

431

CNS System
central Nervous

Block

Physiology Team


Female Side

Male side

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Slide No.(1)

POSTURE & EQUILIBRIUM

Q-What is posture?

It is maintenance of upright position against gravity (center of body is needed to be between the legs) it needs **antigravity muscles**


Team Notes :

Main cause of balance maintenance is postural reflexes(that the body do it without interference from the person or any coordination)

The center of gravity changes during movement, and it is adjusted by the postural reflexes.

Antigravity Muscles :

Extensor of the lower limb- abdominal muscles- muscles of the back- flexor of upper limb- mandible muscle



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Slide No.(2)

1-Up-right posture need postural reflexes

**2- posture depends on muscle tone (stretch reflex)
(basic postural reflex)**

3-The main pathways concerned with posture are:-

A- medial (reticulospinal-tectospinal- vestibulospinal) control proximal limbs & axial muscles for posture & gross movements

4- lateral pathways (corticospinal - rubrospinal) control distal limbs.

Team Notes :

Muscle reflex= sustained maintained stretch reflex

No one can maintain his posture without static stretch reflex.

The stretch reflex is produced by co-activation of both Alpha & Gamma motor efferents.

For smooth, efficient well-coordinated posture we need:

1- Vestibular apparatus.

2- Basal ganglia.

3- Cerebellum.



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Slide No.(3)

- postural reflex depends on the following receptors:-
- 1- vestibular apparatus receptors as
- Maculae (utricle&sacculle) & SCC cristea
- 2- visual (vision)& auditory(hearing) receptors:-
Vision can compensate for loss of auditory, vestibular & proprioception (Tabes dorsalis + Rombergism)
- 3-Proprioceptors of muscles , tendons , ligaments & joints:-

Team Notes :

- Vestibular apparatus = non auditory membranous labyrinth..
- Maculae → linear acceleration..
- Semicircular canal(SCC) → rotation..
- Proprioceptors → initiate many reflexes in the body which maintain balance & posture..
- Visual receptor is more important than auditory receptor, e.g:
- If the inner ear of a person is damaged and he is going to dive in a deep water. Because there is no vision and his inner ear is damaged he will sink → he can't feel his head orientation.



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Slide No.(4)

- **a- Neck Proprioceptors:-**
- **detect head position in relation to trunk**
- **b- Body Proprioceptors** proprioceptors of anti-gravity muscles
- **c- pressure receptors** as in sole of feet initiate positive supporting reaction (magnet reflex)

Team Notes :

Nothing else was mentioned about this slide.



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Slide No.(5)

-
- - **Stretch reflexes & postural reflexes** can be modified by coordinated activity ;-
 - Spinal cord
 - Medulla
 - Midbrain
 - Cerebral cortex
 - cerebellum

Team Notes :

Nothing else was mentioned about this slide.

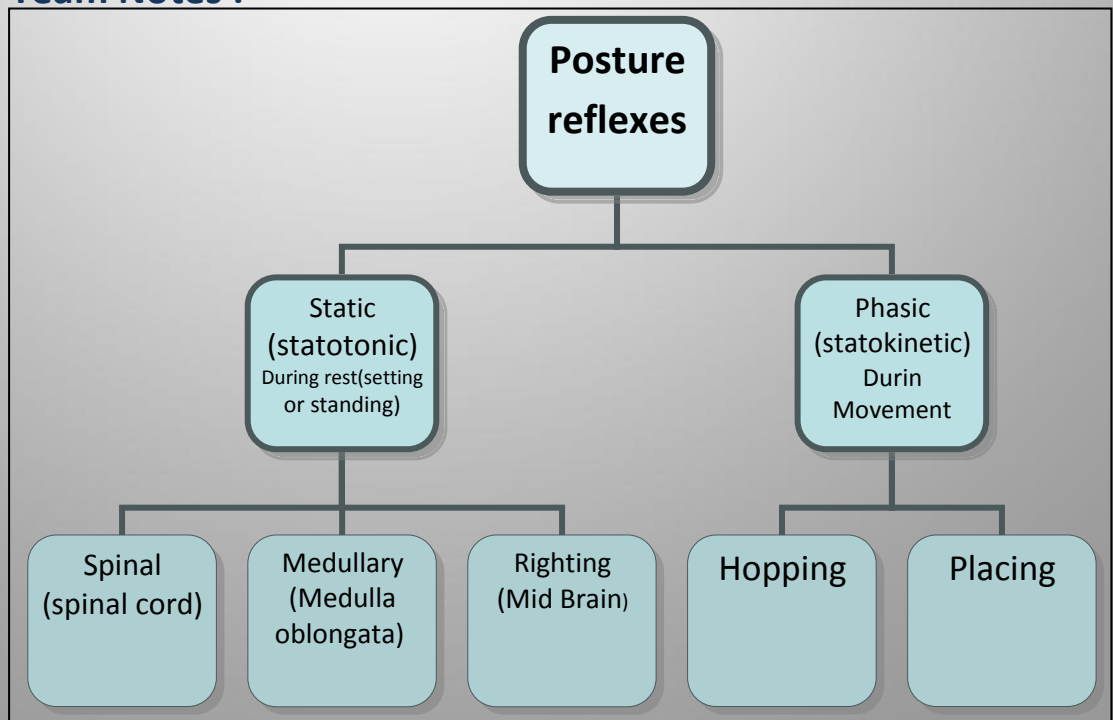
Slide No.(6)

Postural reflexes are:-

A-Static reflexes

B-Phasic reflexes

Team Notes :





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Slide No.(7)

A-Static R:- (statotonic):- maintain posture at rest:-

a- spinal+ medullary reflexes

B-Righting reflexes(midbrain)

- Spinal reflexes:-

1- local static reflexes: as positive supporting reaction (magnet reflex) (receptors are proprioceptors of flexors)

2 -Stretch reflex

3- segmental static reflexes:- mediated by one segment of the spinal cord as :-

--Crossed extensor reflex

- Negative supporting R (which release +ve supporting reaction
-(receptors are proprioceptors of extensors of the released limb)

N.B spinal R can be studied in spinal animal with cut at neck b/w the S.C& brain stem so all S.C is intact.

Team Notes :


Spinal reflexes:

1- Stretch reflex.

2- Inverse stretch reflex.

3- Crossed stretch reflex.

4- Positive & Negative supporting reactions.



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Slide No.(8)

- - Medullary static Reflexes (center=medulla oblongata) are:-Neck& labyrinthine
- **1- Neck static reflexes**(studied in **a decerebrated** animal cut above medulla + labyrinth destroyed)
- -Stimulus is :-changing head position (+) neck proprioceptors
 - 1-- ventroflexion of head** /arms flexion+ extend hindlimb(as in decerebration).
 - 2-- dorsiflexion of head** /arms extended + flex hindlimb.
 - 3-- turning head to one side**----- extention of limbs on that side + flexion of other side.


Team Notes :

It is important to know the centers..

-Spinal reflexes → Spinal cord..

-Medullary static reflexes → Medulla oblongata..

-Righting reflexes → all centers from mid brain **except** visual reflex from cerebral cortex..



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Slide No.(9)

- **2- labyrinthine static reflex:- (in decerebrated animal) + elimination of neck proprioceptors)**

- **Receptors are otolith organs (maculae)**


- **Stimulus is gravity**

1-ventroflexion of head (or prone position)----- 4 limbs flexion

2- dorsiflexion of head (or supine position)-----4 limbs extended(as in decortication)

Team Notes :

Decerebrated → To eliminate cerebral brain function in (an animal) by removing the cerebrum , cutting across the brain stem, or severing certain arteries in the brain stem, as for purposes of experimentation..



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Slide No.(10)

- **b- Righting reflexes:- (center is midbrain except the visual in C.C):-** when upright posture is disturbed as in falling down
 - - studied in a decerebrated animal (cut above midbrain)
 -
 - **a- visual righting reflexes(cortical):-** visual image can correct position of head & body if position is disturbed
 - (center is C.C - stim: visual stim, receptors; eye receptors,
 - **b- labyrinthine righting reflexes (midbrain):-**
(cover eyes) —(if the body is not in the proper position (animal held in air from pelvis)
 - **tilting the head (+) otolith organs -----(+)** neck muscles to correct the head level, when head is not in proper site
 - **receptors**; otolith organs,
 - **response**; righting of head

Team Notes :

Nothing else was mentioned about this slide.



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Slide No.(11)

- **c- body on head righting reflexes (midbrain):- :-**
-
- **stim:** pressure on side of body ,
- **receptors;** trunk proprioceptors
- **Response/ reflex correction of head .**
-
- **d- body on body (midbrain):- :-** pressure on side of the body ---
--(and head is fixed)
- **Receptors/** trunk proprioceptors
- **response /reflex correction of body**
- **e- neck righting reflexes (midbrain):- :-**
- **stim:** stretch of neck muscles(if head is corrected & body still tilted) ----- righting of shoulders & body.
- **receptors;** muscle spindles of neck muscles
-
- **response;** righting of body.

Team Notes :

Nothing else was mentioned about this slide.



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Slide No.(12)

- **B- Phasic reflexes (statokinetic reflexes) (center in C.C):-**
-maintain posture during motion
- **a- Hopping reaction:-** when animal is pushed laterally--- --
-- reflex hopping to keep limbs in position to support body. The **receptors are in muscle spindles.**
- **b- Placing reaction :-** blind folded animal suspended in air & moved towards a supporting surface, the feet will be placed firmly on the supporting surface (**receptors are touch receptors& proprioceptors in soles of feet**)

Team Notes :

E.g of **placing reaction** → when you put an infant on a straight surface he/she will try to place hi/her feet on the surface.



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Slide No.(13)

Decerebrate rigidity :-

-- In section between superior & inferior colliculi of midbrain-----block normal inhibitory signals from brain & red nucleus of midbrain to tonically active pontile RF & Vestibular N causing:

- 1- **maintained** tonic static postural reflexes that support animal against gravity (medullary **tonic neck & labyrinthine R**).
- 2- **Absent midbrain righting R**
- 3- extension of head & 4 limbs extensors due to increased extensor tone from vestibulospinal & reticulospinal tracts to extensor motor neurons
- 4- spasticity & rigidity & extension in antigravity muscles

-In human by vascular lesion of brain stem between red N & vestibular nucleus

Team Notes :

Nothing Else was mentioned about this slide.


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Slide No.(14)

- Decorticate rigidity more common in human than decerebrate rigidity:-
 - 1- lesion in cerebral cortex but brain stem is intact
 - 2-Medullary tonic neck & tonic labyrinthine reflexes present
 - 3-Righting midbrain reflexes present
 - 4-Visual righting, placing & hopping reflexes lost

Team Notes :

| Decerebrated rigidity | Decorticate rigidity |
|---|--|
| Animal dissecting between superior colliculi and inferior colliculi of mid brain | Lesion in cerebral cortex but the brain stem is intact |
| Cerebral cortex reflex is lost(tract that descend to spinal cord+ visual reflex) | Cerebral cortex reflexes is lost |
| Mid brain reflexes lost (all righting reflexes is lost) | Mid brain reflexes present |
| Medullary reflexes present | Medullary reflexes present |



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Slide No.(15)

- 5- it causes extensor rigidity in legs & moderate flexion of arms if head unturned , as supine position (tonic neck reflexes)
- 2- Tonic neck reflexes are produced by turning the head to one side e.g **to the left -----extension of limbs on left side & flexion of RT**

(as what seen in hemiplegic pts on affected side after Hge of internal capsule, there is loss of inhibitory cortical signals to gamma motor neurons via **reticulospinal** (from suppressor area 4 strip in the anterior edge of precentral gyrus)

Team Notes :

Nothing Else was mentioned about this slide.

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Slide No.(16)

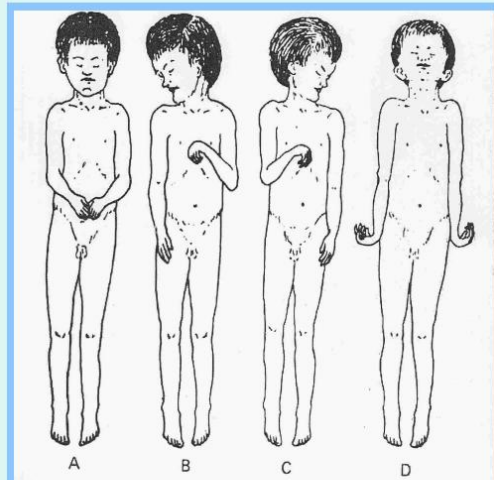


Figure 12-7. Human decorticate rigidity (**A-C**) and true decerebrate rigidity (**D**). In **A** the patient is lying supine with the head unturned. In **B** and **C**, the tonic neck reflex patterns produced by turning of the head to the right or left are shown. (Reproduced, with permission, from Fulton JF [editor]: *Textbook of Physiology*, 17th ed. Saunders, 1955.)

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Slide No.(17)

Table 12-2. Principal postural reflexes.

| Reflex | Stimulus | Response | Receptor | Integrated In |
|---------------------------------------|--|--|----------------------------------|----------------------|
| Stretch reflexes | Stretch | Contraction of muscle | Muscle spindles | Spinal cord, medulla |
| Positive supporting (magnet) reaction | Contact with sole or palm | Foot extended to support body | Proprioceptors in distal flexors | Spinal cord |
| Negative supporting reaction | Stretch | Release of positive supporting reaction | Proprioceptors in extensors | Spinal cord |
| Tonic labyrinthine reflexes | Gravity | Contraction of limb extensor muscles | Otolithic organs | Medulla |
| Tonic neck reflexes | Head turned: (1) To side (2) Up (3) Down | Change in pattern of extensor contraction (1) Extension of limbs on side to which head is turned (2) Hind legs flex (3) Forelegs flex | Neck proprioceptors | Medulla |
| Labyrinthine righting reflexes | Gravity | Head kept level | Otolithic organs | Midbrain |
| Neck righting reflexes | Stretch of neck muscles | Righting of thorax and shoulders, then pelvis | Muscle spindles | Midbrain |
| Body on head righting reflexes | Pressure on side of body | Righting of head | Exteroceptors | Midbrain |
| Body on body righting reflexes | Pressure on side of body | Righting of body even when head held sideways | Exteroceptors | Midbrain |
| Optical righting reflexes | Visual cues | Righting of head | Eyes | Cerebral cortex |
| Placing reactions | Various visual, exteroceptive, and proprioceptive cues | Foot placed on supporting surface in position to support body | Various | Cerebral cortex |
| Hopping reactions | Lateral displacement while standing | Hops, maintaining limbs in position to support body | Muscle spindles | Cerebral cortex |

Team Notes :

This table is summarizing the postural reflexes..

Questions

1- Which of the following is statokinetik reflex

- A. Spinal reflex
- B. Placing reflex
- C. Medullary reflex

2- receptors of hopping reaction in :

- A. sole of the feet
- B. trunk
- C. muscle spindle

3- in decorticate rigidity :-

- A. Cerebral cortex reflexes are present
- B. Mid brain reflexes are lost
- C. Medullary reflexes are present

4- In Decerebrated rigidity :-

- A. Midbrain reflexes are lost
- B. Medullary reflexes are lost
- C. Cerebral cortex reflexes are present

Answers

1- B

2- C

3- C

4- A