

" Dz & Spinal cord "

Dr. Ejjad

13,500,000 : عدد ال Neuron cylindrical column : (anatomy)

35g : الوزن cm 43 : ♀

1 cm : diameter ♂ cm 45

(medulla oblongata) : Foramen magnum من حيث ال Spinal cord *

vertebral column : موجود جوار ال (يتفرع) : *

• at 3rd month intrauterine : fills whole s. canal Canal ال

L4-5 : Lp ال Spinal cord • at birth : end at level of L3 vertebra.

L3-4 : ال Spinal cord • in adult : " " " lower border of L1

Function of spinal cord

Conduction Function

Reflex Center

for all spinal reflexes

Ascending tracts

descending

Brain ← Sensory impulses SC

SC ← motor impulse Brain

pain, Temp. Sensation ← [lat. spinothalamic Tract]

motor ← [lat. corticospinal Tract]
[ventral " "]

Meninges of SC

SC

one layer

Dura matter

S2

external layer

Arachnoid

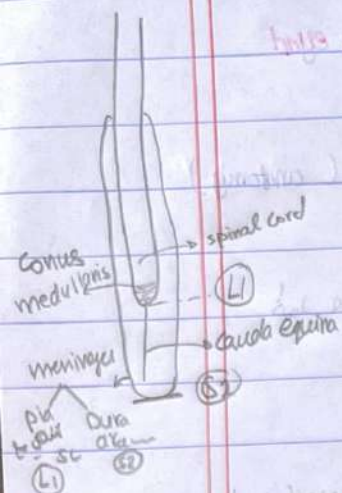
S2

Pia matter

at level of SC termination (lower border of L1 in adult)

Spinal cord, ال : more internal layer

" D2 & Spinal cord "

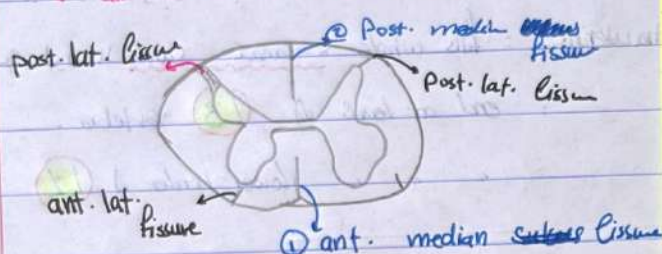


• Vertebral plexus, (contains fat) vertebra II, dura III space ← epidural space
(lubrication II serous fluid) arachnoid II, " " " ← subdural "
(root spinal N, CSF + B.V. III) " , pia " " ← sub arachnoid "

(LMNL) Cauda equina Syndrome

Collection of nerve roots - cauda equina - 11 bilat
(horsetail-like) * L3-L5 N: roots *
: in Triad - 2, 4, 6 11 = 10 *
11 bilat. paraplegia of m. & leg, buttocks
21 saddle anesthesia + sensory deficit below groin
31 incompetence of bladder, rectal sphincter

♥ external structures of S. cord :-



* Spinal cord segments // 31

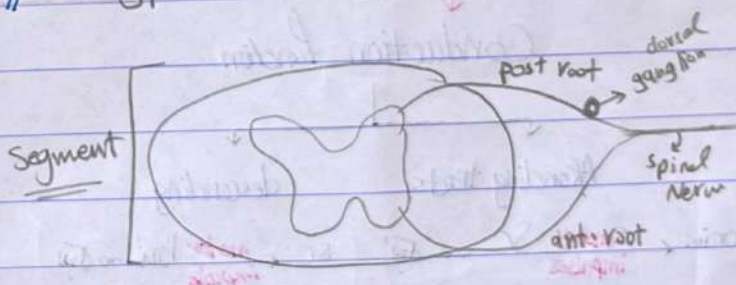
8 Cervical segments

12 Thoracic "

5 lumbar ~

5 Sacral

1 conjugate



CNS [$\begin{array}{l} \text{Conus medullaris } \rightarrow L4, 5, S1, 2 \text{ segments} \\ S3, 4, 5 \leftarrow \text{Terminal part of S. cord} \\ \text{Collection of lumbosacral roots} \end{array} \leftarrow \begin{array}{l} \text{epiconus} \\ \text{Conus medullaris} \\ \text{Cauda equina} \end{array} \right] *$

* cord يتردد عند level 1 ، نفق roots لـ س يملأوا ، فواصل

peripher nervous system 6 الحبل العنبري Cauda equina, ذئب
LMNL ذئب في الحبل العنبري

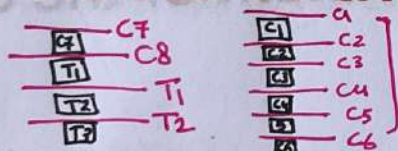
between the Spinal Cord and the Vertebra

No	Spinal Cord Vertebral Column	Vertebra
1	From C ₁ - C ₄ segments	Opposite C ₁ - C ₄ C ₁₋₄ على مستوى
2	From C ₅ - C ₈ segments Vertebra C ₅ على مستوى C ₆ segment	Subtract 1 يعني
3	From T ₁ - T ₆ segments	Subtract 2 بقي 2
4	From T ₇ - L ₂ segments Vertebra T ₅ على مستوى T ₈ segment	Subtract 3
5	L ₃ - L ₄ segments	Opposite T ₁₂ T ₁₂ على مستوى
6	L ₅ and all sacral	Opposite L ₁ L ₁ على مستوى

segments

من T₇ على مستوى T₁₀ segment
loss sensation at umbilical level
من T₁₀ على مستوى T₁₂ segment

The Roots of the Spinal Cord



* ال roots بتطلع من قوس ال vertebra زي :
من T₁ نصل ال T₁ لتي بصير يطلع
من C₁ ال vertebra

1. **Two posterior roots:** there are **sensory fibers** (afferent fibers).

2. **Two anterior roots:** there are **motor and autonomic** fibers (efferent fibers).

- The **anterior and posterior roots** will join to form a single **mixed nerve** called the **spinal nerve** → **31 pairs of spinal nerves** (right and left).
- Each spinal nerve emerges from the **intervertebral foramen**.

// Spinal Cord // major ligaments *

Post. longitudinal ligament ✓

ant. " " ✓

Supraspinous " ✓

interspinous " ✓

Lacet capsulary " ✓

intertransverse " ✓

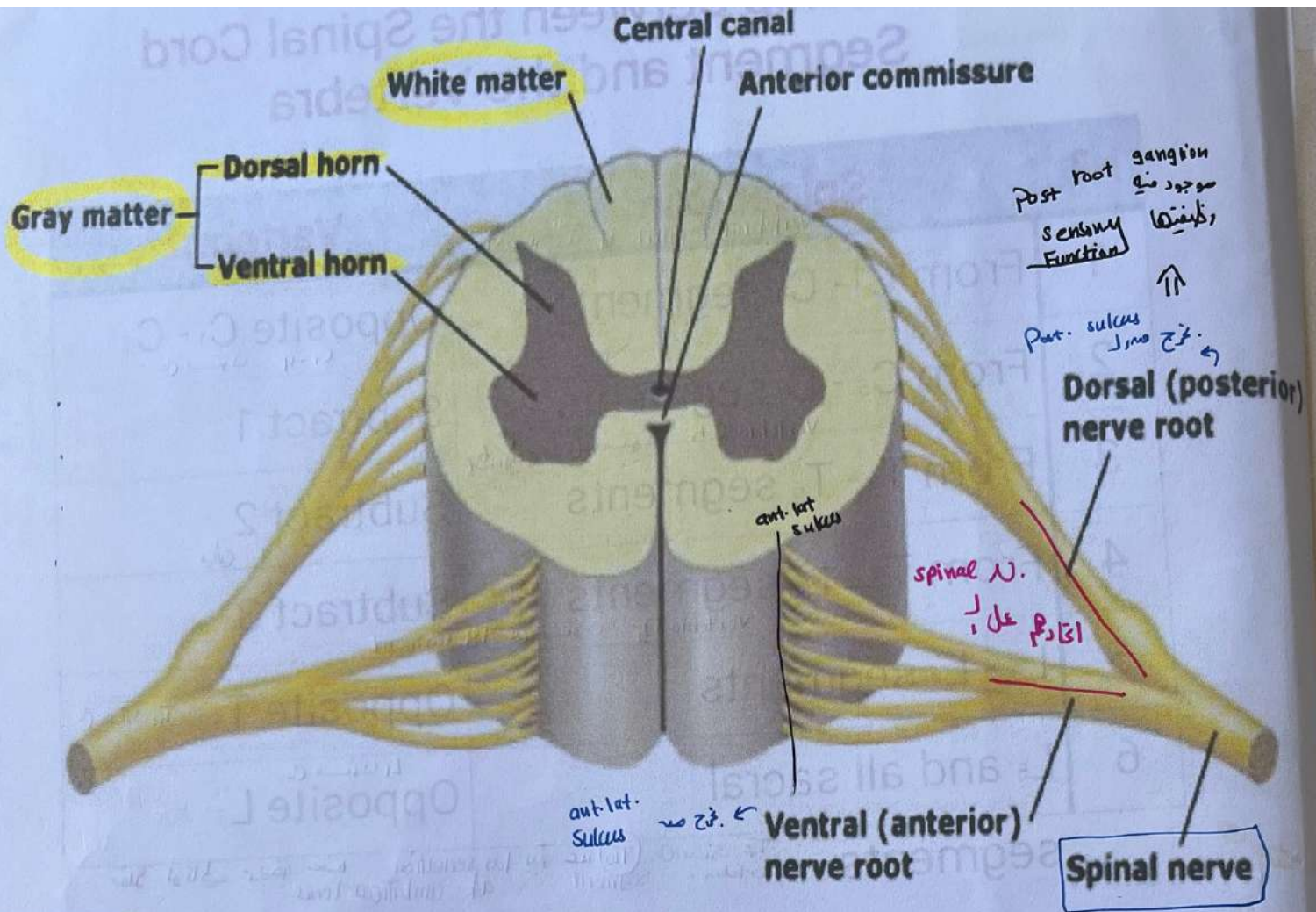
Ligamentum Flavum ✓

3 From T₁ - T₆ segment

4 From T₇ - L₂ segment

vertebra T₅

5 L₃ - L₄ segment



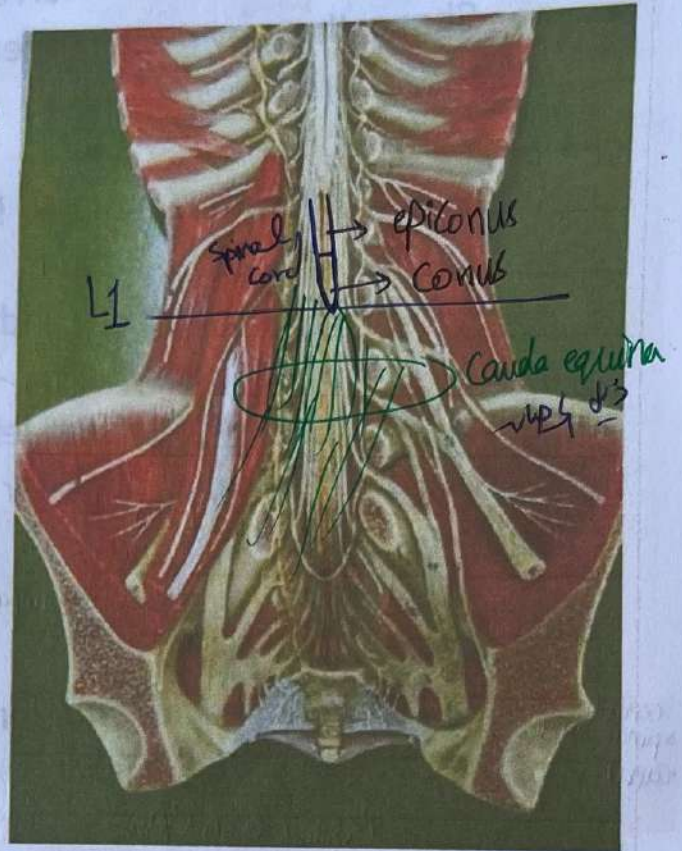
Cervical Enlargement of the Spinal Cord

It is the C5, 6, 7, 8 and T1 segments of the SC, corresponding to the region from which the brachial plexus arises → give spinal nerves that supply the upper limbs.



Lumbar Enlargement of the Spinal Cord

It is the L1, 2, 3, 4, 5 and S1, 2 segments of the SC, corresponding to the region from which the lumbar and sacral plexuses arises → give spinal nerves that supply the lower limbs.

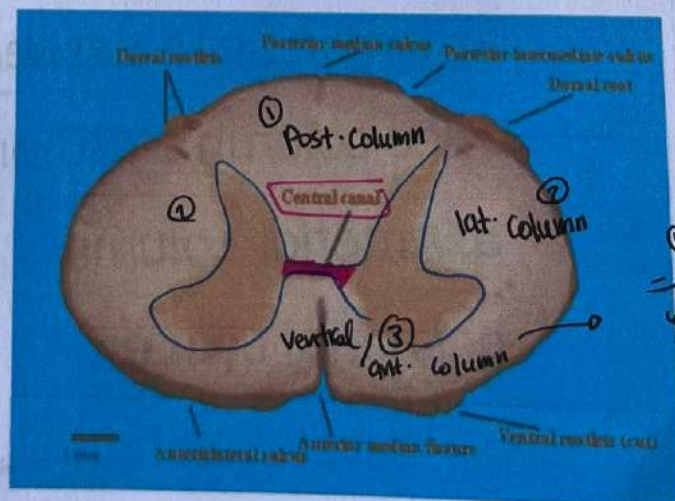


Internal Structure of the Spinal Cord

A transverse section in the SC is

formed of:

- **White matter.** → more outer
- **Gray matter.** (more inner)
- **Central canal** (1 mm in diameter): is present in gray matter.



①②③
→ iso
white
matter

The Gray Matter of the Spinal Cord

Structure: it consist of nerve cells.

Shape: the grey matter resembles the letter "H" and formed of:

1. Anterior horns (right and left):

Consist of motor cells. ✓

2. Posterior horns (right and left):

Consist of sensory cells. ✓

3. Lateral horns (right and left):

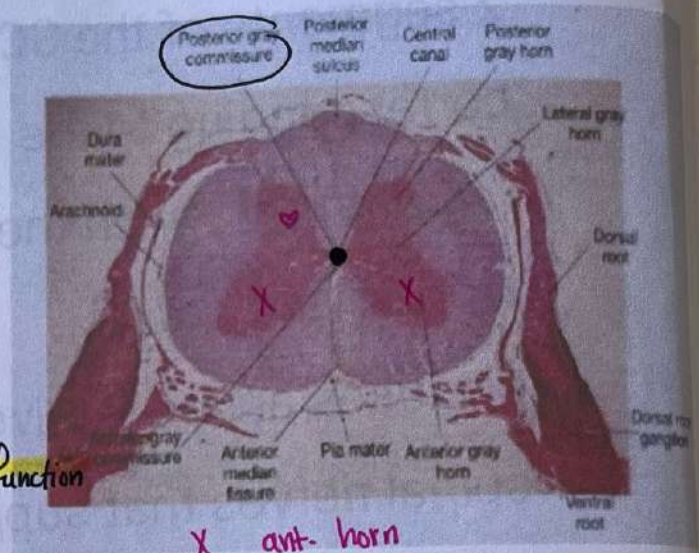
In the thoracic and lumbar regions (T₁ → L₂)

has autonomic cells. sympathetic function

4. central canal.

5. Gray commissure: anterior and posterior gray commissure.

... 4th ventricle or دماغية ناعية



central spinal canal
قناة النخاع

The White Matter of the Spinal Cord

white matter
النخاع الأبيض
myelinated fiber
ألياف مغطاة بالميالين

The white matter surround the gray matter and contains

ascending and descending tracts. It is divided into three column of SC on each side:

a. Anterior column

b. Lateral column

c. Posterior column → deep sensation

ant-lat. 2/3 SC

- 2 ant. art I Vertebral art
ثم يتجهوا الى جوفاء واحد
Post-art خلف الشرج

PICA

occlusion
Post-5.6
4B

-
- Arteries of Spinal Cord - Intrinsic Distribution**
- Schema**
- post 113
SC
- Right posterior spinal artery
- Subclavian branches to right side of spinal cord
- Peripheral branches from post plexus
- Subclavian branches to left side of spinal cord
- Left posterior spinal artery
- Zone supplied by penetrating branches from post plexus
- Zone supplied by central branches
- Zone supplied by both central branches and branches from post plexus
- Left posterior radicular artery
- Left anterior radicular artery
- Anterior spinal artery
- Right anterior radicular artery
- Post arterial plexus
- Right posterior radicular artery
- Radicles
- ant-art
- radicular
- Rt
- IF
- " " " "

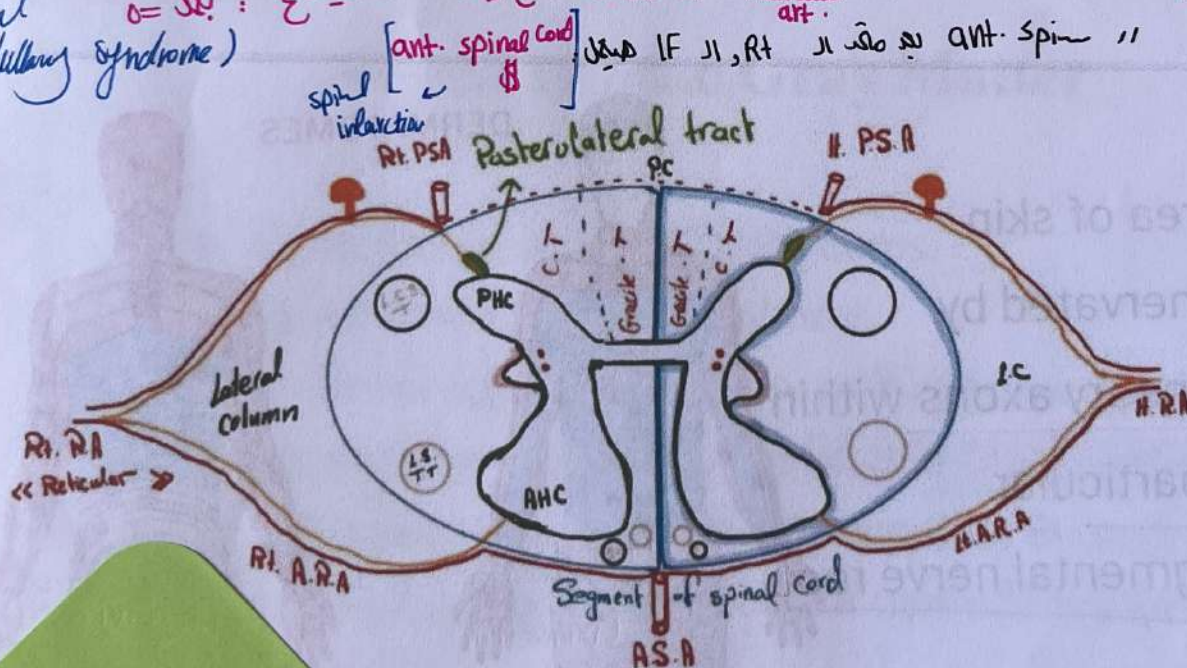
- حد فیرم
of

Adamkiewicz.

- e. Ascending sacral

arteries.

(Medial medullary syndrome)



Post. spinal Post. R. A
ant. spinal art. ant. R. A

radial

L.C.S.T $\Rightarrow$ Lateral corticospinal tract
L.B.T.T $\Rightarrow$ Lateral spinothalamic tract
V.C.S.T $\Rightarrow$ Ventral corticospinal tract

Myotomes

- Segmental nerve root innervating a muscle

- Upper limbs:

C₅ - Deltoid.

C₆ - Wrist extensors.

C₇ - Elbow extensors.

C₈ - Long finger flexors.

T₁ - Small hand muscles.

منه كد
منه دونه جها
innervation

(patellar reflex)

ant. motor neuron in horn → patella (كعب) → dorsal horn

kick → m. rect femoris
LMNL in horns → reflex

hyperactive → LMNL

(plantar reflex)

= Babinski sign.

plantar flexion (انحناء القدم) : normal

normal
abnormal → dorsiflexion
LMNL

Dorsiflexion is normal in infant
< 12 m. due to incomplete myelination

[Myotomes]

• Lower Limbs :

L₂ - Hip flexors.

L_{3,4} - Knee extensors.

L_{4,5} - S₁ - Knee flexion.

L₅ - Ankle dorsiflexion.

S₁ - Ankle plantar flexion.

* [reflex Grading]

+3 = Brisk (UMNL)

0 = No reflex

+4 = Very "

+1 = Diminished (LMNL)

+5 = Sustained Clonus

+2 = Normal

Spinal Cord Reflexes

... هامل انواع ال reflexes

- ✓ • Spinal stretch "Myotatic" reflexes.
- ✓ • Withdrawal spinal reflexes.
- ✓ • Changes in vascular tone resulting from changes in local skin heat.
- ✓ • Sweating which results from localized heat on the surface of the body.
- ✓ • Intestino-intestinal reflexes that control some motor functions of the gut.
- ✓ • Peritoneo-intestinal reflexes that inhibit gastrointestinal motility in response to peritoneal irritation.
- ✓ • Evacuation reflexes for emptying the full bladder or the colon.

قطع الهمية الكاملة باليد اليمنى

Complete Spinal Cord Lesion

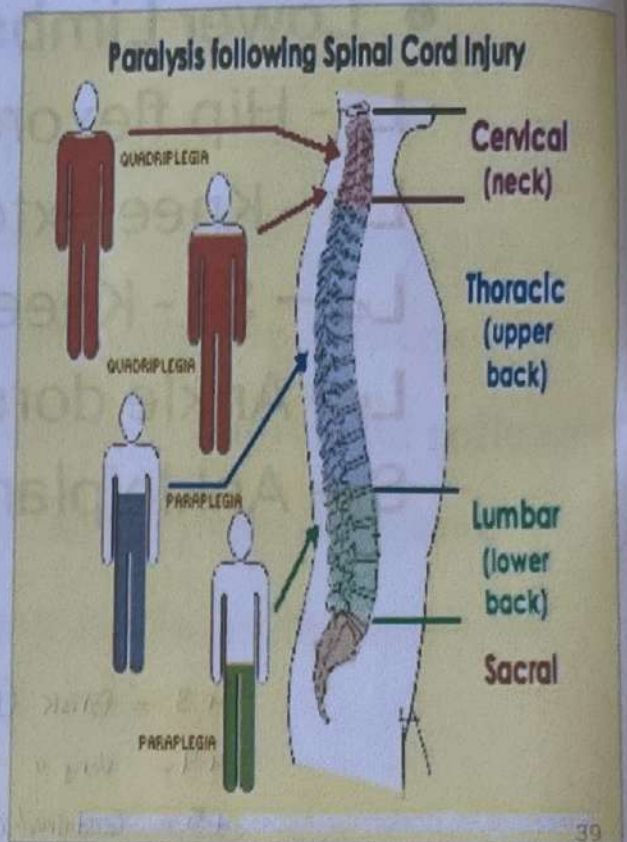
امنا اتول دة عند Complete S.C lesion

① ★ Complete loss of motor power below the level of lesion.
فقدانه، اقله بالكمال
اقل مستوى الهمية

② ★ Complete loss of sensation (superficial and deep) below the level of lesion.
فقدانه، اقله
اقل المستوى

③ ★ Atonia and flaccidity with areflexia (in shock stage).
فقدان، اقله
فقدان الهمية
brain
S.C. cord
فقدان الهمية
Shock

④ ★ Sphincter dysfunction.



What is the Difference Between Spinal Shock and Neurogenic Shock?

- Spinal shock is mainly a loss of reflexes (flaccid paralysis).
- Neurogenic shock is mainly hypotension and bradycardia due to loss of sympathetic tone.

high level
of S.C
injury
فقدان الهمية
symp. tone
damage
فقدان الهمية

* يتقطع الهمية الهمية Sympath fibers الهمية hypothalamus
(T₁ - L₂) lat. horn cell
Cardiac plexus الهمية S. fiber الهمية الهمية heart الهمية الهمية
upper thoracic segments
hypotension, brady. ف. ↓ symp. to heart
فلو الهمية الهمية T₆ الهمية

Neurogenic Shock

- More commonly seen in cervical injuries "above T₆" due to interruption of the sympathetic input from hypothalamus to sympathetic centers in the lateral horn cells "T₁ - L₂".
- Neurogenic shock is characterized by **Triad of**:
 - Hypotension.
 - Bradycardia.
 - Hypothermia.

bilat Flaccid paralysis (loss LMN) below lesion $\Leftarrow$ **Spinal Shock** $\uparrow$ = spinal shock ant. spinal art. infarction

• LMN defects below lesion not recover.

- **Definition:** immediately loss of all SC functions, including the spinal reflexes after sudden transection of the SC.

لا بد في جميع الحالات من الانتعاش بعد إصابة الخلايا العصبية فوق الحبل الشوكي، لكن في بعض الحالات لا تتعافى الخلايا العصبية تحت الحبل الشوكي (LMN defect after lesion) $\rightarrow$ لا تتعافى الانعكاسات الشوكية (deep tendon reflex)

- **Duration:** from two weeks to several months.

- **Mechanism:** Due to sudden withdrawal of supraspinal facilitation on the alpha motor neurons in AHCs.

لكن يمكن أن يكون عديم spinal shock $\rightarrow$ Neurogenic shock $\rightarrow$ Lumbar or lower thoracic injury

لكن Neurogenic shock $\rightarrow$ spinal shock $\rightarrow$ spinal shock

The Manifestation of Spinal Shock

- Loss of all sensation **below** the level of lesion.
- Vasodilatation and hypotension **below** the level of lesion.
- Quadriplegia or paraplegia (depending **on the** level of the lesion)
- Loss of spinal reflex activity **below** the level of lesion:
 - Loss of deep and superficial reflexes.
 - Loss of muscle tone with flaccidity of the paralyzed muscles.
 - Loss of erection, micturition and defecation reflexes.

Complication of the Spinal Shock

- **Hypotension** (specially in cases of high-level spinal cord lesion).
- **Muscle wasting**.
- ulcers ● **Bed sores** due to ischemia of the areas are compressed against bed.
- **Urine tract infection** due to urine retention and stasis. *urosepsis*
- **Decrease of the body temperature** due to reduction of the metabolic rate after loss of the muscle tone.
- **DVT and pulmonary embolism.** *stasis in venous drainage*

m. hypotonia

Complete Lesion of C₁ - C₄ Segments of the Spinal Cord

Phrenic N. في C₃₋₄
(diaphragmatic)

لأنه على مستوى

تقطعناه من C₁-C₄ سنو بصر ؟

★ Paralysis of respiratory muscles.

من حيقير يتنفس

★ Central or spastic

لا تتكيف ال
Shock stage
Central/spastic

quadriplegia. (flaccidity in shock stage).

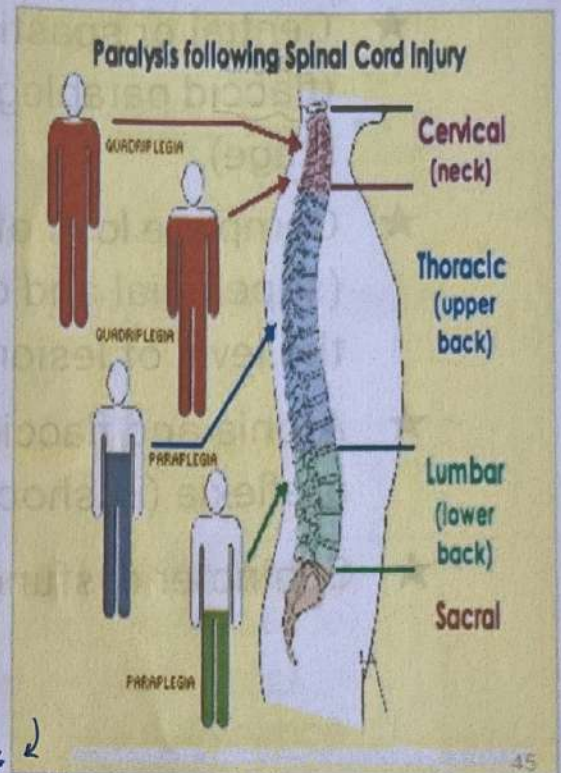
تتغير من 3 أسابيع - 3 شهور

★ Complete loss of sensation (superficial and deep) below the level of lesion.

★ Atonia and flaccidity with areflexia (in shock stage).

★ Sphincter dysfunction.

في النخاع هذا MRI لتأكد اننا قطعنا C₁ - C₄ ..



Complete Lesion of C₅ - T₂ Segments of the Spinal Cord

(brachial plexus)

هذا اعطى فخرج منه

LMNL due to damage A.H.C

★ Quadriplegia (flaccidity at the level and spasticity LMNL below the level). Flaccid quadriplegia in shock stage.

★ Complete loss of sensation (superficial and deep) below the level of lesion.

★ Atonia and flaccidity with areflexia (in shock stage).

★ Sphincter dysfunction.

♥ Damage C₇ segment :-

upper limb partial paralysis

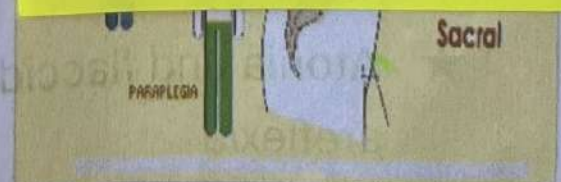
لأنه C₅₋₆ سلبية مفادى - شغل

Shoulder (لا يقوى لا شغل اعتراف)

لكن اليد شغل مش هتتحرك خالص

LL Complete paralysis

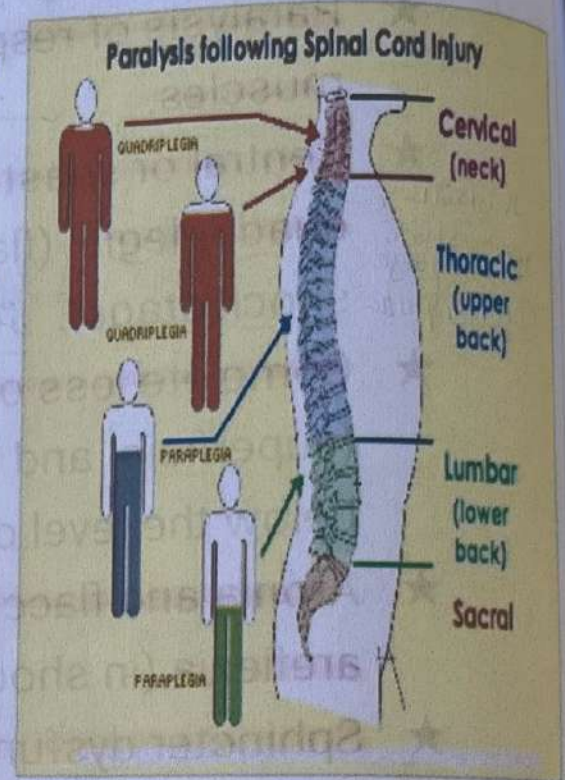
لأنه من C₅-T₂ damage



Complete Lesion of T₃ – T₁₂ Segments of the Spinal Cord

✓ ال LL هيكونوا في الفل

- ★ **Central or spastic paraplegia** (flaccid paraplegia in shock stage).
- ★ **Complete loss of sensation** (superficial and deep) below the level of lesion.
- ★ **Atonia and flaccidity with areflexia** (in shock stage).
- ★ **Sphincter dysfunction.**



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Complete Lesion of L₁ – S₂ Segments of the Spinal Cord

ال origin يقع :
plexus

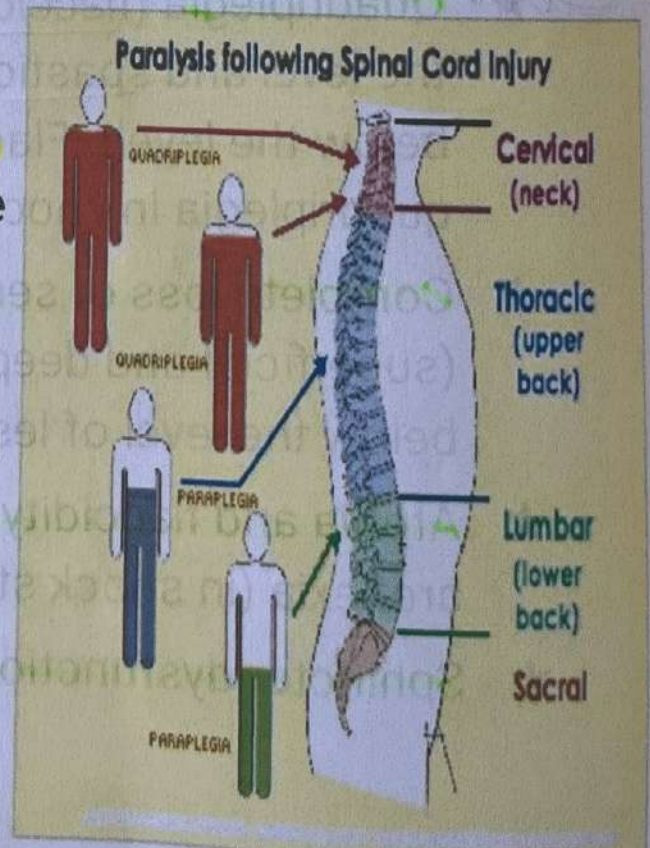
LL الى ليفوا (lumbo-sacral)

- ★ **Paraplegia: LMNL at the level and UMNL below the level of injury.**

قد تكون partial
لو انضوب L5-S1
هتكون Quadriceps
سليمة extension, knee
... سليم

- ★ **Complete loss of sensation** (superficial and deep) below the level of lesion.
- ★ **Atonia and flaccidity with areflexia**

- ★ **Sphincter dysfunction**



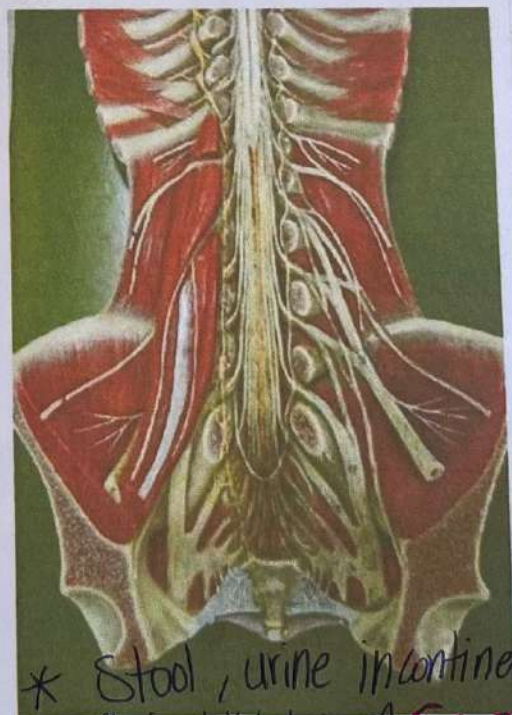
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Differentiation between Conus Medularis and Epiconus Lesion

	Epiconus	Conus medularis
Segment	L 4 - S ₂	S 3,4,5
Motor weakness	Flaccid lower paraparesis or monoparesis	Absent <i>لا نه هذا مركز Parasymp. nervous system</i>
Reflexes	Lost ankle reflexes with preserved knee reflexes <i>L1,2,3 ←</i>	Lost anal reflexes
Sensory loss in the L.L.	Lost below the level of	Lost in S 3,4,5 area
Autonomic changes	lesion Sphincter dysfunction	Early urinary incontinence Early fecal incontinence

Lesion of the Cauda Equina

- ★ Weakness of one or both L.L. (asymmetrical): lower asymmetrical flaccid paraparesis or monoparesis. (weakness and loss of reflexes occur according to affected roots).
 asymmetric m. power ✓
 لانه PNS
 لغير
 Lower motor neuron
- ★ Painful onset (radicular pain) referred to L.L.
- ★ Later radicular sensory loss of both superficial and deep sensation according to affected roots.
- ★ Neurogenic bladder occur in bilateral lesions of S 3, 4,5 roots.
- ★ Loss of anal sphincter



* Stool, urine incontinence occur in bilat. lesion of S2,3,4

Differentiation between Lesion of Cauda Equina & Polyneuropathy

	Lesion of the Cauda Equina	Polyneuropathy
Symmetry	~~Asymmetrical~~	~~Symmetrical~~
Sensory loss	According to affected root	Stock and glove loss sensation distally in hand, foot
Affected of UL	Not affected	Commonly LL affect > UL
UL Sphincters	Commonly affected S3-4,5 segment فاصلة لوضوئیت	affected Not affected
Bed sores	common	May be present

" Spinal cord "

Tracts (sensory / motor)

Sensory

Motor

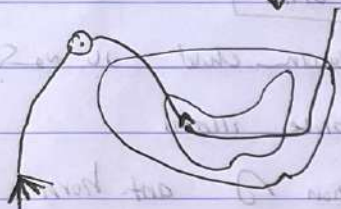
spinothalamic

Post. Column

Corticospinal

Cross in Cord level

muscles → signal → ipi → ✓



2 Neuron
1st neuron → from Cortex to ant. horn
LMNL ← 1st neuron

2nd " → " ant horn to m.
LMNL ← 2nd neuron

1st neuron → Cortex → ant. horn

medulla & pons & ipsi → midbrain

Contra. → Cross down to, lower medulla

lat. white matter → spinal cord

ant. horn → neuron → synapse

→ m. → ant. horn



UMNL

LMNL

spastic paralysis

Flaccid

hyperreflexia

loss reflex

pronator drift

atrophy

arm out
palm up

fasciculation

Pain, Temp, crude touch

Carries Contralat. sensory information

1st Tract → Cross in cord level

synapse in dorsal horn

Contra. → Tract → 2nd neuron

white matter → RT → ipsi

spinal cord → medulla → pons → midbrain → Thalamus

Post. Column

= Dorsal column = medial lemniscus

Cross in medulla

Vibration, fine touch, proprioception

ipsilateral then cross in medulla

Pacinian corpuscle
Meissner "

sensory info → ipsi

Tract → Post-column

medulla → Cross → lower medulla

Contralat

pons → medulla

ant. neuron → synapse in lower medulla

Ascend on same side as sensory

Lecture:



Diseases of the Spinal Cord - 2

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Incomplete Spinal Cord Lesion (Partial Transection)

If any form of sensation, motor power is preserved below the level of the lesion, spinal cord lesion is considered incomplete:

- Brown Sequard syndrome (hemicord lesion).
- Anterior cord lesion.
- Central cord lesion.
- Posterior cord lesion.

الاعصاب
الحبل الشوكي

Partial sensory loss

يعني واحد عنده

Power 1 2 3

Complete

لا شيء

Complete

deep sensory loss

superficial

أو واحد عنده m. power 1 2 3

وفاقد اللمس

سليم



Brown-Sequard Syndrome

Hemisection Lesion of the Spinal Cord

* Causes : MS, Trauma (knife, bullet)

damage half of S.C

A. At the level of :

(ipsilat. hemiparesis)

نصف الامعة من نفس المستوى

1. Ipsilateral zone of cutaneous anesthesia in the

CXT

Dermatome anesthesia

damage

Post. horn cell

segment of the lesion (due to damage of afferent fibers that entered the cord & have not yet crossed).

Paralysis myotome

جزء من العضلات

في نفس المستوى

كشلت ...

due to damage A.H.C

2. Ipsilateral lower motor neuron paralysis in the segment of the lesion (due to damage of the lower motor neuron).

إصابة نصف الحبل الشوكي وإما في الحبل أو السائر

Brown-Sequard Syndrome

B. Below the level of lesion:

PK

➤ Ipsilateral loss of proprioception & fine touch below the level of the lesion (due to damage of the dorsal column).

➤ Ipsilateral upper motor neuron paralysis below the level of the lesion (due to damage of the lateral corticospinal tract).

Cross عند medulla من نفس المستوى

(ipsilat. loss of deep sensation due to damage gracile, cuneate)

لأنه لا يقطع عند medulla

Tract

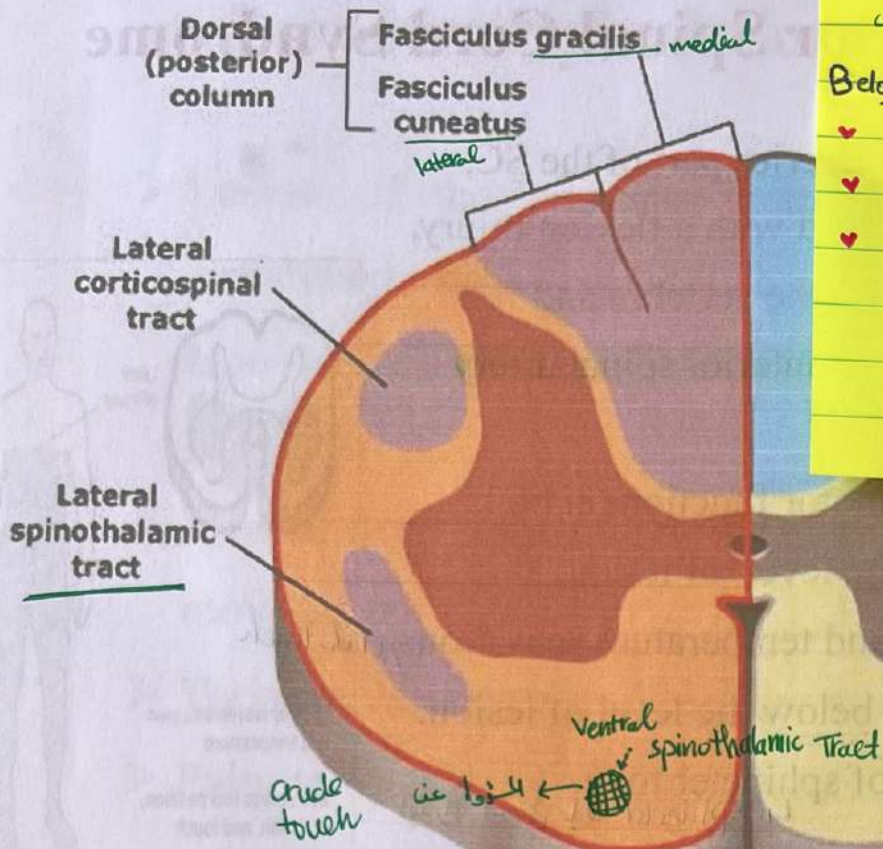
➤ Contralateral loss of pain and temperature sensation below the level of lesion (due to damage of lateral

Crude touch

spinothalamic tract, which has decussated). Damage to the

lateral spinothalamic tracts causes contralateral loss of pain and temperature sensation beginning two levels below the level of the lesion.

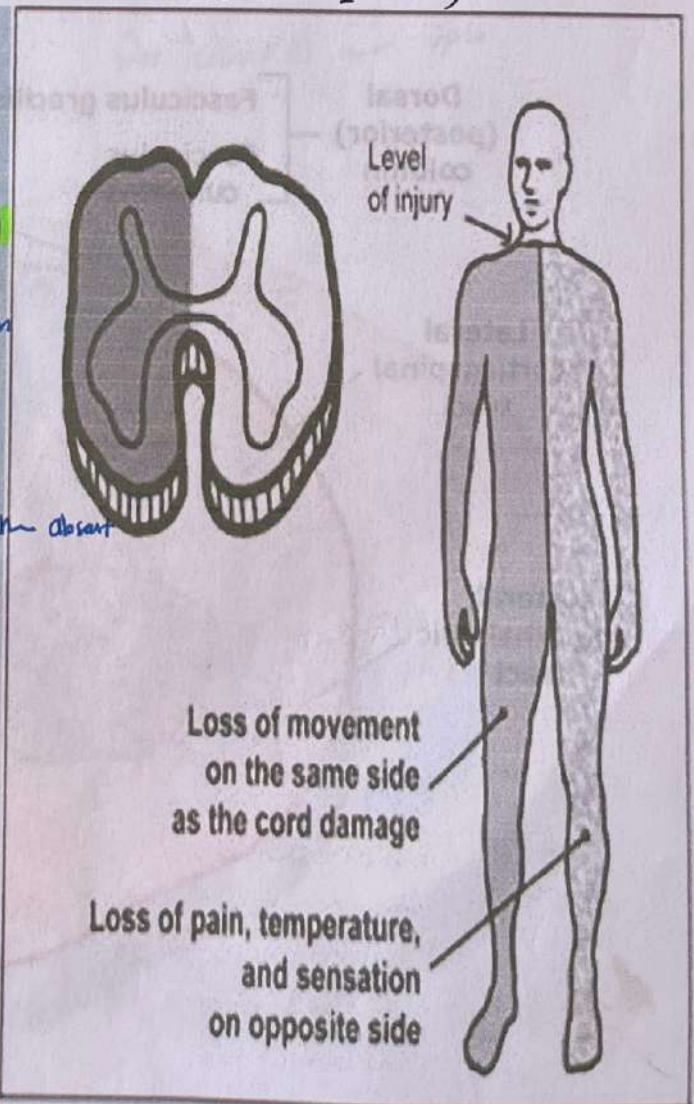
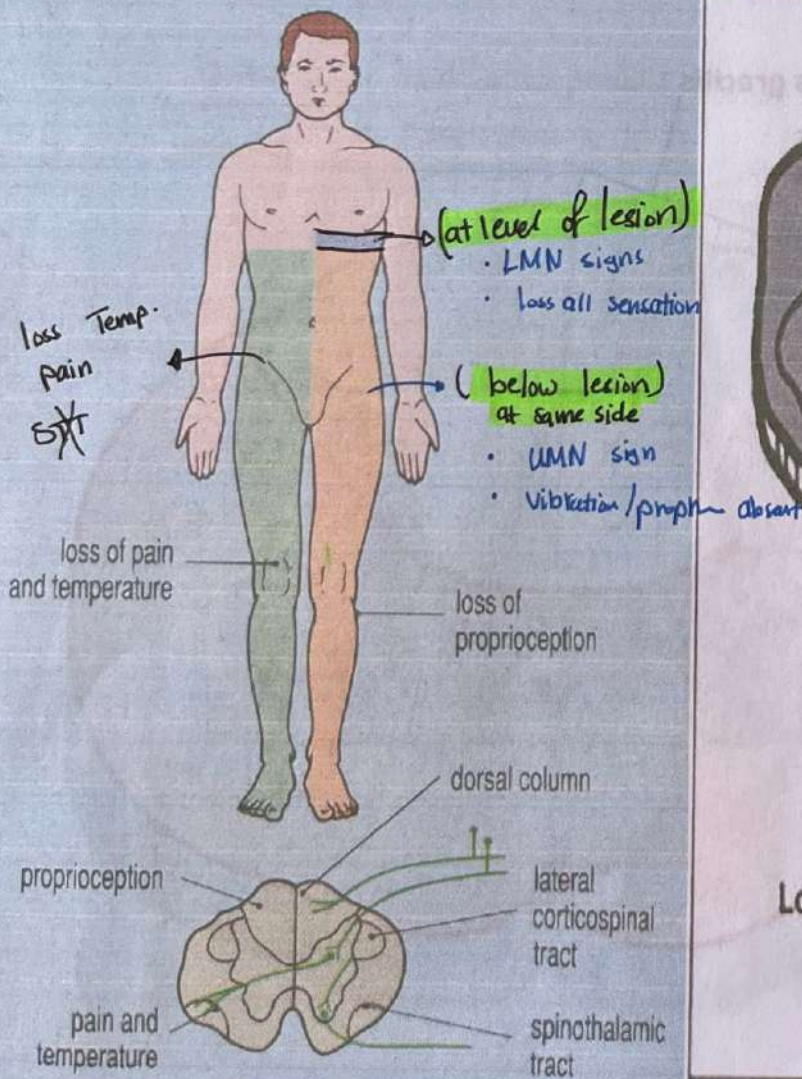
Cross عند Spinal cord
Contra. lat



Below lesion ... If side is T6-7
 ♥ ipsilat. loss deep sensation, fine touch
 ♥ " Paralysis
 ♥ Contralat. loss Pain, Temp, Crude touch

* Weak side : side with lesion
 * Complete sensory loss : level of "

(Horner's sign)



Anterior Spinal Cord Syndrome

- Lesion of the anterior part of the SC, usually associated with a flexion injury, burst fracture of the vertebra and **occlusion in the anterior spinal artery territory.**

- Total loss of motor function on both sides below the level of lesion.

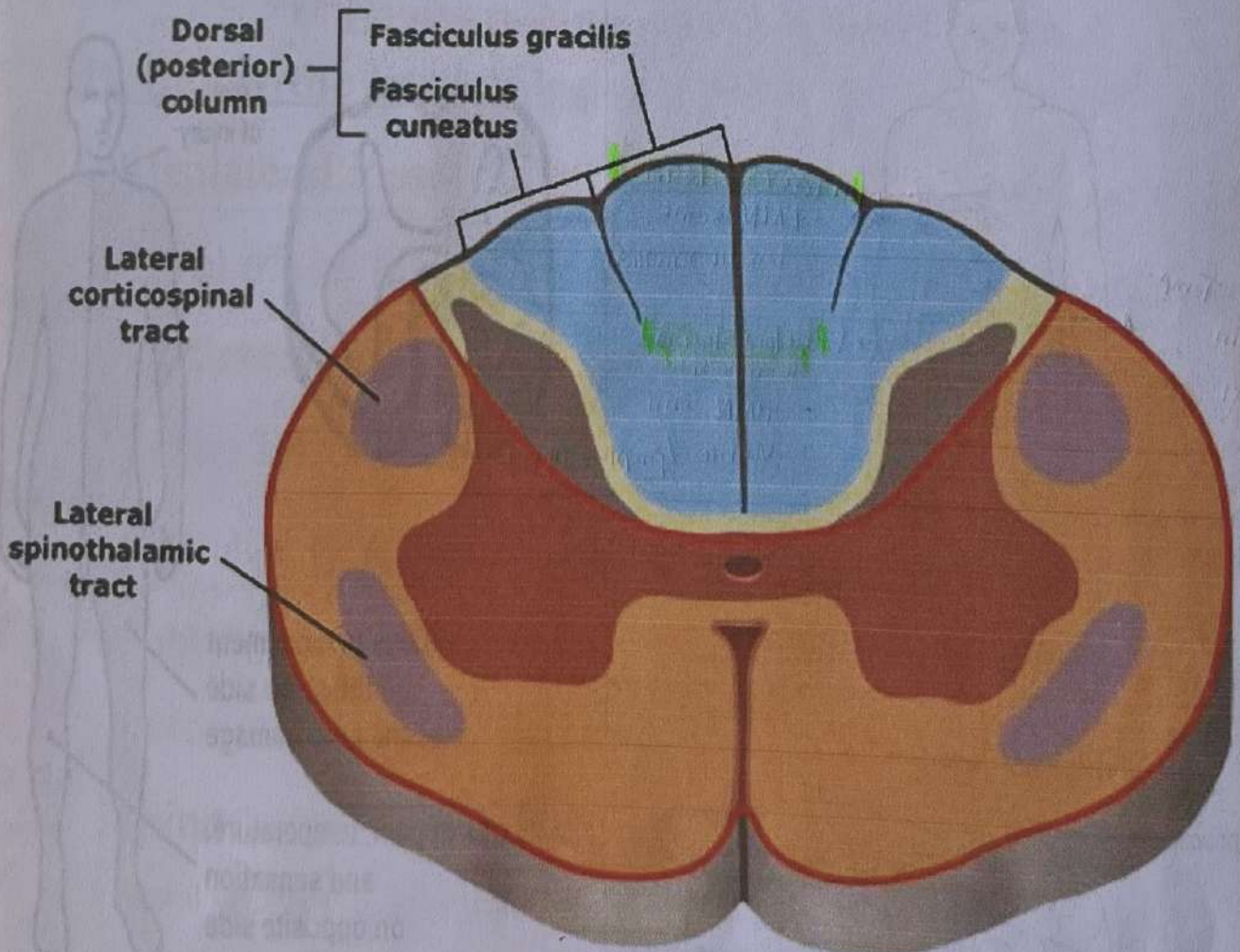
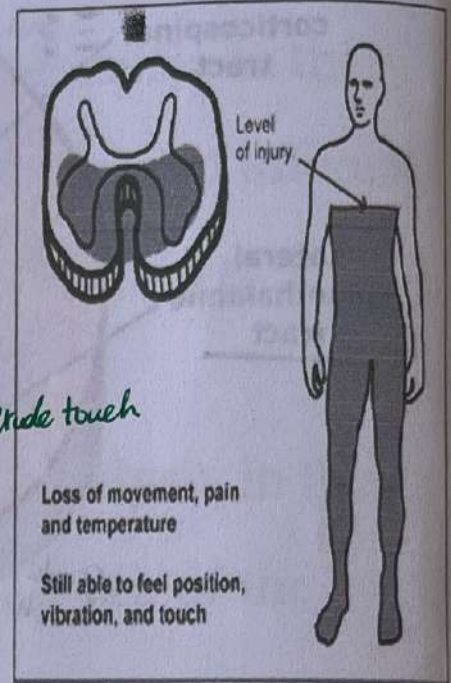
- Loss of pain and temperature sensations, *Crude touch* on both sides below the level of lesion.

- Dysfunction of sphincter tone.

- **Deep sensation "proprioception" is preserved.**

نقص الحس
بسبب
تلف الخلايا
بسبب
تلف الخلايا
بسبب
تلف الخلايا

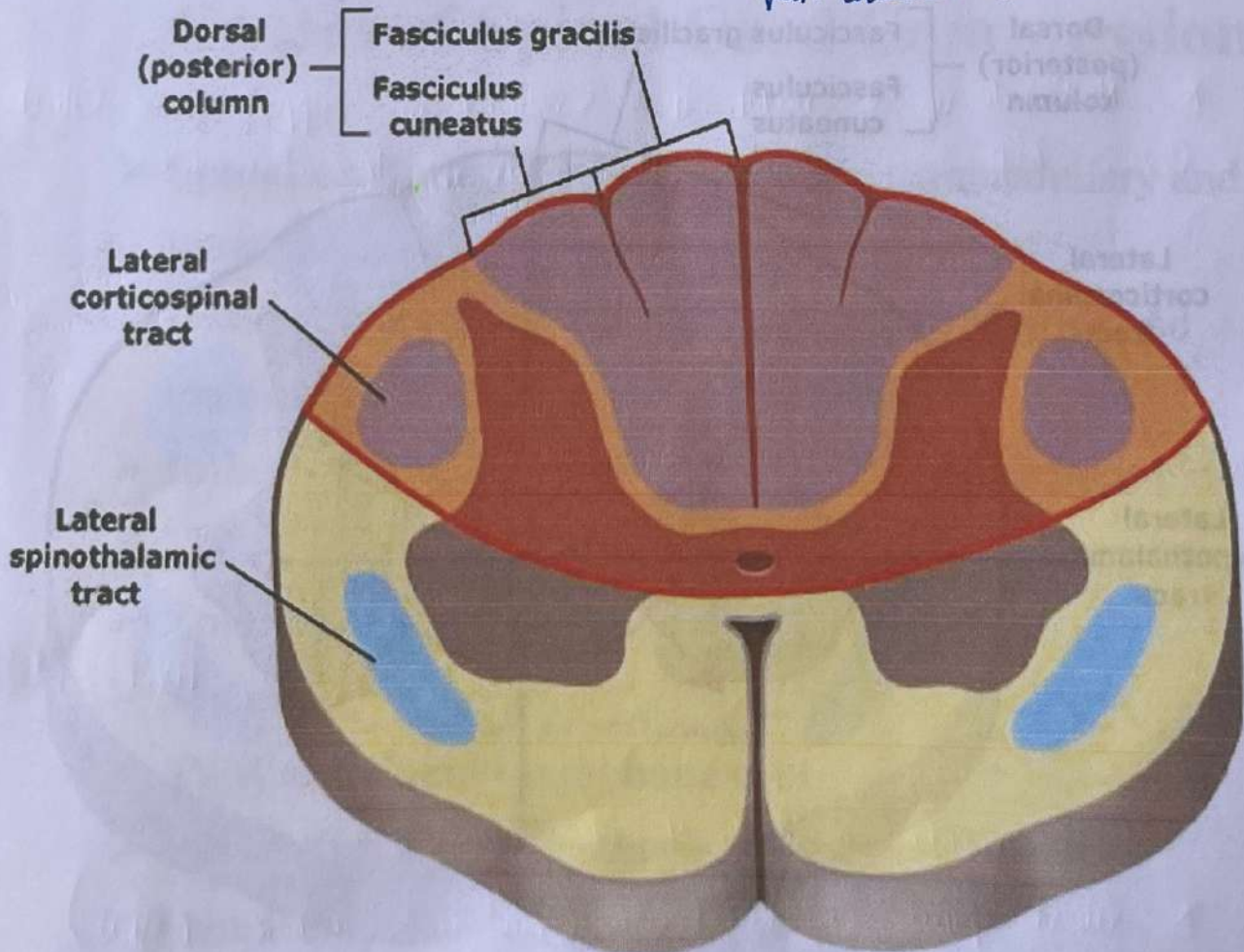
لأن gracile
Cuneate
في الحبل



Posterior Spinal Cord Syndrome

- Lesion of the posterior part of the SC, usually associated with cervical hyperextension injuries, tabes dorsalis, ischemia in the posterior spinal artery territory.
- Loss of deep sensation and difficulty in coordinating movement. *line touch*
- Variable weakness and bladder dysfunction
- Pain, temperature sensation intact. *crude touch*

more posterior موجود lat. C.S.T Some weakness عند بعض
isolated لا في 5/5 m. power بعض اللفظ
ماخذ به (Post. Column)



grey matter
فقدت المادة الرمادية
at the level
of injury

The Central Spinal Cord Syndrome

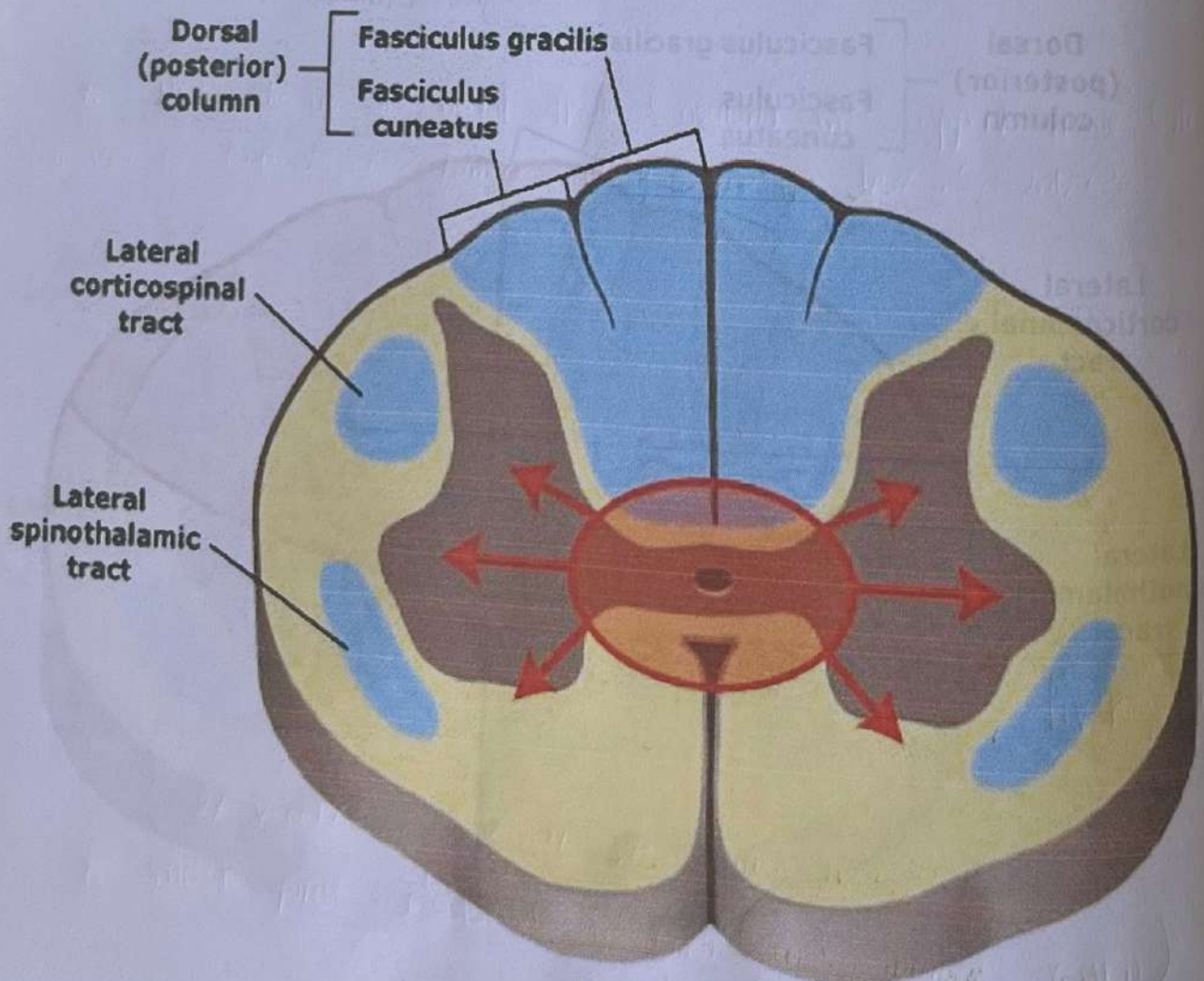
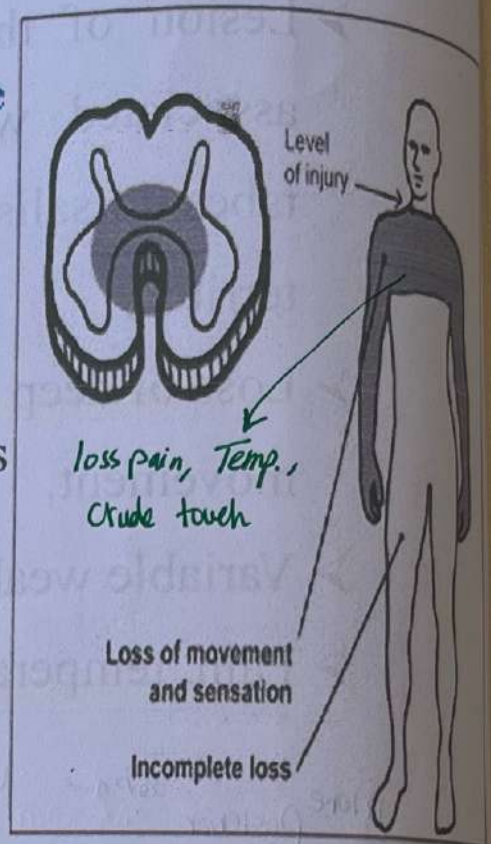
➤ Often is associated with a cervical region hyperextension injury in the grey matter of the SC and **syringomyelia**.

لو زاد الموضوع
تتضيق
White matter
فقدت
weak below lesion
أكثر من ضعف
weakness
at level

➤ Leading to greater weakness in the upper limbs than in the lower limbs and **jacket or half jacket** loss of Superficial sensation (at the level of lesion).

➤ Sparing of deep sensation.

لأنه ما يدخل بار
direct grey
من Post-root
Cuneate, Gracile



Spinal cord
شوا الاضرار في بطن بار

The Spinal Cord Lesion

1. **Congenital:** spinal canal stenosis, meningocele.
2. **Traumatic:** gun shot spinal cord injury, RTA, fracture, disc prolapse, dislocation
3. **Inflammatory:** transverse myelitis, poliomyelitis
4. **Tumor**
5. **Vascular:** infarction of the spinal cord, transient spinal ischemic attacks, hemorrhage of the spinal cord.
6. **Motor neuron disease.**
8. **Deformities:** kyphoscoliosis.
9. **Degenerative:** vertebral spondylosis.
10. **Syringomyelia:** gliosis and cavitations around the central canal in grey matter of the spinal cord.
11. **Hereditary:** hereditary spastic paraplegia.
12. **Demyelinating disease:** Multiple sclerosis, ADEM
13. **Vitamin B12 deficiency:** subacute combined degeneration.
14. **Tabes dorsalis:** neurosyphilis.

مرض الزهري، داء، داء الجذع، التهابات...

Causes of Spinal Cord Compression

- **Spinal cord neoplasms:** Extradural, extramedullary and intramedullary.
- **Disc and vertebral lesions:** chronic degenerative and trauma
- **Inflammatory:** epidural abscess, tuberculosis, granuloma
- **Vertebral neoplasms:** metastasis, myeloma, angioma
- **Epidural haemorrhage**
- **Scoliosis** → arteriovenous malformation
- **AVM and aneurysmal bone cyst**
- **Osteoporosis with fracture**
- **Hematomyelia** : spinal cord hemorrhage.

✓ Trauma

✓ infection

Spinal cord compression

Causes	• Spinal injury (eg, motor vehicle accident) • Malignancy (eg, <u>lung</u>, <u>breast</u>, <u>prostate</u> cancers; <u>myeloma</u>) • Infection (eg, <u>epidural abscess</u>) <i>Handwritten notes:</i> IV Drug abuse, uncontrolled DM, Cellulitis, Complications: see page 2
Signs & symptoms	• Gradually worsening severe local back pain • Pain worse in the recumbent position/at night • Early signs: <u>Symmetric lower-extremity weakness</u>, <u>hypoactive/absent deep-tendon reflexes</u> • Late signs: <u>Bilateral Babinski reflex</u>, <u>decreased rectal sphincter tone</u>, <u>paraparesis/paraplegia with increased deep-tendon reflexes</u>, <u>sensory loss</u> * Classically worse when lying in bed at night
Management	• Emergency MRI • Intravenous glucocorticoids • Radiation-oncology & neurosurgery consultations

Classification of Spinal Tumors by Origin

بہت کم ہوتے ہیں۔ یہ تفریق مریض Tumors .. بہت کم ہوتے ہیں B.V. تقریباً S. cond

1. **Primary Spinal Cord Tumors:** originating in the spinal cord or meninges.

- ## 2. Secondary Spinal Cord Tumors (Metastasis):

metastasis from other parts of the body., liver, prostate

• CP Vertebral, B.V. MD Tumor, SS ✓

* Most spinal cord tumors are found in (Thoracic region)

الأكلة Thorax

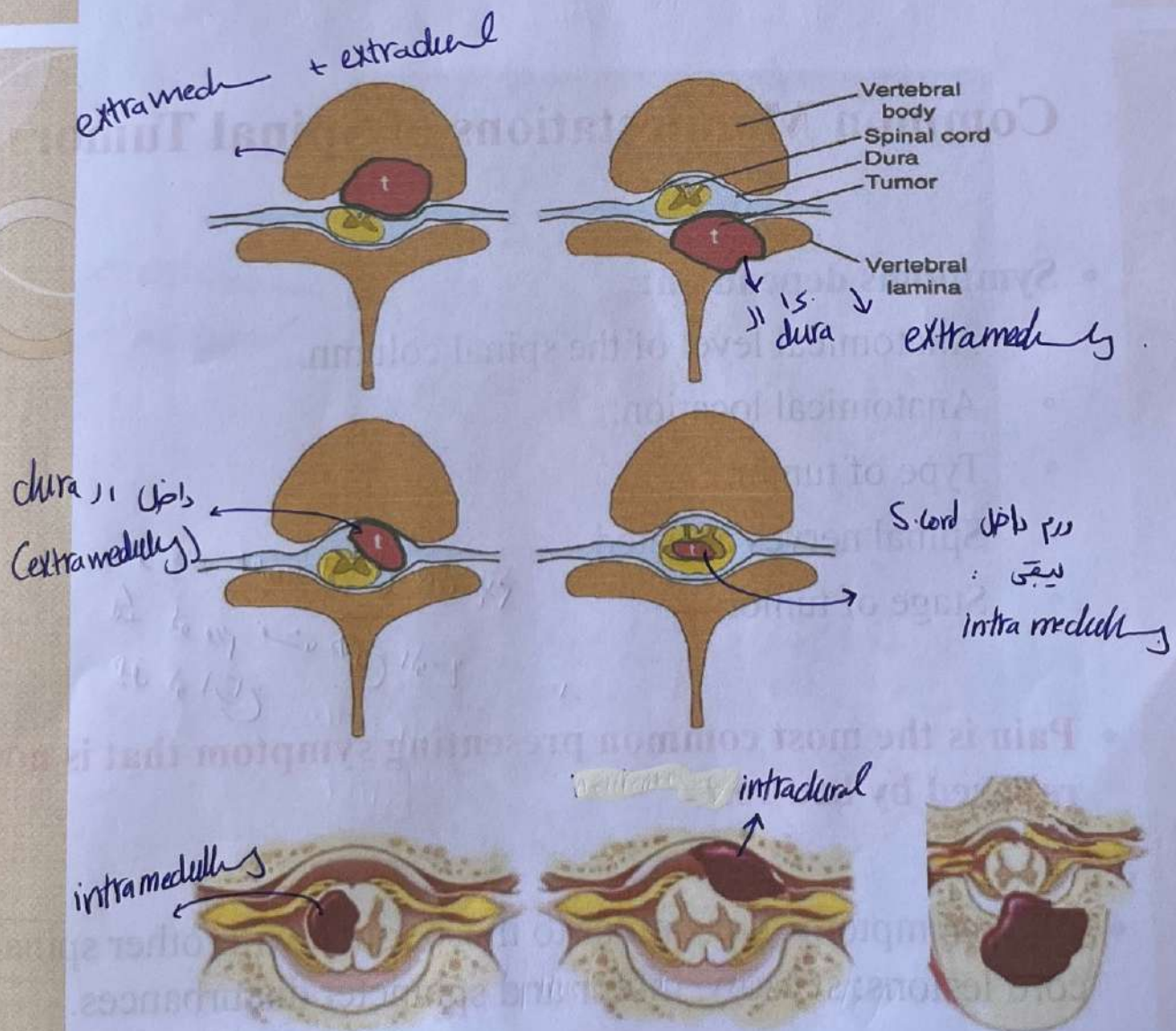
Classification of Spinal Tumors by Location

1. **Intramedullary Tumors:** arise from neural tissues of the spinal cord.
 spinal Cord داخلي Tumor •

2. **Extramedullary Tumors:** arise from tissues outside the spinal cord may be:

a. **Intradural Tumors:** from the nerve roots or meninges in subarachnoid space.
 دخلي dura

b. **Extradural Tumors:** from the epidural tissue or vertebra.



Classification of Spinal Tumors by Location

1. **Intramedullary:** glioma, lipoma, haemangioblastoma, teratoma, ependymoma, astrocytoma.
2. **Extramedullary - may be:**
 - a. **Intradural:** meningioma, neurofibroma, schwannoma, dermoid tumors and others.
 - b. **Extradural:** osteosarcoma, hemangioma, lymphoma, myeloma and metastases (lung, breast, prostate, thyroid, liver, stomach, kidney melanoma).

Common Manifestations of Spinal Tumors

- **Symptoms depend on:**
 - Anatomical level of the spinal column.
 - Anatomical location.
 - Type of tumor.
 - Spinal nerves affected.
 - Stage of tumor.
- **Pain is the most common presenting symptom that is not relieved by bed rest.**
- Other symptoms are similar to those found with other spinal cord lesions: sensory, motor and sphincter disturbances.

لو عنده غصون لو ارتاح بيخف الألم
لكه لو ورم مش هيرج الوجع
حق لو ارتاح

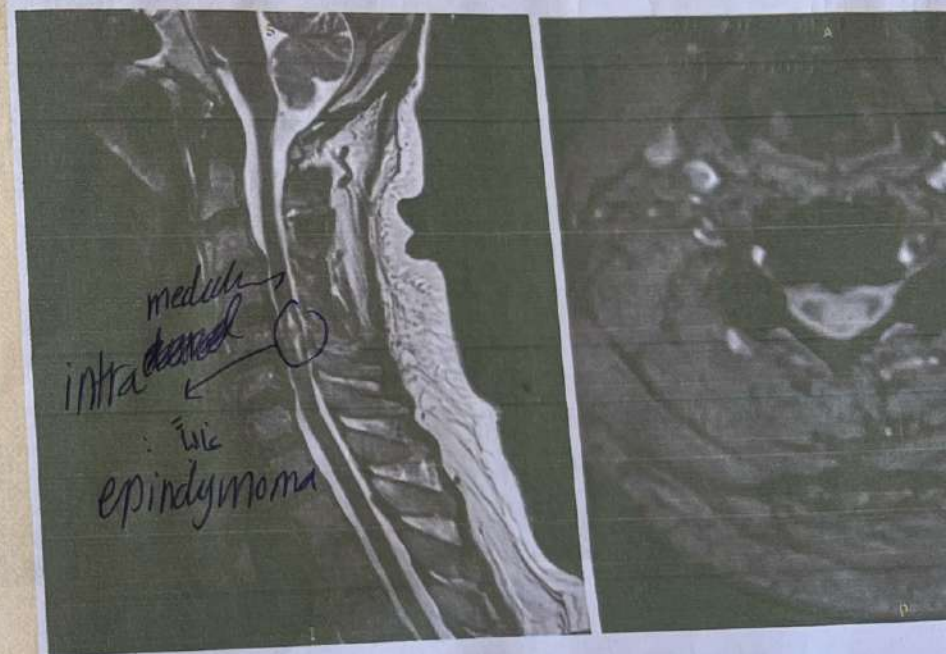
Common Manifestations

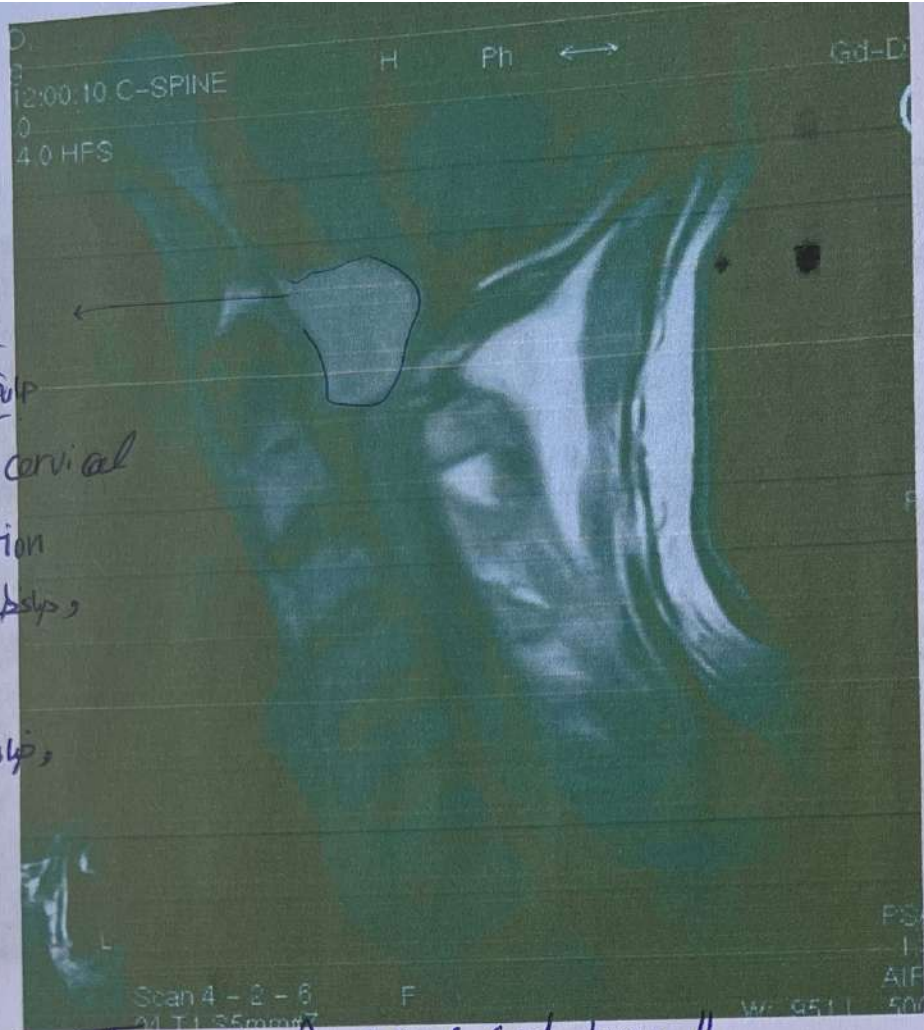
- General symptoms of tumors (loss of weight, anorexia, general muscle fatigue and others).
- Pain back & chest, not relieved by bed rest.
- Sensory changes.
- Paresis and spasticity of U.L.s and L.L.s according to the level "more in one leg or both"
- UMNL
- Bowel, bladder dysfunction.

✓ extramedullary
✓ intradural



Neurofibroma





meningioma

C5

medulla-cervical

junction

upper part of S. cord

medulla oblongata

* Treatment of spinal cord tumors //

جراحياً : 1-2

- analgesics

- steroids (high dose dexamethasone for reduction of spinal cord edema and tumor compression)

- Symptomatic therapy .

* (Laminectomy)

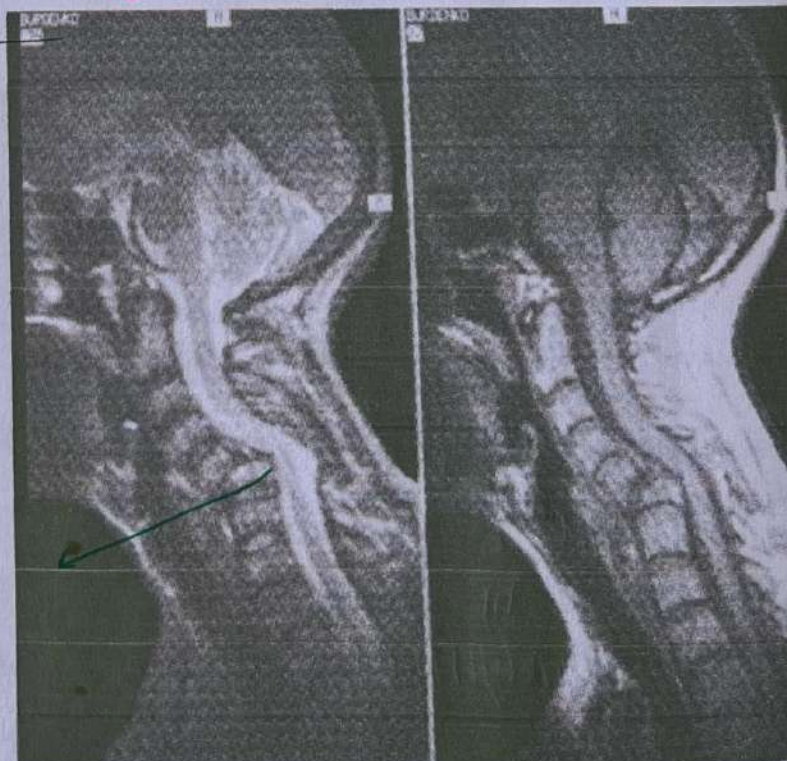
to remove or to decrease the size of spinal cord tumor

* (tumor removal)

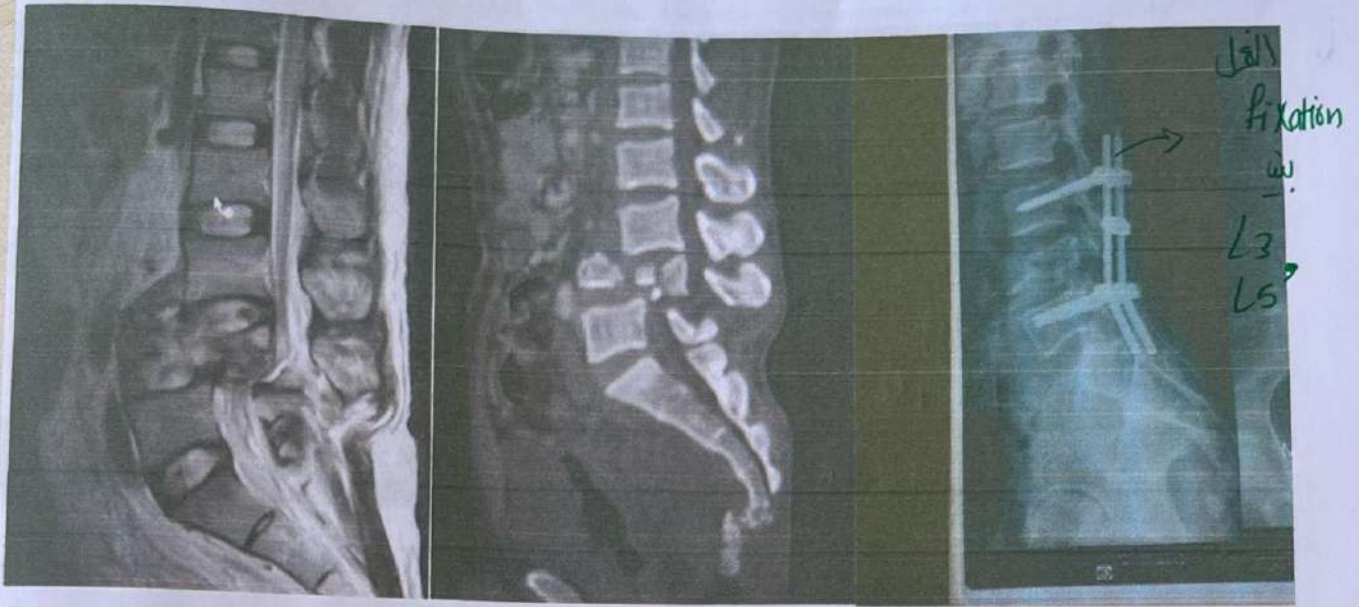
* (radiation) to reduce size and control pain

- Complete dislocation of **C5** with severe compression of spinal cord.

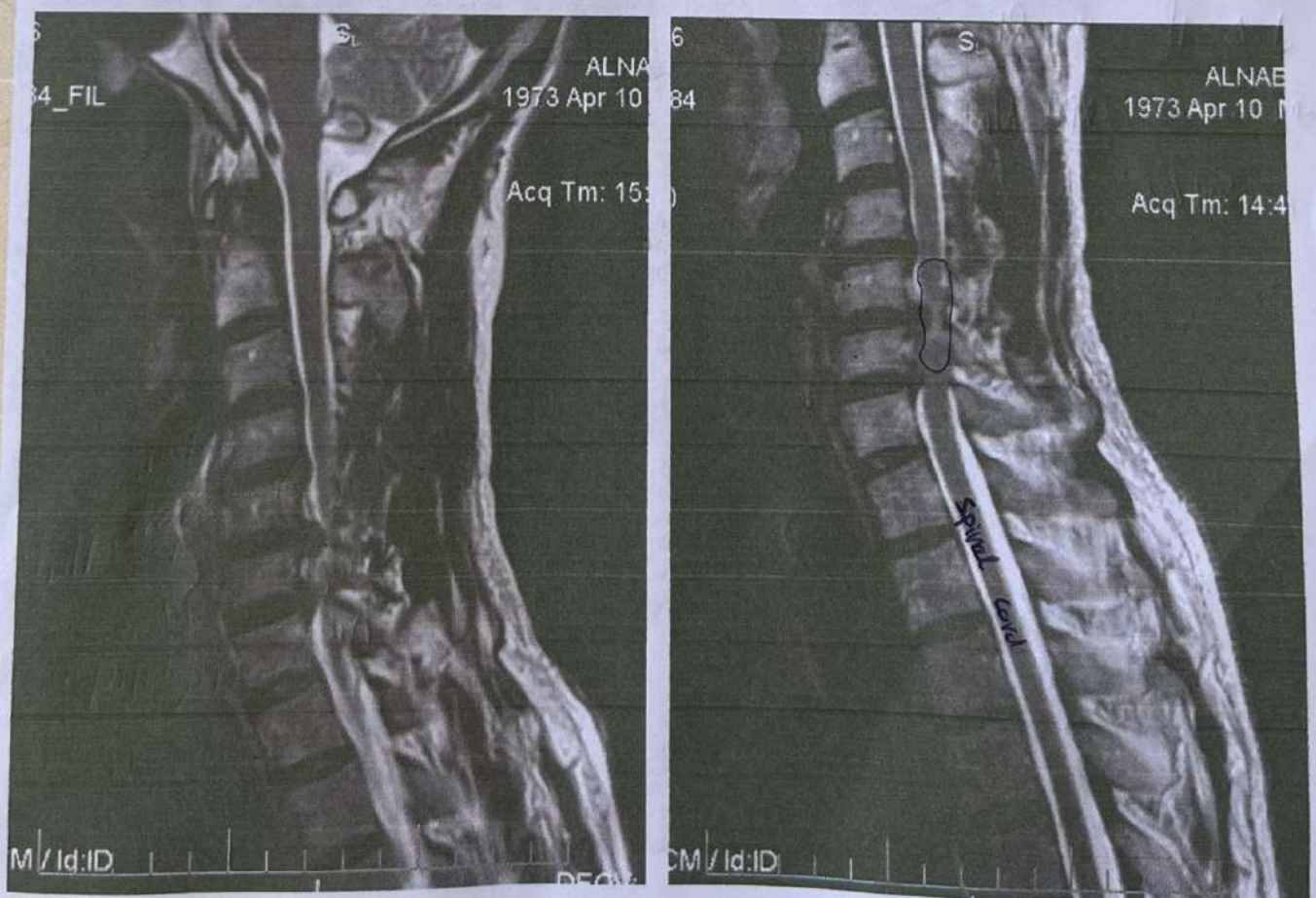
S.C. C5 compression, fracture =



L4 Fracture-Dislocation



Sagittal CS MRI: C5-6 and C6-7 Posteriolateral Disc Bulge

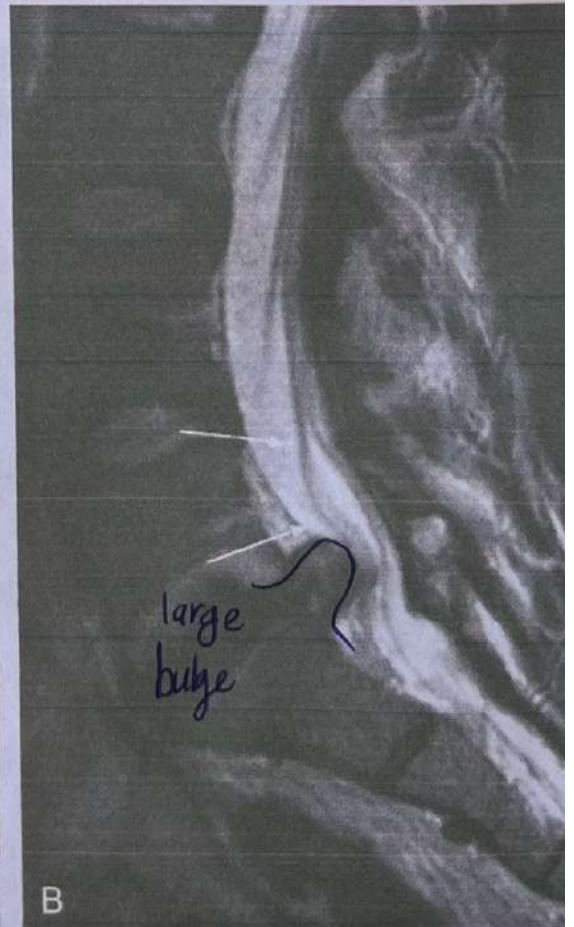


Axial CS MRI: C5-C6 Left Posteriolateral Disc Bulge

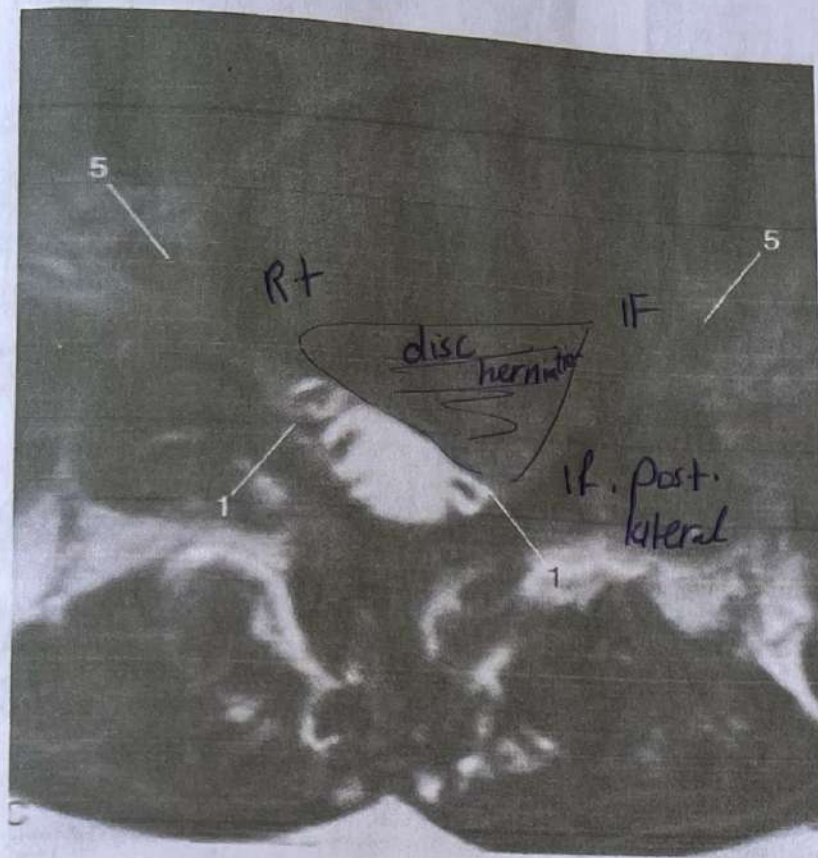


Sagittal LSS MRI: L5-S1 Large Disc Bulge

عنه اقتر احد ال bulge رايح
 ولا R+ IF هزل
 axial MRI بقدرت اهدر
 # sagittal ال



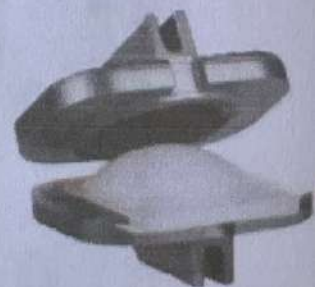
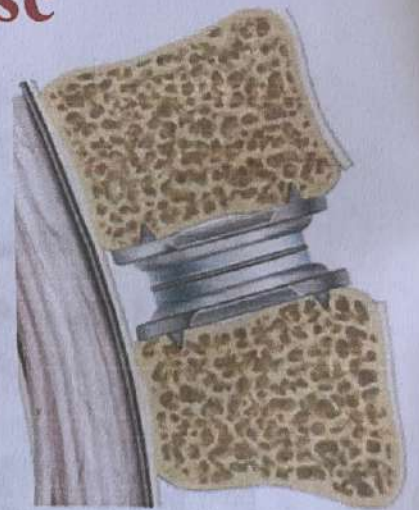
Axial LSS MRI: L5-S1 Large Left Posteriolateral Disc Bulge





Artificial Disc

- Combination of metal and plastic.
- Attached to vertebrae above and below.



— Slip disc

S.C. lesion → intra medullary
 = س.ج. = Syringomyelia → Central cord
 spinal cord fluid space ← syrinx ← spinal cord.

➤ Chronic disease characterized by a fluid-filled cavity located within the central canal in the gray matter of spinal cord

➤ The syrinx, a fluid-filled cavity

دجیر، gliosis، Cavity حوالہ ال
 Central canal
 داخلہا CSF

➤ **Site of lesion:**

• **Brain stem:** syringobulbia → Cavity of brainstem.

• **Cervico-dorsal:** commonest site

اکثر مکانیہ میں

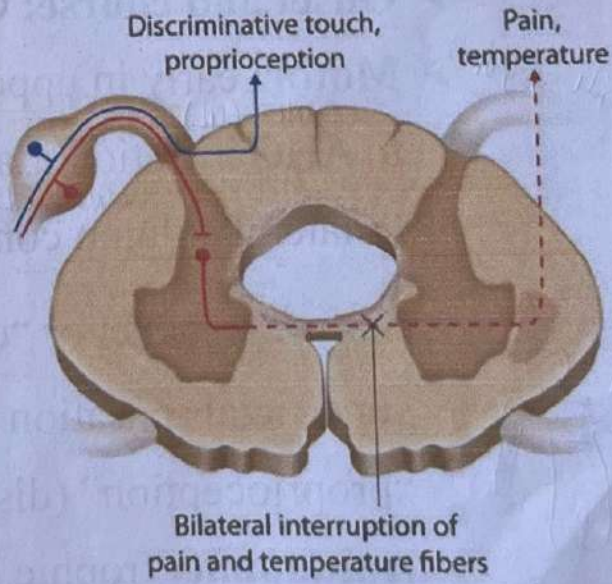
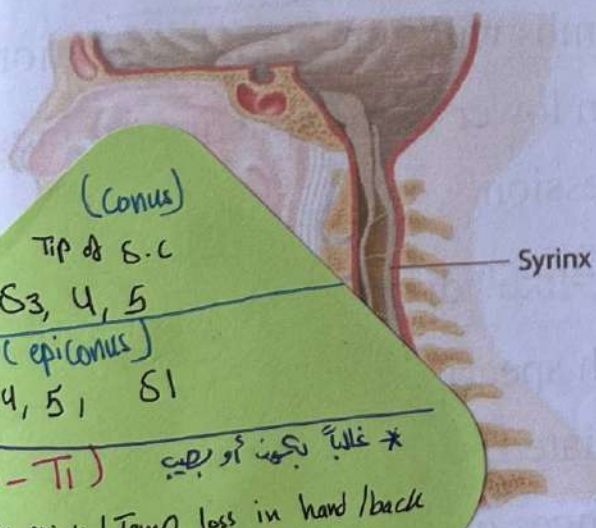
• **Lumbar region:** picture of epiconus lesion

• **Lower end of spinal cord:** picture of conus medularis

معہ دلچسپی

* الفحیہ | احنا عنہ Central canal بال grey، الموجودة بالنسب، هنا = فيها CSF lesion
 وحوالہ undiff. cells (resting glial cells) هنا لیبی غیر موزن بجز proliferation لہا = ال cells
 بتجسس تاخذ وتشكله الخلية النورال بال supply، ال nutrition، الخلية بتوزن بعدہ منہ ال blood supply
 الخلية النورال و glial جھوتہا مازل liquefaction نورا ال canal دی ہستومع فلا موضع مقرر ال aut-horm.
 * لہا هو intra medullary ← with level Paraplegia ب هي Compression هنا
 gradual onset aggressive course
 early sphincter disturbance
 late root pain

Syringomyelia



(Conus)
 Tip of S.C.
 S3, 4, 5
 (epiconus)
 L4, 5, S1
 * غالباً بكون أو بصيغ (C8-T1)
 ↳ pin prick / Temp loss in hand / back
 لك وعا نورال

Aetiology of Syringomyelia

(في صفة)

✓ قديشون idiopathic

Tonsil of cerebellum

يكون الجزء lower

Cerebellum نازل

8. cord

قنطرة spine

foramen في magnum

Tonsil هات

بالتي ضغطت في

spinal cord

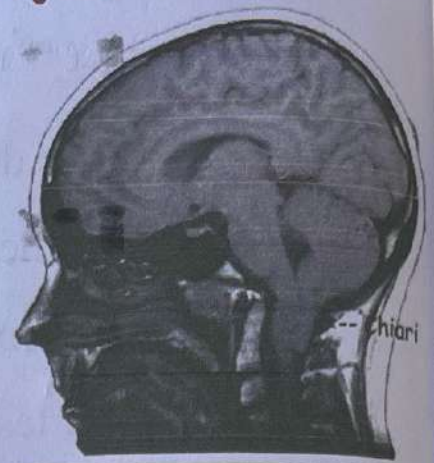
علية توسيع لها

Bramen

➤ Classical syringomyelia is associated with Arnold-Chiari malformation

➤ Bony anomalies at the foramen magnum, meningocele, hydrocephalus, spinal cord tumor (glioma and epindymoma) lead to cavity formation

➤ Spinal cord trauma leads to cavity formation



Posttraumatic syringomyelia

at level → LMNL, sensory loss

below → LMNL, sphincter disturbance

Clinical Picture of Syringomyelia

"Cervical region"

➤ Age: 15-35 years epiconus lesion ← حبل الشوك في المنطقة cervical

➤ Onset and course: Gradual onset and progressive course

الترافف الشوكي

➤ Motor: early in upper limbs with muscle fasciculation due to AHC irritation. Late in lower limbs spastic paraplegia due to lateral column compression

LMNL (UL)

LMNL (LL)

➤ Sensory: jacket or "cape-like" distribution sensory loss of superficial sensation with sparing deep sensation "proprioception" (dissociated type).

➤ Autonomic: trophic changes of the skin, coldness and cyanosis ↳ loss of hair, brittle nails

➤ Skeletal deformities: pes cavus (high arch foot) (صرة)

➤ Brain stem signs: in syringobulbia

* Position, Vibration normal at all level.

* horner may occur.



Cranial N. Palsy

جنتون

في جال شوكي

brainstem

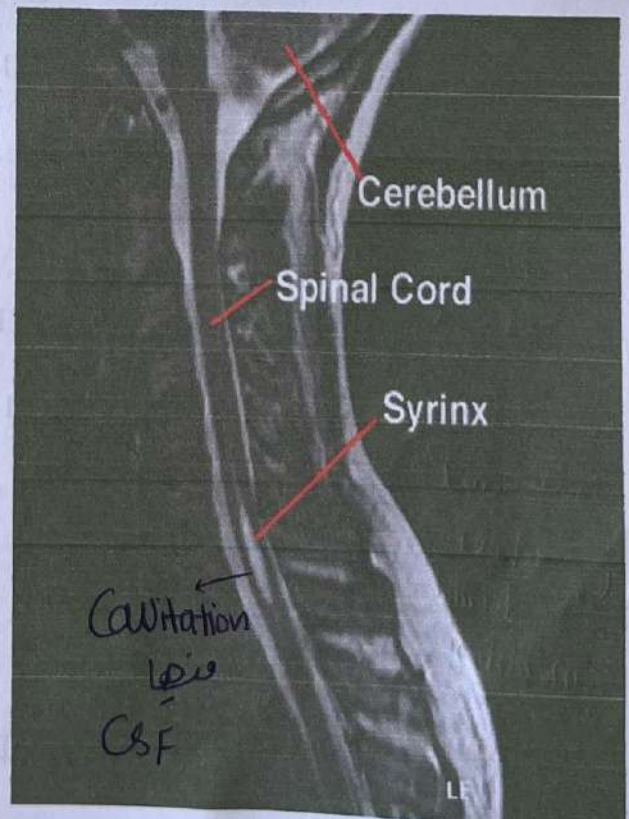
Investigation and Management of Syringomyelia

- **Investigation:** Brain and Spinal cord MRI
- **Management:**
- **Surgical:** decompression: laminectomy and foramen magnum decompression
- Symptomatic therapy
- Physiotherapy

, syring (w) Shunt 1st 2nd 3rd *
Peritoneum

(Motor) I
~~ant. horn~~ below lesion : LMNL
 at level " : LMNL
 Lower limb : hypertonic, hyperreflexia
 upper " : mixed (Tonic atrophy)
 (Sensory) I
 crossing sp. fiber is
 Jacket sensory loss of dissociated nature
 * loss Pain, Temp. sensation.

MRI of Syringomyelia



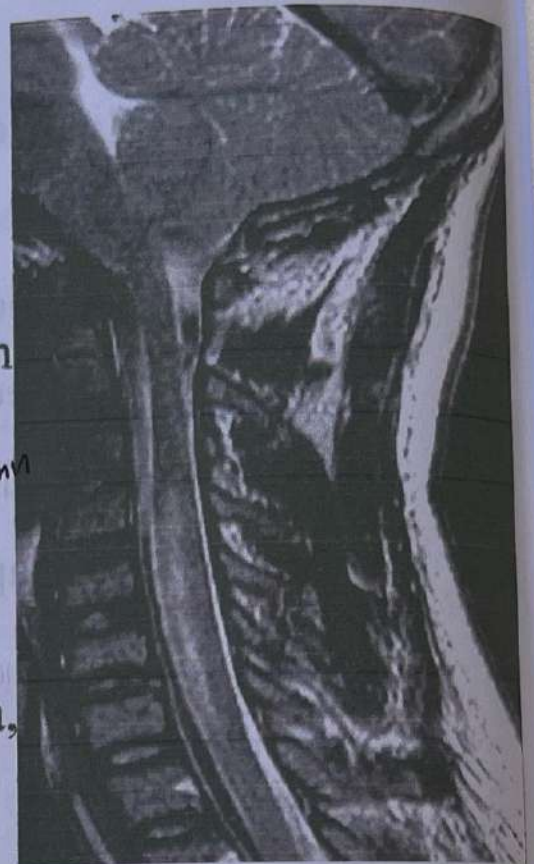
Anterior Spinal Artery Occlusion

تفزی نه
Post. S. att. ۶

Post. Column) ۱ کله حیاتی ما عدا ، ventral cord ۲ بیل ۶ rare form ۳ acute onset ۴ stroke ۵

- Spinal cord infarction, causing an acute paraplegia or tetraplegia or paresis with loss of superficial sensation below the level of lesion and sparing deep sensation

- **Causes:** thrombotic or embolic vascular diseases (endocarditis, AF, severe hypotension, atheroma, DM, polycythemia, vasculitis)



spinal shock * ۲۰

Spinal Cord Lesion: Investigation

- General investigations
- Vitamin B12 serum level
- Spine X-Ray
- CT scan
- Magnetic resonance imaging (MRI). ۱ نقل
- CSF examination
- Chest X-Ray: to exclude pulmonary TB and bronchial carcinoma ۲ بارس ۳ کون
- EMG
- Special investigation

۴ نقل
۵ نقل
۶ نقل
۷ نقل
۸ نقل
۹ نقل
۱۰ نقل
۱۱ نقل
۱۲ نقل
۱۳ نقل
۱۴ نقل
۱۵ نقل
۱۶ نقل
۱۷ نقل
۱۸ نقل
۱۹ نقل
۲۰ نقل

Complications of the Spinal Cord Lesion

- Spasticity
- Depression
- Chronic pain
- Urinary tract infection
- Pressure sores
- Osteoporosis and fractures
- Pneumonia
- Changes in sexual functioning
- ✓ • Autonomic dysreflexia
- ✓ • Neurogenic shock
(hypotension, bradycardia, and hypothermia) in SC injury
- ✓ • Deep vein thrombosis (DVT)
- ✓ • Pulmonary embolism (PE)
- ✓ • Post traumatic syringomyelia
- Others.

Autonomic Dysreflexia

❖ Definition of Autonomic Dysreflexia (AD):

- Is complication of SCI above T6 level. → ^{لأنه autonomic fibers في} راحة لا heart مؤثر T6
- Manifestation of the loss of coordinated autonomic responses to demands on heart rate and vascular tone.
- AD occurs in about 20-70 % of patients with SCI injury above T6 level.
- AD is unusual within the first month of SCI but usually appears within the first year.
- Bladder distension and fecal impaction are the most common precipitants for AD. → Constipation، حمى البرد، بيزوروا

عكس ال aut. dysreflexia

(hypotension, bradycardia, and hypothermia) in SC injury

- ✓ • Deep vein thrombosis (DVT)
- ✓ • Pulmonary embolism (PE)
- ✓ • Post traumatic syringomyelia
- Others.

ning

mic Dys

mic Dysref

SCI above T

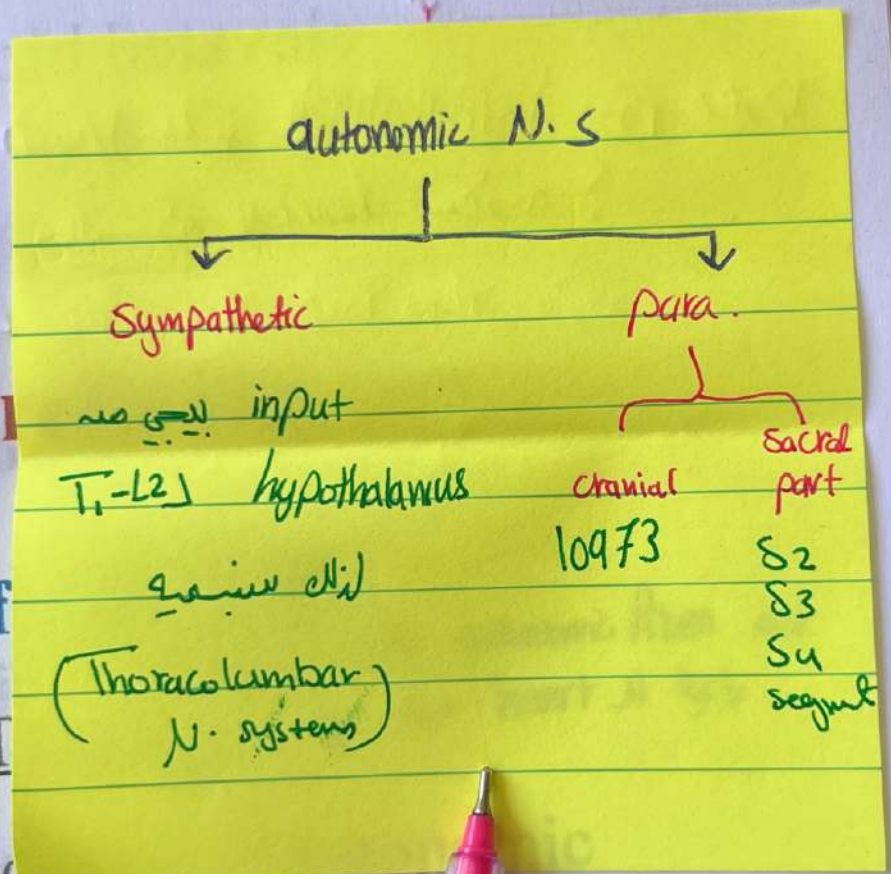
the loss of coo

nds on heart rate and vascular tone.

at 20-70 % of patients with SCI injury

thin the first month of SC but usually

e first year



Mechanism of Autonomic Dysreflexia

1. Exaggerated sympathetic responses in the hypothalamus to noxious stimuli → below the level of the injury → lead to diffuse vasoconstriction and hypertension above the level of injury.

الحيان قولنا عنده
اصالة و P بول
Parasymp. فار
هو المثلث
نقوم بتنشيط
سب بكمة زود رلبي
heart زود ال
bradycardia ...

2. A compensatory parasympathetic response → produces bradycardia and vasodilation above the level of the lesion, but this is not sufficient to reduce elevated blood pressure.

* الفتح Symp. fibers فوه T6 6 منبر bradycardia Hypothalamus تقوم بفرقتها
مزود ال symp. innervation ال طاعة منها س ال اندية والسكة ل heart مقطوعة ؟
فالأجزاء ال فوه مستوى الصابة بصلها : HIN لفة بصر V.C طبعاً ال فوه ...

Clinical Manifestation of Autonomic Dysreflexia

❖ Common clinical manifestations are:

- Headache. → ↑ ICP
- Diaphoresis "Hyperhydrosis". ↑ اللم
- High blood pressure and hypertensive crisis.

① Compensatory Parasy.

② الفتح ال symp
T6 فوه

Bradycardia → قة قة قة قة Cardiac arrest
د: و عيو

❖ May also occur:

- Flushing.
- Blurred vision.
- Anxiety.
- Nausea.

Complications of Autonomic Dysreflexia

- ✓ 1. Hypertensive crisis.
- ✓ 2. Bradycardia and cardiac arrest.
- ✓ 3. Intracranial hemorrhage: SAH and intracerebral hemorrhage.
- ✓ 4. Seizures.

Management of Autonomic Dysreflexia

- ✓ Measuring and monitoring blood pressure.
- ✓ • Immediately sitting the patient upright to orthostatically lower blood pressure.
من بعد الكرفي لنقل المريض ..
- ✓ • Bladder catheterization and evacuation of rectum.
- ✓ • Urgent and rapid reduction of blood pressure.

بند قسطرة ..
عنه نفضي كمانه ، كان منفي
Parasymp. ال Rectum عنه نقل ال

Spinal Disc Herniation

(الانزلاق الغضروفي)

* بين الـ Vertebra، أحدها Disc
 Central nucleus of a jelly like substance (nucleus pulposus)
 له حوالها يكون في (annulus fibrosis) Fibrous coil
 Disc هي hyaline cartilage plates
 ومنه قدام في ant. longitudinal ligament
 ومنه الخلف في post. longitudinal
 * عن 31 فقره 23 disc للـ Sacrum (5) والـ Coccyx (4) يكونوا
 lumbar ... فقرتين بين disc

* The herniated disc compresses :-

Spinal nerve

Spinal cord

disc انزله مضطرب يضيق spinal root
 Central disc يضيق على spinal cord
 Cauda ... فقرتين في roots مضطرب على
 spinal cord

* Function of disc :-

allow normal mobility of spine
 vertebral shock absorb
 Tracture

* Risk factors developing herniated disc

- 1) Standing erect
- 2) aging changes in disc and ligaments , osteoarthritis
- 3) Poor body mechanics
- 4) Overweight
- 5) Trauma

* Sites of herniated disc :-

1.80 occur in lumbar region, particularly L4/5 and L5/S1

1.19 occur in Cervical " " C5/6 and C6/7

(L5/S1 & L4/5) Lumbosacral (كيتي) لومبوساكرال

1.1 in Thoracic

Thoracic level 11 - ribs - good fixation

♥ Clinical manifestation :-

Pain, Paresthesia or loss sensation $\leftarrow$ sensory root

Paralysis $\leftarrow$ motor " "

arm - cervical disc - numbness, tingling, weakness

thumb, small finger

low back pain - Sciatic N. - L4-S1 disc

T10-S1 - small toe - L4-5 - big toe - numbness, radiates to post. lat. of LL

(Sciatic nerve)

(pathology of N. root) radiculopathy / root

* Common manifestation of lumbar herniated disc //

L4-5 disc : mc site

Root of post. sensory nerve : L5 is most common

low back pain, Sciatica pain

1 leg pain in 31 (31/100) ✓

"pain radiating to post. lat. surface of lower limb"

Paresthesia, numbness, m. spasm, sphincter dysfunction,

sexual dysfunction, Paresis, drop foot, absent LL deep reflexes.

* Common manifestation of Cervical herniated disc //

C5-6 : mc site

Neck pain, Pain radiating to shoulder, arm, thumb, m. spasm

numbness, Paresthesia, Paresis, absent UL deep reflexes → C5, C6 roots

Signs of cervical myelopathy in cases with large cervical post. central disc bulge (L4/L5 in both LL with sensory level)

Spinal Cord C5-6 disc

* Differential diagnosis //

1) TB of the spine

2) Primary and 2nd tumors of spine

3) Osteoporosis with pathological fractures

• Pott's disease → TB spondylitis

* Diagnostic procedures //

- Plain X-ray → identify deformities and narrowing of the intervertebral disk space.

- CT, MRI the best ...

- EMG and NCS → to detect electrical activity of skeletal muscles and conductivity of peripheral spinal N.

• nerve conduction studies

* Conservative Treatment //

- cervical flexion of spine
- medication: analgesic, anti-inflammatory, m. relaxant, short course of steroid
- medical rehabilitation and physiotherapy.

* indication for surgical //

- 1) Failure of conservative T.
- 2) Cauda equina & LL weak, sp, cauda & hip
- 3) sphincter dysfunction
- 4) progressive neuro deficit while on conservative T.
- 5) intolerable pain in spite of adequate narcotic analgesics

* Surgical management //

- laminectomy → remove lamina to relieve pressure to spinal root
- spinal fusion → remove most of disk and replace it with bone usually
- foraminotomy → intervertebral foramen from the patient iliac crest
- microdiscectomy
partial removal of disc

" Traumatic Spinal Cord injury "

- * جيو بار young < old > جامة < > elderly بار = >
 - * حوالي 40 حالة سنوية في مصر
 - * 755 cases occur in 16-30 y of age
 - * 78% are male
 - * أكثر مكان بحدوثه cervical spine (75%)
 - * Thoracic (15%), Thoracolumbar (15%), lumbosacral (15%)

* The Causes //

- motor vehicle accident حوادث الطرق 47%
- Falls 23%
- Violence (especially gunshot wound) 14%
- Sports accident 9%
- other 7%

* injury to the vertebral column //

- أغلب S.C injury بحدوثه في v. column injury
 - Fracture of vertebral column
 - Dislocation at one or more joints
 - Tearing of ligaments
 - herniation of intervertebral disc

traumatic spine cord injury

* mechanism of injury

✓ flexion injury

✓ extension

✓ Vertical Compression

✓ rotational

✓ extension injury

flexion injury

SCI

Direct trauma, Traction, Compression by bone fragments, hemodroma or disc material

bone fragments

hemodroma

or disc material

ischemia from damage of spinal arteries

ASIA (american spinal injury association)

new grading system which include:

✓ level

✓ score

✓ completeness

✓ zone of preservation

Pre hospital care:

ABC
airway tube O₂ fluid

Collar, backboard

(T)

methylprednisolone

30 mg/kg in 15 min

then 5.4 mg/kg/h for

24-48h

edema, لفتة

Traction بالشد, Compression by disc material

bone عظم

spinal arteries

(injury association)

system which include:

* indication of emergent surgical?

Deformity correction, stabilization, Decomp.

1) Progression signs

2) ^{complete} Sub arachnoid block

3) Spinal cord compression on image

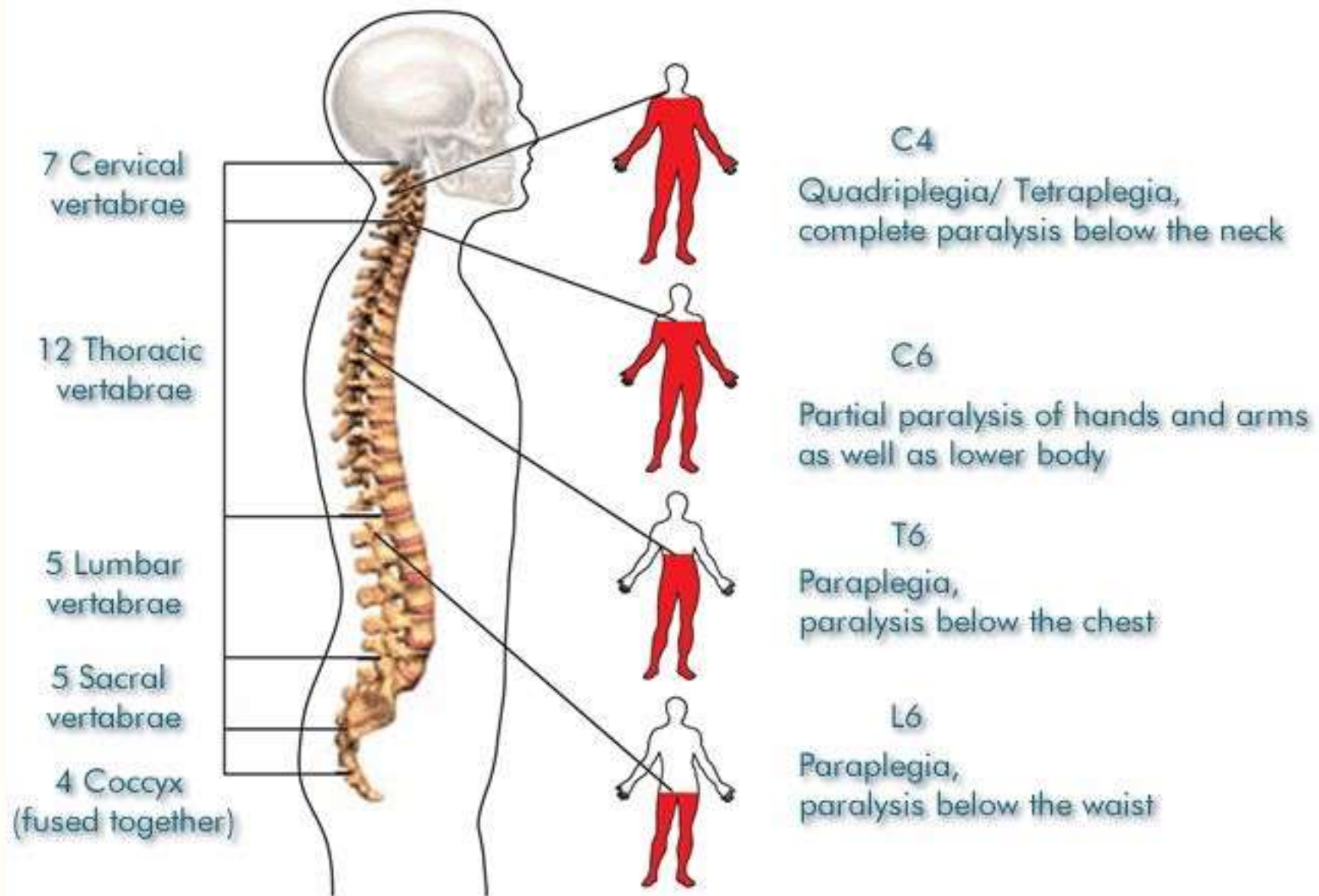
4) acute ant. spinal cord

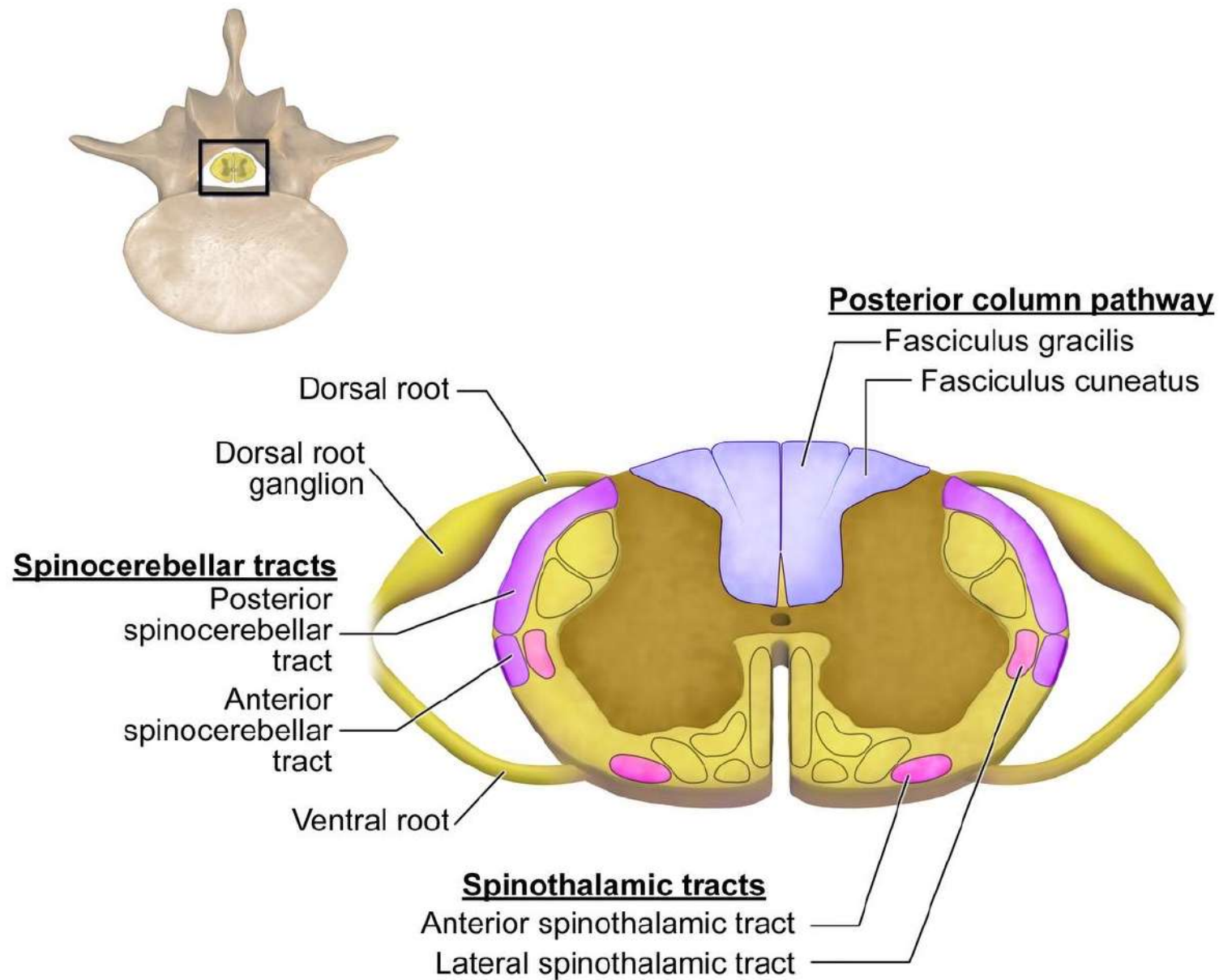
5) Penetrating trauma

30 mg/kg in 15

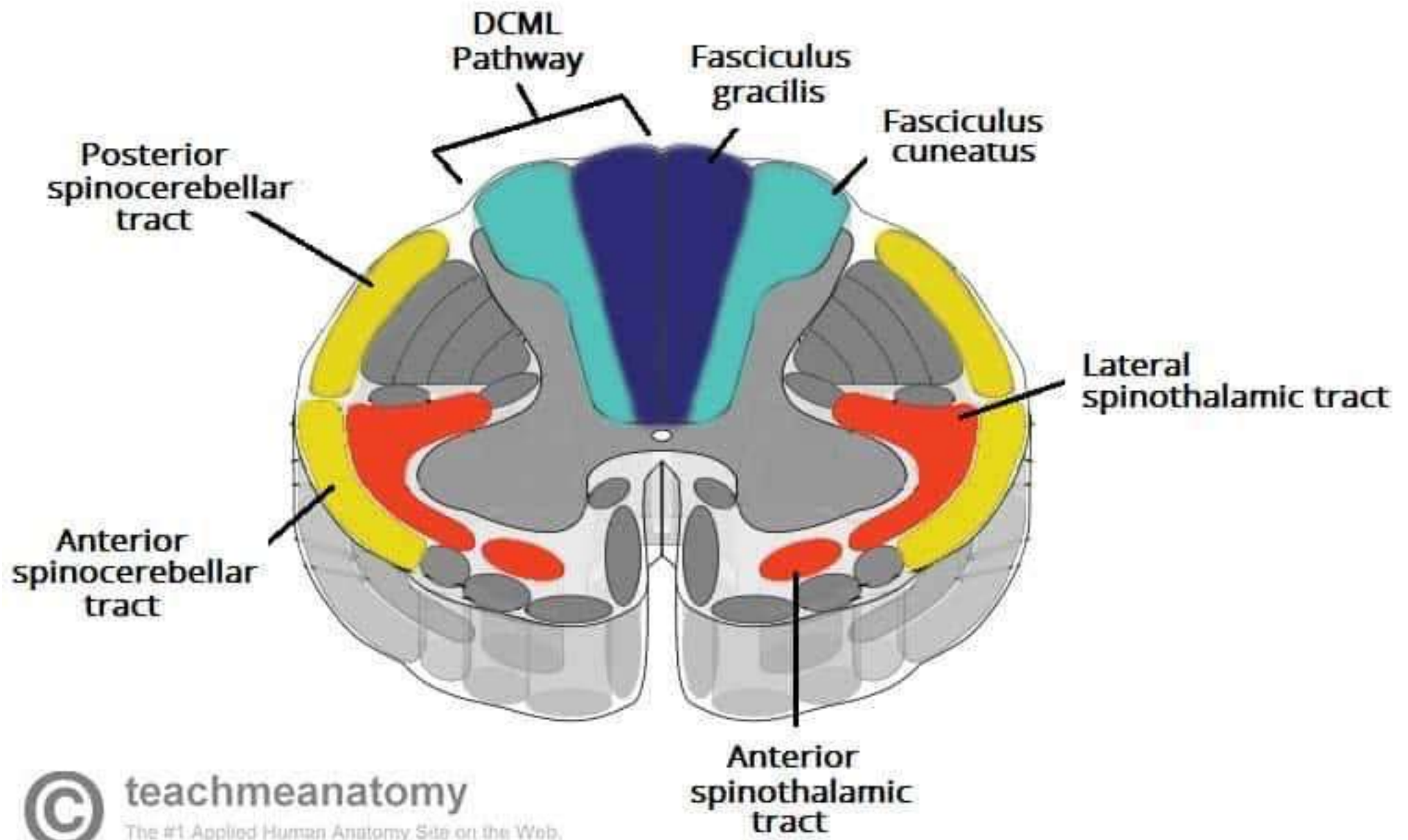
24-48h

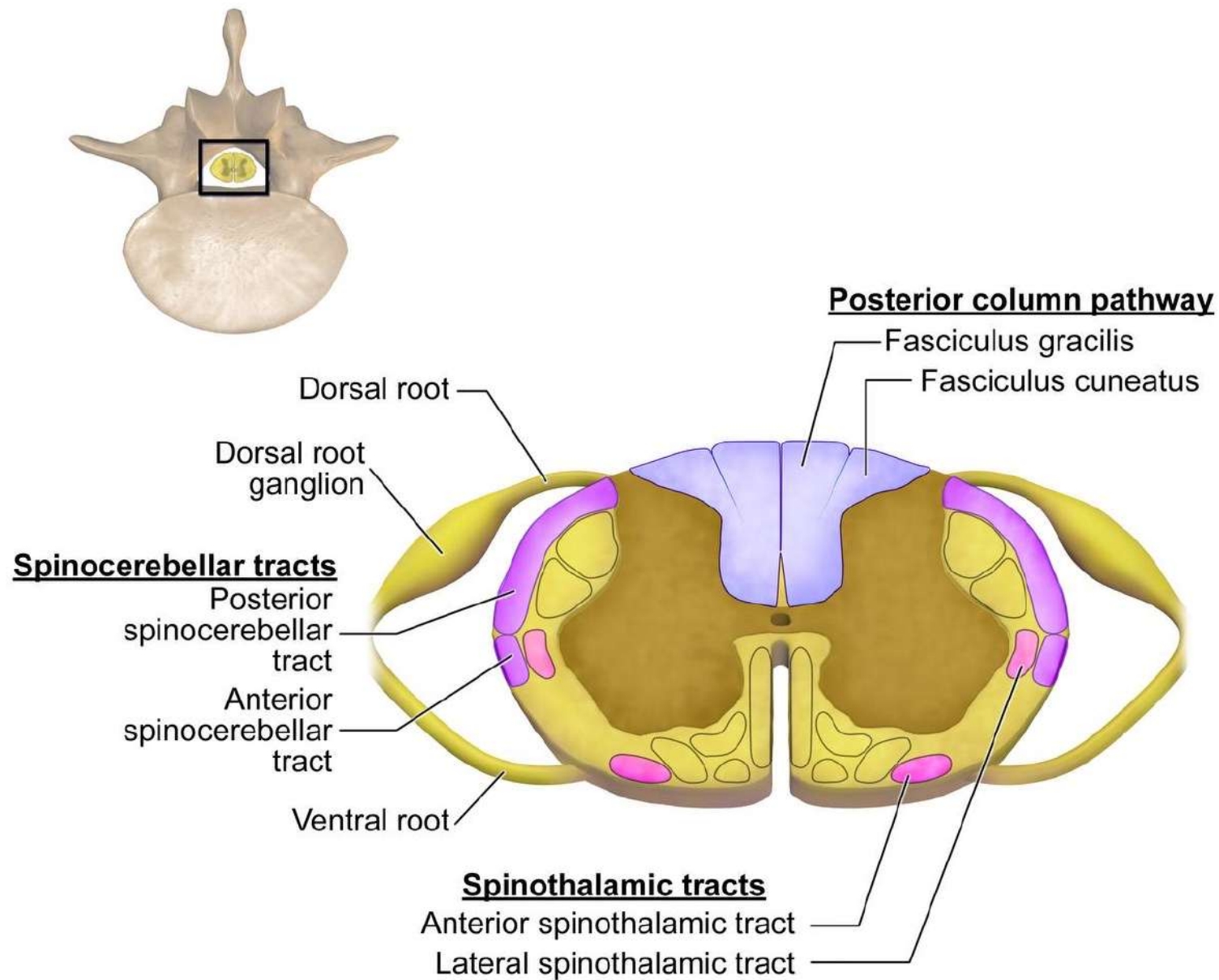
SCI: The spinal column





Sensory Pathways and Ascending Tracts in the Spinal Cord





Sensory Pathways and Ascending Tracts in the Spinal Cord