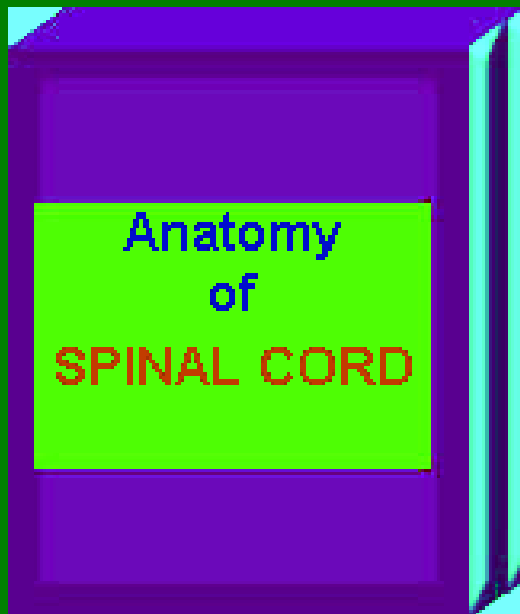
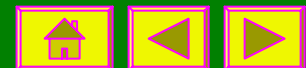




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Anatomy of The Spinal Cord

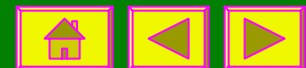


PROTECTION FROM TRAUMA

- Part of CNS
- Vertebral column
- Dura mater – cord is anchored to it by denticulate ligaments and nerve roots. DL – 21 pairs on lateral surface of cord
- Arachnoid mater + CSF
- Pia mater

MENINGES

- Dura mater – is continuous with the cranial dura. Extends upto S 2-3. There is a potential epidural & subdural space.
- Arachnoid mater, contains sub-arachnoid space filled with CSF
- Pia mater – is closely applied to the cord. Continues as the Filum terminale. FT merges distally with the periosteum of the coccyx.



EXTERNAL MARKINGS

- Has white matter outside & Gray matter inside.
- Divided into symmetrical halves by a deep anterior median fissure & a superficial posterior median sulcus
- Ventral rootlets exit via anterolateral sulcus & dorsal exit via posterolateral sulcus

DIFFERENTIAL GROWTH OF SPINE & CORD

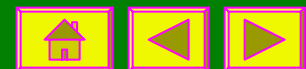
- At 3 month fetal life spinal cord extends along the entire spinal canal
- In a newborn it extends till L3
- In adults cord extends from Foramen Magnum to L1/L2. (T12 – L3)
- Average length of cord is 42-45 cm in adult

SEGMENTAL LEVELS

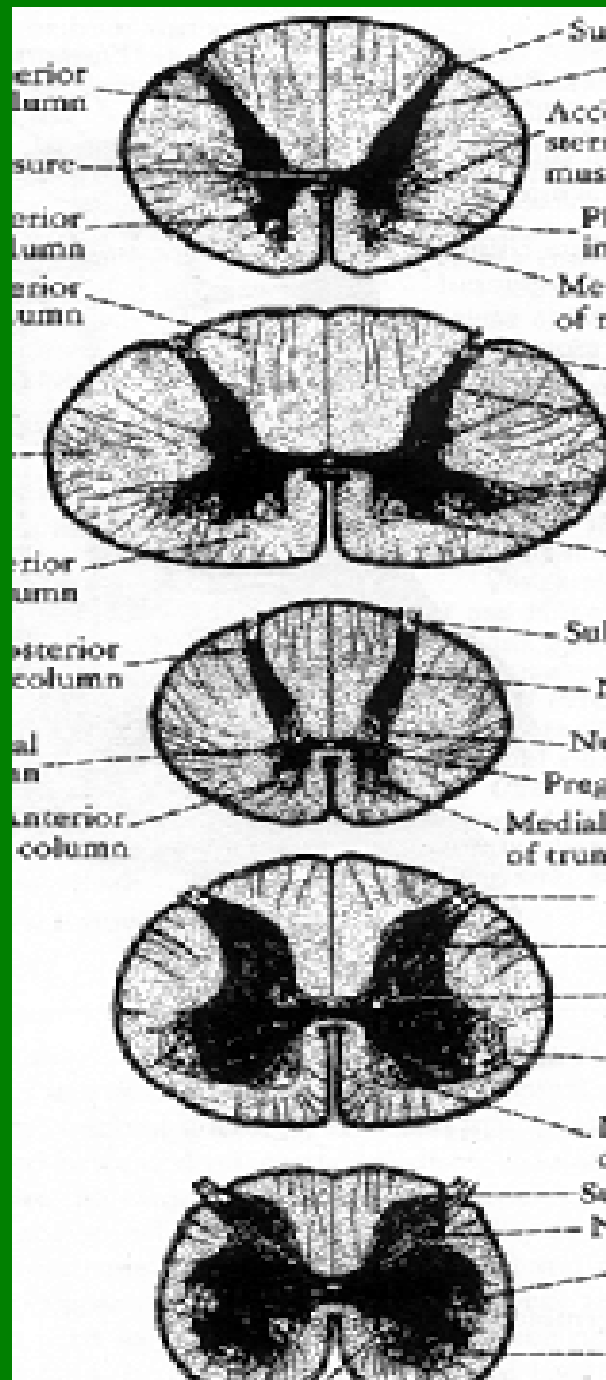
VERT LEVEL	SEGMENTAL LEVEL
CERVICAL	ADD 1
T1 – T6	ADD 2
T7 – T9	ADD 3
T10	L1, L2
T11	L3, L4
T12	L5
L1	SACRAL + COCCYGEAL

CERVICAL & LUMBAR ENLARGEMENTS

- Cord reduces in dimension from cranial to caudal
- However there is enlargement of cord in cervical and lumbar regions corresponding to the brachial and lumbo-sacral plexi. Maximum at C6-7 & T12
- Cervical Enlargement is $>$ LS enlargement. Cord is flattened in AP in cervical region



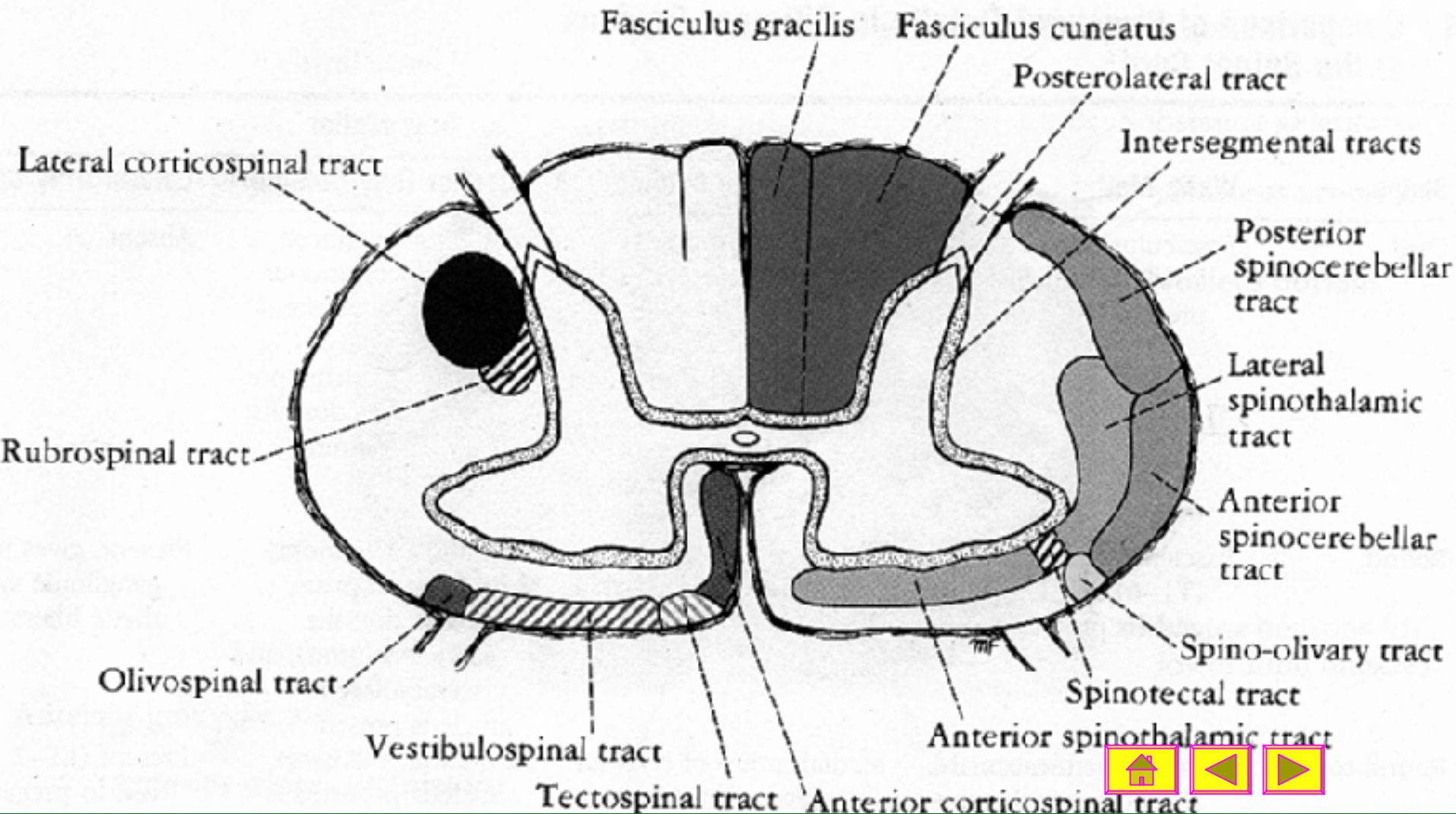
REGIONAL DIFF IN CORD TS



GRAY MATER

- Max. at brachial & lumbosacral plexi.
(proportional to amount of muscles innervated by the segment)
- Anterior column
- Lateral column – T1-L3 (Symp), S2-4 (Parasymp)
- Posterior column
- Gray commissure.

TS OF CORD



WHITE MATER

- Reduces from cranial to caudal
- Posterior columns – fasciculus gracilis & fasciculus cuneatus
- Lateral columns
- Anterior columns
- White commissure

CENTRAL CANAL

- In centre of gray commissure. Lined by ciliated columnar epithelium
- Barely visible to the naked eye
- Continuous with central canal of Medulla Oblongata
- In the conus medularis expands to form the terminal ventricle
- May have septae of epithelial lining

SPINAL NERVES (SEGMENTS)

- 31 Pairs :-
 - Cervical -- 8
 - Thoracic -- 12
 - Lumbar -- 5
 - Sacral -- 5
 - Coccygeal -- 1

Spinal nerves

- C1 to C7 nerves exit from I.V. foramina above the respective vertebrae
- At other levels they exit from I.V. foramina below the respective vertebra.
- Increased obliquity of spinal nerves in the distal spinal canal due to differential growth
- \therefore PIVD compresses subsequent roots in cauda equina

MAX FRACTURES

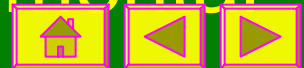
- Occur in cervical vertebrae as they are smallest & most fragile & most unsupported
- Max cord damage in dorsal region due to small spinal canal

MAX DISLOCATIONS

- Occur at sites of maximal mobility
 - C5 - C6
 - T12 - L1
 - C1 – C2

MAX PIVD

- L4-5 presses L4/5 root
- L5-S1 presses L5/S1 root
- C5-6 presses C6 root
- C6-7 presses C7 root
- Lumbar PIVD
 - Central PIVD compresses multiple roots
 - Lateral PIVD compresses segmental roots

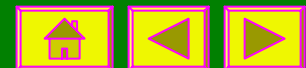


SITES FOR CSF TAP

- CISTERNA MAGNA
- LUMBAR
 - CHILD – at L4-5
 - ADULT – below L2-3

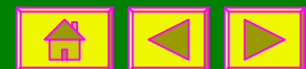
Conscious sensory information

- Pain & Temp – Lateral ST Tract on oppo side -> post cent gyrus oppo side
- Discriminative touch, vibration sense, muscle, joint sense > fas grac / cun on same side > cross in mid meddula oblongata > post central gyrus on oppo side
- Light touch & pressure in anterior spino-thalamic tract oppo side> post cent gyrus oppo side



Unconscious sensory information

- From muscle, joint, tendons > posterior spinocerebellar tract on same side and anterior spino-cerebellar tracts on both sides. Fibres of anterior spino-cerebellar tracts cross to same side in cerebellum. Thus proprioceptive info goes to same side cerebellum
- Cuneo-cerebral & spino-olivary tracts also carry proprioceptive info to same side cerebellum



Spino-tectal tract

- Carries info from opposite side of body to superior colliculus for spino-visual reflexes

Somatic vs visceral pain

- Somatic sharp pain travels via fast neurons, burning pain travels via slow neurons
- Visceral pain travels via ANS in lateral gray horns to post central gyrus. Is poorly localised and asso with nausea, vomiting, salivation, sweat, tachycardia.

CORTICOSPINAL TRACTS

(Pyramidal tracts)

- Rapid, skilled, voluntary movements esp distal ends of limbs
- Motor cortex >
 - most decussate at pyramids > lat corticospinal tracts
 - Few > antr corticospinal tracts > decussate at level of segment
 - Terminate at anterior horn cells

RETICULOSPINAL TRACTS

- Can inhibit / facilitate voluntary movements
- Reticular formation to anterior horn cells

TECTOSPINAL TRACTS

- **EXTENT** :- Superior colliculus to anterior motor neurons
- **FUNCTION**:- Reflex postural movements concerning sight

RUBROSPINAL TRACTS

- **EXTENT:-** Red nucleus to anterior horn cells
- **FUNCTION:-** Facilitate activity of flexor muscles. Inhibit activity of extensor muscles

VESTIBULOSPINAL TRACTS

- **EXTENT:-** Vestibular nucleus to anterior horn cells
- **FUNCTION:-** Facilitate activity of extensor muscles. Inhibit activity of flexor muscles
- Uncrossed

OLIVOSPINAL TRACTS

- **EXTENT** :- Inferior olivary nucleus to anterior motor neurons
- **FUNCTION**:- ??

- Pyramidal tracts increase muscle tone.
- Extrapyramidal tracts reduce muscle tone
- Thus in lesions affecting these opposite occurs

INJURY TO CORTICOSPINAL TRACTS

- Loss of fine skilled voluntary movements
- Babinski's sign
- Loss of superficial abdominal reflexes
- Loss of cremasteric reflex
- Hypotonia

INJURY TO EXTRAPYRAMIDAL TRACTS

- Hypertonicity / spasticity.
- UL in flexion. LL in extension
- Exaggerated deep muscle reflexes.
Clonus in calf, quadriceps femoris,
flexors of fingers
- Clasp knife rigidity

Injury to fasciculus cuneatus / gracilis

- Loss of proprioception of ipsilateral side below level of lesion. Can't tell position of limb if eyes are closed
- Loss of vibration sense on same side
- Loss of tactile discrimination on same side. Normal 3-4 mm in finger tips, 65 mm on back
- Light touch is preserved

Injury to anterior spino-thalamic tracts

- Contra-lateral loss of light touch & pressure below the level of lesion
- Can't feel wisp of cotton or pressure from blunt objects

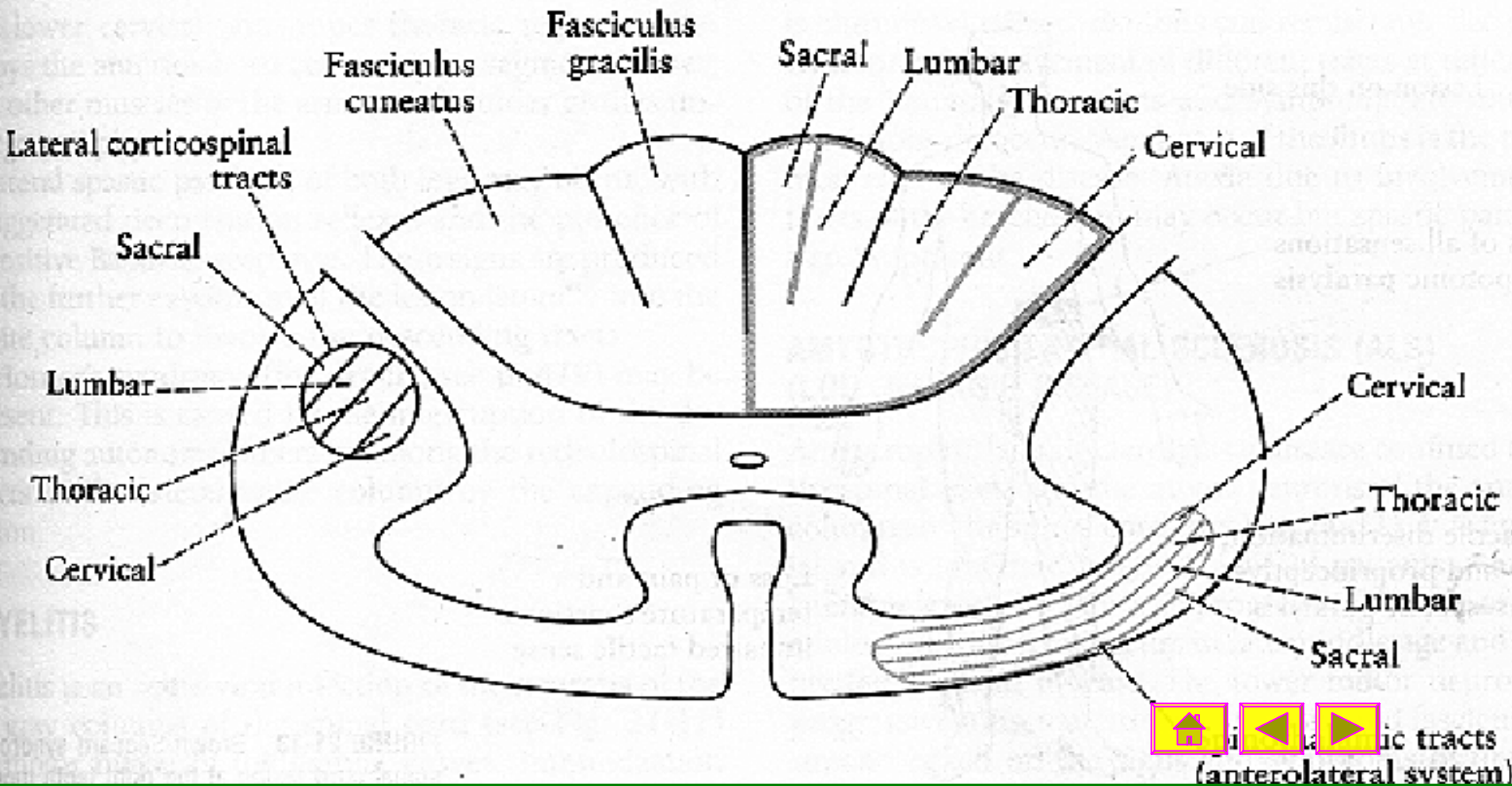
Injury to LAT ST TRACTS

- Contra-lateral loss of pain & temp below the level
- Can't recognise pin prick or hot & cold objects

BRAINSTEM VS CORD LESION

- Spinothalamic tracts decussate at segmental level
- Dorsal columns decussate at lower medulla oblongata
- All sensations of opposite side are lost in brainstem lesion
- Pain & Temp of opposite side & touch & proprioception of same side is lost in cord lesions

LAMINATION OF TRACTS



CORD COMPRESSION

- Affects corticospinal, then affects posterior columns and then spinothalamic tracts.
- Compression of cervical cord causes paresis of ipsilateral UL, LL, contralateral UL, LL

SPINAL SHOCK SYNDROME

- Total loss of function of cord below level of severe cord lesion for 24h upto 4 weeks.
- May cause hypotension due to loss of sympathetic vasomotor tone

COMPLETE CORD TRANSECTION SYNDROME

- Bilateral LMN at the level of lesion
- Bilateral UMN palsy below the level
- Loss of pain temp and light touch is caused a few levels below due to oblique decussation of ST tracts
- Loss of proprioception & vibration & tactile discrimination below the lesion
- Loss of bowel & bladder control

ANTR CORD SYNDROME

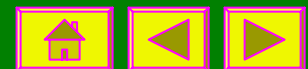
- Caused by PIVD, antr spinal artery infarction
- Bilat LMN palsy at the level. Damage to antr horn cells
- Bilat UMN palsy below the level
- Bilateral loss of pain temp and light touch below the level
- Postr columns are preserved

CENTRAL CORD SYNDROME

- Caused by hyperextension of cervical spine
- Bilat LMN palsy at the level
- Bilat UMN palsy below the level. Sacral sparing. UL involved more than LL
- Bilat spinothalamic tract signs below the level. Sacral sparing. UL involved more than LL

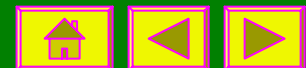
BROWN SEQUARD SYND

- Caused by hemisection of cord
- Ipsilateral LMN at the level
- Ipsilateral UMN below the level
- Ipsilateral loss of dorsal columns below the level
- Contralateral loss of pain & temp & light touch distally from 2-3 segments below the level



SYRINGOMYELIA

- Central canal dilation causes white commissural damage. Usually occurs in cervical segments.
- Bilateral Lateral & Anterior spinothalamic tracts are damaged, causing loss of pain & temp. & light touch sensations. Posterior columns are preserved. Causes dissociative sensory loss. Shawl like distribution



AMYOTROPHIC LATERAL SCLEROSIS

- Involves bilateral corticospinal tracts and anterior horn cells
- Progressive disease. Late middle age. Fatal in 2-6 years
- LMN sign sget superimposed on UMN signs

TABES DORSALIS

- Destroys nerve fibres at entrance of posterior root into cord esp in lower dorsal & lumbosacral segments. Affects trunk and lower limbs
- Stabbing pain, paresthesia, Loss of all sensations, ataxia worse on closing eyes, loss of tendon reflexes
- Fig 20.9 354

SUBACUTE COMBINED DEGENERATION

- Due to deficiency of Vit B12 (Cyanocobalamin)
- Pernicious anaemia
- Degenerative changes in CNS & PNS
- Posterior white columns(fasciculus gracilis) & Corticospinal tracts are involved

LOCALISATION OF LESION

- SENSORY LEVEL
- MOTOR LEVEL
- SUPERFICIAL & DEEP REFLEXES



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