find that their sense of balance is impaired when in orbit because they are in a constant state of weightlessness. This causes a form of motion sickness called space adaptation syndrome.

Vestibular system

- Sense of body position
- CNS sensory-motor coupling
- Eye movements

- Position of the head

Sense of balance – Generation of receptor potential

1)K+ influx through the cilia for depolarization

2) Ca++ influx through voltage-gated channels

3) K+ outflux for repolarization

Central Pathways for Balance

• CNs III-IV ve VI via medial long.

fasciculus

• Vestibulocerebellum

• Medial vestibulospinal tract

• Lateral vestibulospinal tract

• To sensory cortex via the thalamus

THE COORDINATED BALANCE SYSTEM

The human balance system involves a complex set of sensorimotor-control systems. Its interlacing feedback mechanisms can be disrupted by damage to one or more components through injury, disease, or the aging process.

Impaired balance can be accompanied by other symptoms such as dizziness, vertigo, vision problems, nausea, fatigue, and concentration difficulties.

The complexity of the human balance system creates challenges in diagnosing and treating the underlying cause of imbalance. The crucial integration of information obtained through the vestibular, visual, and proprioceptive systems means that disorders affecting an individual system can markedly disrupt a person’s normal sense of

balance.

Vestibular dysfunction as a cause of imbalance offers a particularly intricate challenge because of the vestibular system’s interaction with cognitive functioning, and the degree of influence it has on the control of eye movements and posture.