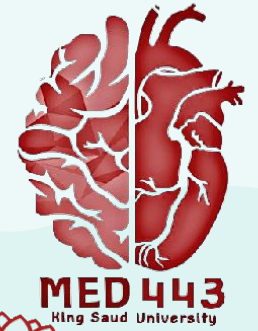
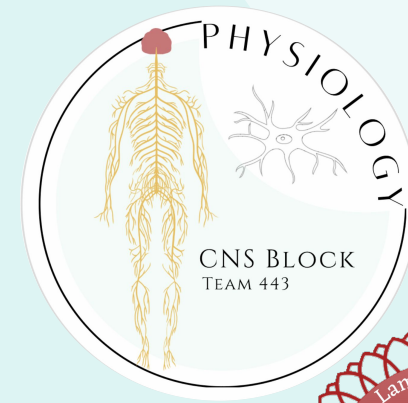




postural reflexes..



Color Index:

- Main text
- **Important**
- Girls Slides
- Boys Slides
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Objectives..

- ❖ **Define human posture.**
- ❖ **Explain what are postural reflexes and their overall functions.**
- ❖ **Know the centers of integration of postural reflexes.**
- ❖ **Describe decorticate rigidity and decerebrate rigidity and explain the mechanism underlying them.**



..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
- ❖ Posture is the attitude taken by the body in any particular situation like standing posture, sitting posture, etc. even during movement, there is a continuously changing posture
- ❖ The basis of posture is the ability to keep certain group of muscles in sustained contraction for long periods. Variation in the degree of contraction and tone in different groups of muscle decides the posture of the individual.

Postural reflexes

These reflexes resist displacement of the body caused by gravity or acceleratory forces, and they have the following functions:

- 1.Maintenance of the upright posture of the body.
- 2.Restoration of the body posture if disturbed.
- 3.Providing a suitable postural background for performance of voluntary movements.

Upright posture needs postural reflexes.
posture depends on muscle tone **Static stretch reflex (stretch reflex)**
(basic postural reflex).

The main pathways concerned with posture are:-

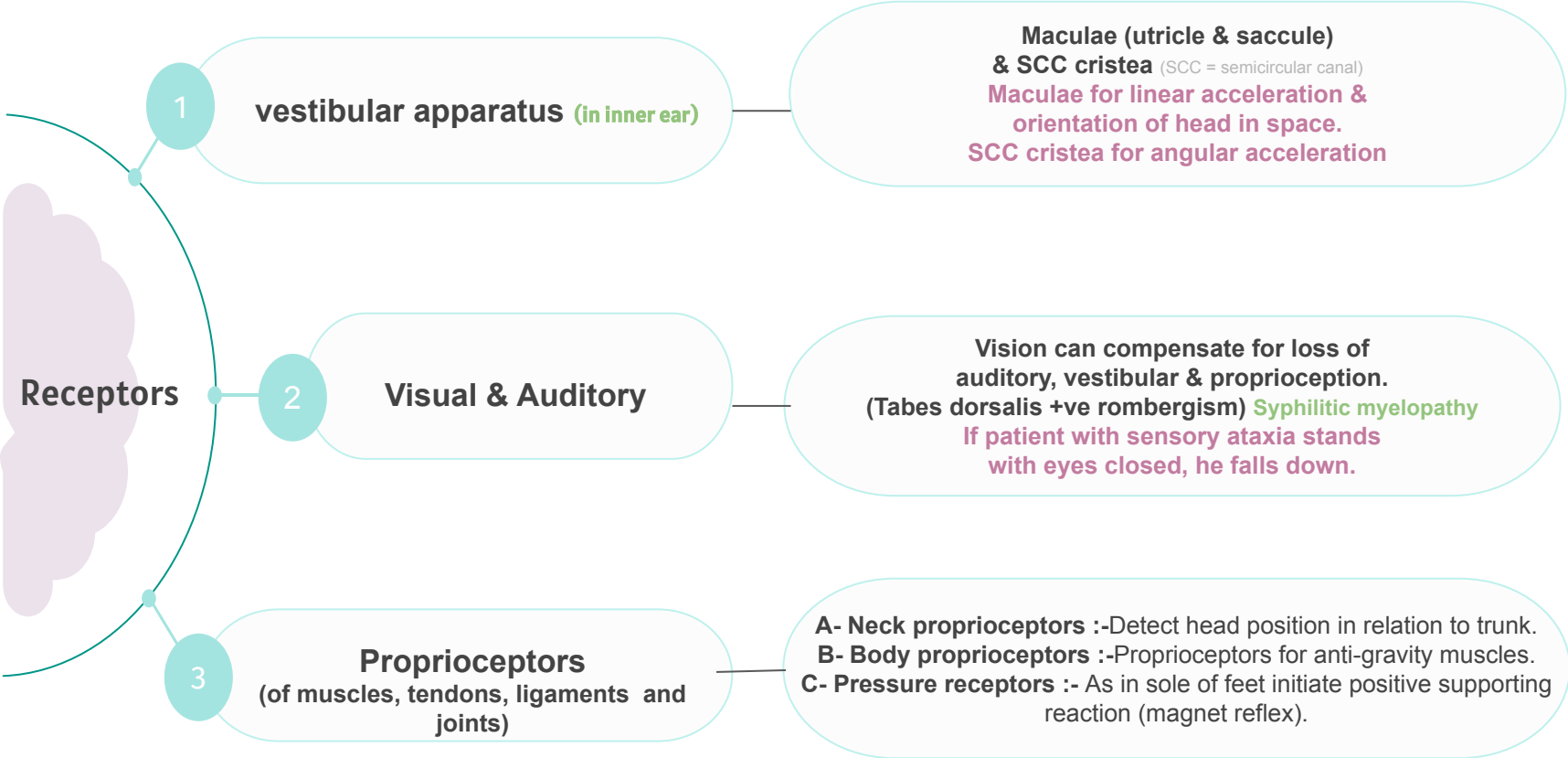
A- medial tracts control proximal limbs & axial muscles for posture & gross movements as **Ventral corticospinal**

B- lateral pathways as (corticospinal –rubrospinal) control distal limbs.



Postural reflexes..

Postural reflexes depend on the following receptors:



Sensory ataxia is the result of disruption of reaction (magnet reflex). neuronal pathways that interfere with proprioception, dysfunction of the dorsal columns of the spinal cord. In peripheral neuropathies DM, and idiopathic neuropathy.

Stretch reflexes & postural reflexes can be modified by coordinated activity:





Postural reflexes are:.....

1 Static reflex (at rest)

2 Phasic reflex (with motion) (statokinetic reflexes)

1 static reflexes (statotonic)

- ❖ Involved sustained contraction of muscles.
- ❖ Maintain posture at rest.
- ❖ Include the following reflexes:

A-spinal

B-medullary reflex

C- Righting reflex (Midbrain)



In study of experimental spinal animals, we cut above C5 because we don't want to paralyze the diaphragm and to separate spinal cord from higher centers.

A- Spinal Center in spinal cord

Local static reflex
(Confine to stimulated limb)

Segment static reflex
(Mediated by one segment of SC as:)

Stretch reflex

Positive supporting reflex(magnet reflex)

Crossed extensor reflex

Negative supporting reflex

This is the most important local static reflex which controls the tone in those extensor muscles which keep the body upright (antigravity muscles).

Deep pressure on the sole lead to contraction (the only reflex) of both flexors & extensors to convert the whole lower limb into a rigid column to support body weight (no reciprocal inhibition). Receptors are proprioceptors of flexors. Protective reflex

To maintain the posture

Disappearance (release) of positive supporting reaction. Receptors are proprioceptors of extensors of the released limb.

we destroy the labyrinth to prove that the reflex is integrated in the medulla by cutting vestibular nerve

B- Medullary (Centre in Medulla Oblongata)

receptors are:
1- otolith
2- neck proprioceptors

Neck Static Reflexes

(studied in a decerebrated animal cut above medulla + labyrinth destroyed)

Stimulus is: changing head position that (+) neck proprioceptors

Tonic Labyrinthine Static Reflexes

We can see the reflexes in children below 2 years because the tracts are unmyelinated yet

we do deafferentation of C1 - C2 - C3
(In decerebrated animal)+ (elimination of neck proprioceptors while labyrinth is intact)

Receptors are otolith organs(maculae) **Stimulus is gravity**

1- **Ventroflexion of head** (animal in prone position)--> 4 limbs flexion.

2- **Dorsiflexion of head** (the animal in supine position) -->4 limbs extended (as in decerebration).



Ventroflexion of head (neck reflex)



Turning the head on one side (neck reflex)



Dorsiflexion of the head (neck reflex)



Dorsiflexion of head (labyrinth reflex)

Ventroflexion of Head

Turning head to one side

Dorsiflexion of Head

Arms (**Forelimbs**) flexion + extended hindlimbs (legs) (as in **decortication**). (Position of a cat looking at a mouse on the floor)

Extension of limbs on that side + flexion of other side (as in **decortication**).

Arms (**Forelimbs**) extended+flexion of hindlimbs (legs). (Position of a cat looking at a bird on a tree)




Ventroflexion of head (labyrinth reflex)



C- Righting Reflex (RR)

center in midbrain except the visual in cerebral cortex

- ❖ when upright posture is disturbed as in falling down → Righting reflex.
- ❖ These reflexes are for correction of disturbed posture.
- ❖ Head correction is first followed by body correction.
- ❖ Studied in the midbrain of decerebrated animal (cut above midbrain = upper decerebration).
- ❖ Initiated by signal from otolith organs, neck proprioceptors, pressure receptors of the body as well as from visual receptors.
- ❖ All static labyrinthine reflexes have macula as receptors, but in statokinetic reflexes during motion SCC receptors (macula act in linear, & SCC receptors act in angular acceleration).

Reflexes	Centre	Stimulus	Receptor	Response/ Reflex
Visual RR (cortical) (studied in intact animal with destroyed labyrinth and cutting upper 3 cervical nerves)	Center in cerebral cortex	visual stimuli	eye receptors	If this animal is thrown in air, visual image can correct position of head & body if position is disturbed.
Labyrinthine 	midbrain	-(covered eyes) نتأكد انه ما في visual clue & animal held in air from pelvis) - The body is not in the proper position	otolith organs As in tilting the head & head is not in proper site → stimulates the otolith organs → stimulate neck muscles to correct the head level	Righting of head by contraction of the neck muscles



C- Righting Reflex (RR)

center in midbrain except the visual in cerebral cortex

Reflexes	Centre	Stimulus	Receptor	Response/ Reflex
Body on Head RR (studied in midbrain animal with destroyed labyrinth)	midbrain	Pressure on side of body & <u>head is free.</u>	*trunk proprioceptors. *Body pressure receptors.	Correction of head
Body on Body RR		Pressure on side of the body and <u>head is fixed.</u>		Correction of body
Neck RR (corrects body position)		Stretch of neck muscles (As if head is corrected & body still tilted)	*Muscle spindles of neck muscles. or *proprioceptors of neck muscles.	Righting of shoulders & then righting of body.



*Correction of the head by previous 2 (labyrinthine RR & body head RR) reflexes lead to twisting of the neck.

*This initiates reflex righting of the body.





Phasic Reflexes (Statokinetic)

2

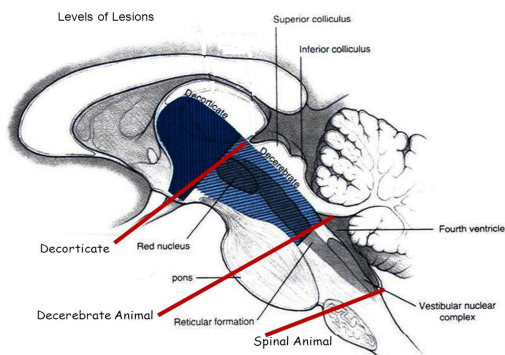
Phasic reflexes (Statokinetic)

- Maintain posture during motion
- Integrated in the **cerebral cortex**
- **Involve transient contraction of muscles**

Reaction	A- Hopping Reaction لما تركل بسمة وتوقف ع اطرافها مره ثانيه	B- Placing Reaction
Stimulus	When animal is pushed laterally (The majority of its weight is only in one limb)	Blind folded animal suspended in air & moved towards a supporting surface
Receptor	Muscle spindle	touch receptors & proprioceptors in soles of feet
Response	hopping to keep limbs in position to support body.	the feet will be placed firmly on the supporting surface
Picture		



Decerebrate Rigidity & Decorticate Rigidity



POSTURING

DECORTICATE (Flexor)



Arms are like "C's" Moves in toward the "Cord"

Problems With Cervical Spinal Tract or Cerebral Hemisphere.

DECEREBRATE (Extensor)



Arms are like "e's"

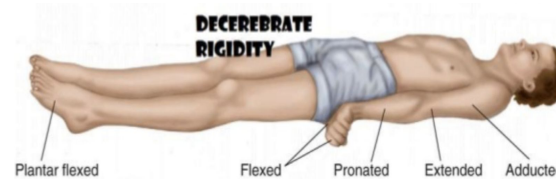
Problems Within Midbrain or Pons.



A- Decerebrate rigidity

Definition

- it is a mid-collicular lesion below red nucleus (**section between superior & inferior colliculi of midbrain**)
- block inhibitory signals from brain & red nucleus to tonically active pontine reticular formation & Vestibular N





A- Decerebrate rigidity

- **Causin :**

1

Maintained tonic static postural reflexes that support animal against gravity (Medullary tonic neck R & Medullary labyrinthine R)

2

Absent midbrain righting R

3

Extension of head & 4 limbs extensors, arms extended by the sides & rotated internally because its above rubrospinal tract which activate flexors. (hallmark : elbows extended)

(as in labyrinthine static R) The jaw may be clenched with the neck hyperextended due to increased extensor tone from vestibulospinal & reticulospinal tracts to extensor motor neuron.

4

Extensive extensor posture of all extremities → Rigidity of all limbs (Spasticity & rigidity & extension in antigravity muscles)

5

Head may be arched to the back

In human is rare and may be caused by a vascular lesion of brain stem between red nucleus & vestibular nucleus



A- Decerebrate rigidity:

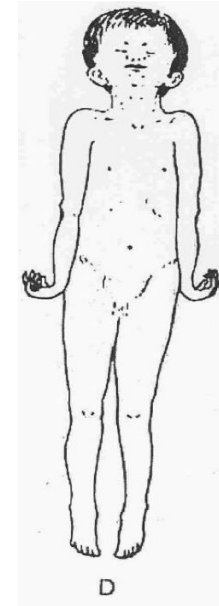
Mechanism of Decerebrate Rigidity:

Diffuse facilitation of stretch reflex due to:

1. increase excitability of motor neuron
2. increase gamma discharge

Lesion:

Lesion **below** red nucleus, resulting in block normal inhibitory signals from brain & red nucleus in midbrain to tonically active pontine reticular formation & vestibular formation





A- Decerebrate rigidity:

in decerebrate animal

damage to (level below red nucleus)

Features of decerebrate rigidity:

- hyperextension of all four limbs
- the animal can be made to stand on four limbs but is easily toppled by slight push
- extreme hyperextension of the spine (opisthotonus) produces concave configuration of the back
- dorsiflexion (hyperextension) of tail and head

Reflexes that are lost/absent	Reflexes that are retained /still present (those which have their centers in SC, medulla or pons)
Righting Reflex	-Stretch reflex -positive & negative supporting reaction -crossed extensor reflex
	Tonic Labyrinthine reflexes
	Tonic Neck Reflexes



B- Decorticate rigidity :

flexion because rubrospinal is intact (above red nucleus)

Definition

- it is a lesion in cerebral cortex but brain stem is intact ,**as what seen in hemiplegic patients after Hemorrhage of internal capsule** which causes UMNL (damage to upper motor neurons). I.e: In humans, where true decerebrate rigidity is rare, since the damage to the brain centers involved in it are lethal. **However, decorticate rigidity can be caused by bleeding in the internal capsule which causes UMNL (damage to the upper motor neurons).**
- it is more common in human than -decerebrate rigidity



- Typical features in decorticated man consist of:

1 Full extension of the legs

3 Semiflexion at the elbow

2 Arm lying across the chest

4 Slight pronation of forearm

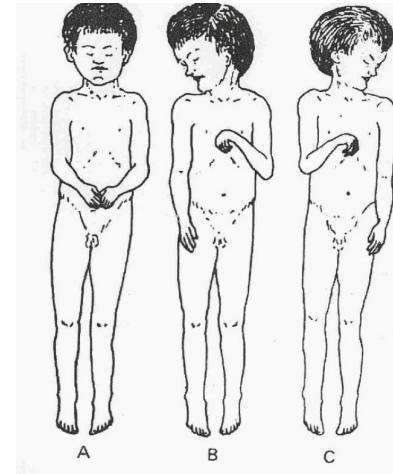
5 Flexion of wrist and fingers.

Note:
I.e it causes extensor rigidity in legs & moderate flexion of arms if head unturned, as supine position (tonic neck reflexes).



B- Decorticate rigidity:

- the hands are clenched into fists, and the legs extended and feet turned inward
- Decorticate rigidity is seen at rest
- Turning the head to one side initiates tonic neck reflexes .
e.g turning head to the left>>>extension of limbs on left side & flexion of right side



Lesion:

- In **decorticate rigidity** the lesions is **above** the red nucleus, so rubrospinal are intact together with pontine reticulospinal and the vestibulospinal, this leads to the characteristic flexion posturing of the upper extremities and extensor posturing of the lower extremities.
- Normally suppressor area 4 strip in the anterior edge of precentral gyrus inhibit red nucleus , if this inhibition is lost by decortication >>> disinhibition of the red nucleus , so facilitate the rubrospinal tract to flex U.L
- Also/ there is loss of inhibitory cortical signals (from suppressor area 4 to gamma motor neurons via reticulospinal)

Note:
Corticospinal tract is interrupted , so the pontine reticulospinal and the vestibulospinal extend LL



B- Decorticate rigidity:

Reflexes that are lost/absent	Reflexes that are retained /still present
Placing Reaction	Tonic Labyrinthine reflexes
Hopping Reaction	Tonic Neck Reflexes
Visual righting reflex	Other Righting Reflexes

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



TEST YOURSELF !

Which of the following can compensate for loss of auditory, vestibular & proprioception?

A) Vestibular Apparatus

B) Neck Proprioceptors

C) Vision receptors

D) Proprioceptors of muscle

Which of the following is true during Ventroflexion of head in Neck Static Reflex?

A) Arms extended + flex hindlimb.

B) Arms flexion + extend hindlimb

C) Arms and hindlimb extended

D) Extension of limbs on that side + flexion of otherside

Which of the following is the Receptors for Labyrinthine Static Reflex?

A) Otolith organs

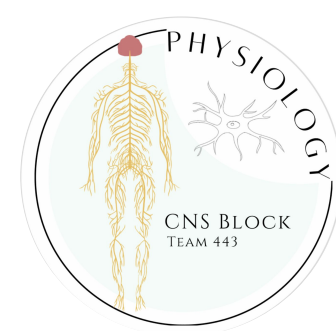
B) SCC receptors

C) muscle spindles

D) eye receptors

answer
key:
1: C
2: B
3 :A

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Sarah Alshahrani

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Ziyad Alsalamah

Omar Alamri

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Mohammad Alzahrani

Khalid Alanezi

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Abdullah alzamil

Mohammed Alqutub

Salmam Althunayan

faisal alzuhairy

Mohammed Alarfaj

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