

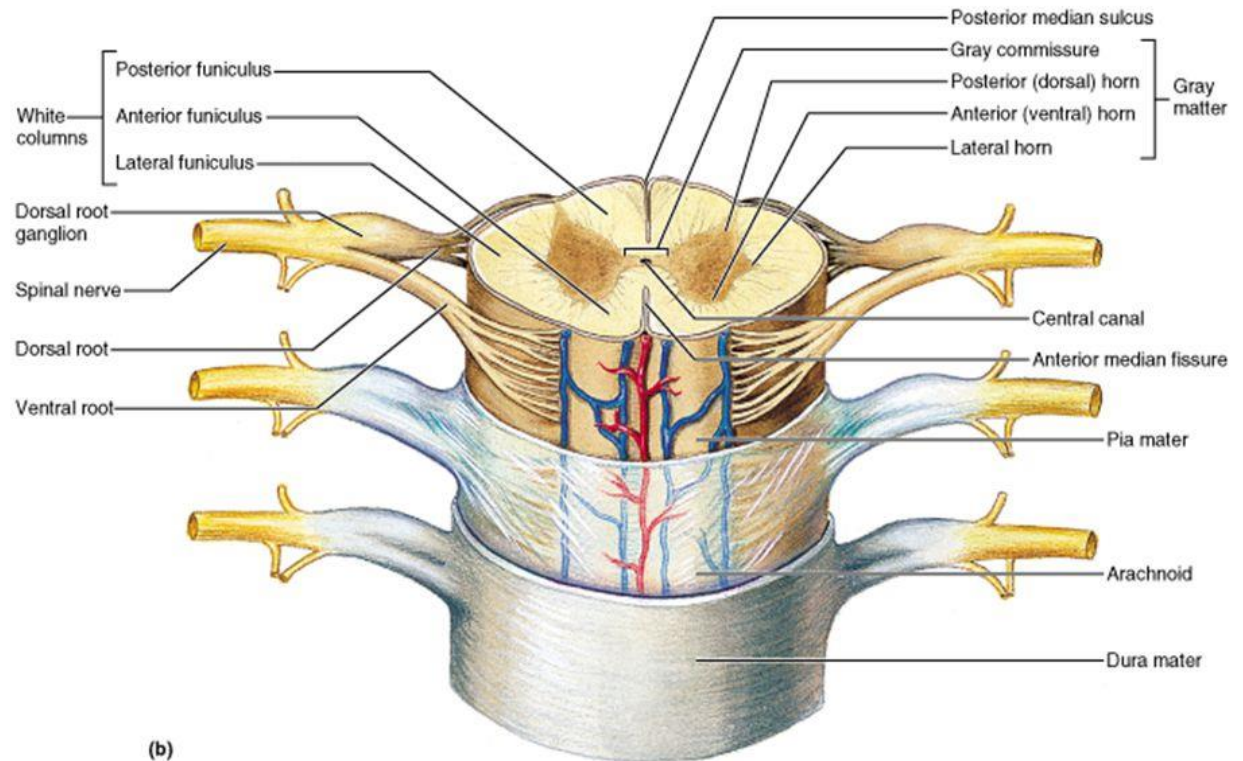
# Evaluation and Management of Spinal Cord Emergency and Cervical Spondylotic Myelopathy

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# Learning Objectives

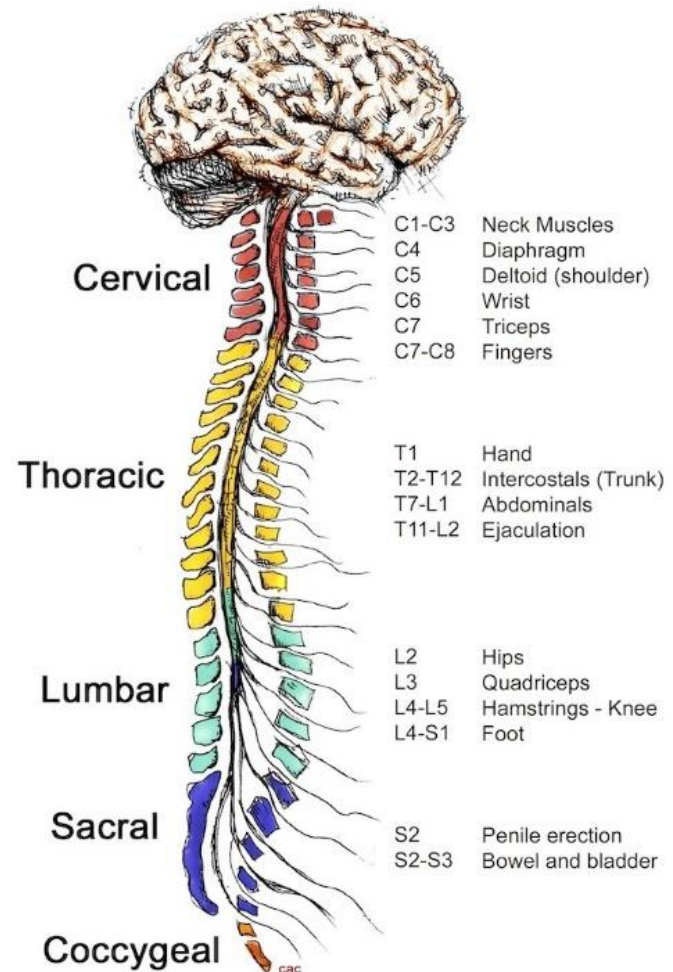
## Central Nervous System – Spinal Cord

- Recognize signs of spinal cord emergency.



# Learning Objectives

- Correlate anatomy and the patients' signs and symptoms in order to identify cervical spondylotic myelopathy (CSM).



# Spinal Cord Injuries (SCI)

- SCI are critical emergencies that must be recognized and treated early to increase the possibility of preventing permanent loss of function.
- Spinal cord emergencies: False reassurance from reflexes. Acad Emerg Med 1998.



# History and Clinical Presentation

- ...can provide the most important information in the assessment of a possible emergency.
- Spinal cord emergencies: False reassurance from reflexes. Acad Emerg Med 1998.



# Red Flags

- Night pain/sweats/fever
- Unexpected weight loss
- Bowel and bladder dysfunction
- Long tract signs
- Signs of neurogenic claudication
- Weakness and paresthesias in extremities



# Cervical Spine Fracture/Dislocation

- Suspect upper cervical spine instability
- History of roll-over MVA or blow to head



# Rust's Sign

- May grab head upon removal of cervical collar
- May use hand to lift head when rising from supine position

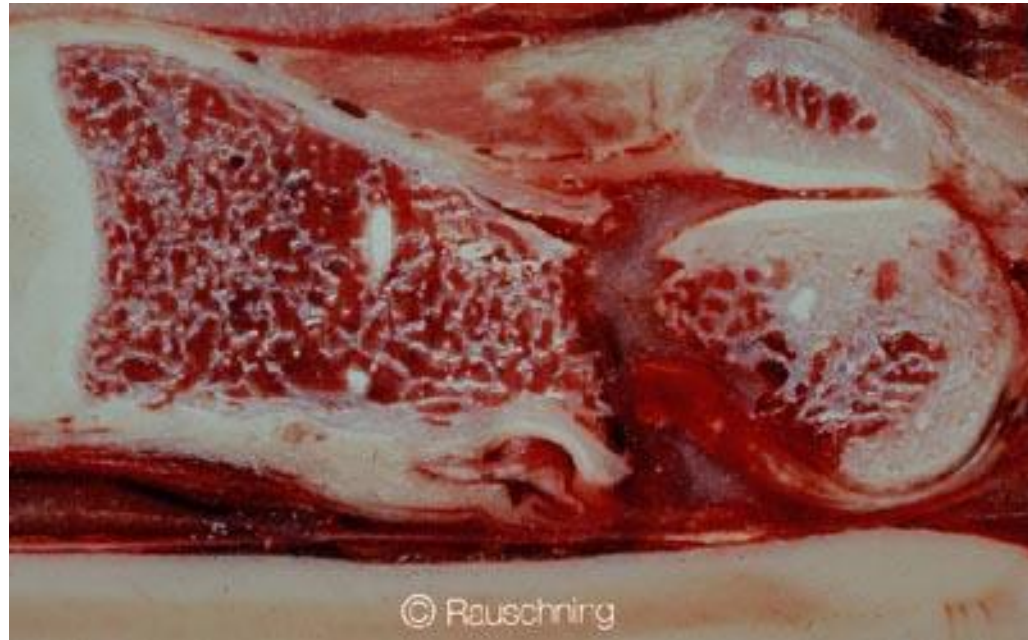




# Rust's Sign

- Patient is attempting to stabilize the head with slight traction and reduce pain
- Patient presents guarded movements
- Imaging studies must proceed any provocative testing
- CT scan is indicated with acute trauma to the cervical spine when radiographic examination is negative.

# Odontoid Fracture CT Scan



# Rust Sign



- Rear-end MVA
- Patient is unable to rise from supine posture without holding hand behind head
- Suspect moderate to severe sprain/strain

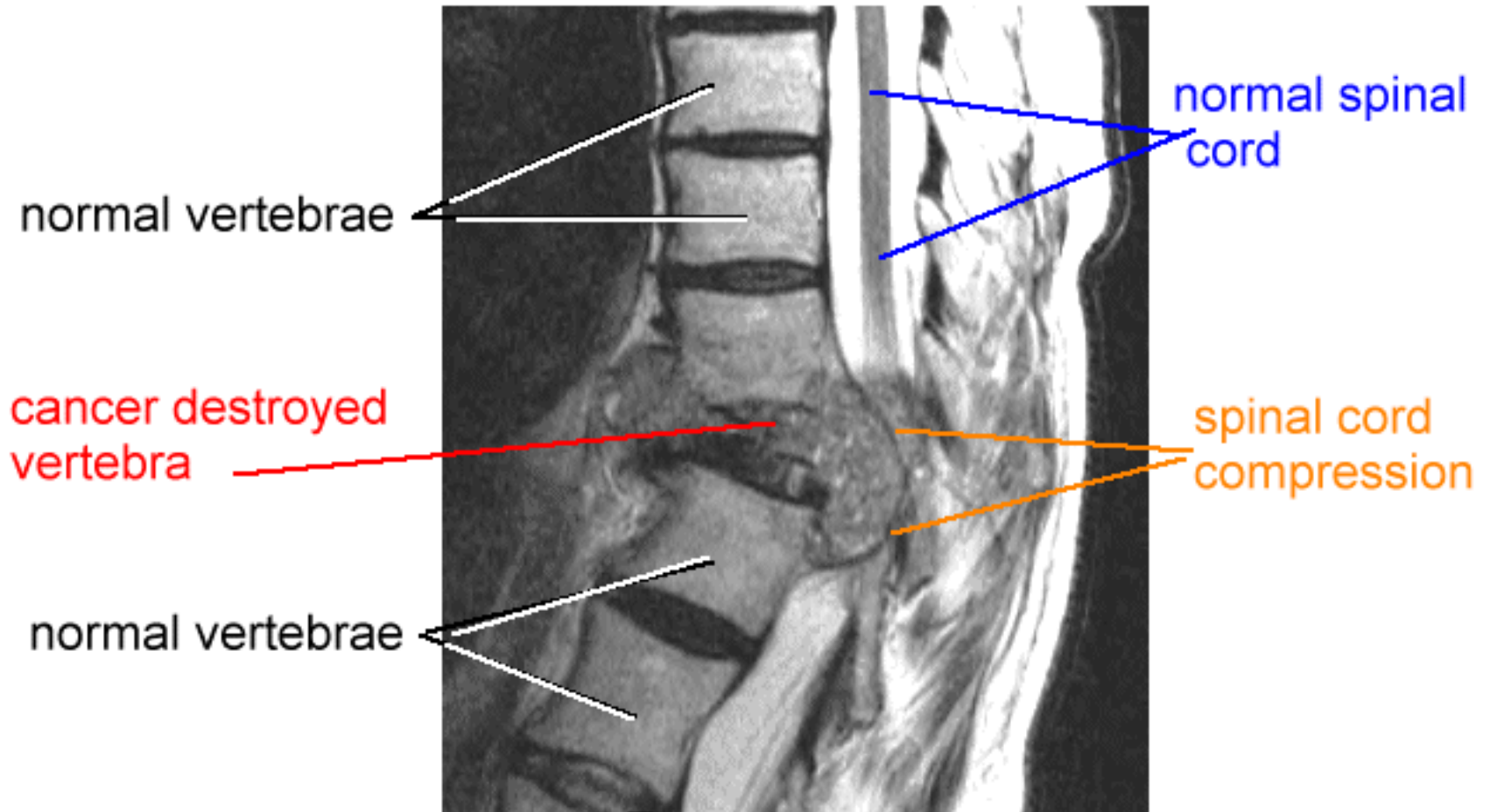
# Recognizing Spinal Cord Injuries Differential Diagnosis

Spinal cord compression secondary to vertebral fracture or space occupying lesion.



# Recognizing Spinal Cord Injuries Differential Diagnosis

Spinal cord compression secondary to vertebral fracture or space occupying lesion.



# Neoplastic Disease

- Metastatic disease most common spinal tumor (25X)
  - Breast
  - Lung
  - Prostate
  - Kidney
  - Lymphoma
- Primary spinal tumor is most often multiple myeloma in adults

# Multiple Myeloma

- What clinical signs would you expect when a patient presents with multiple myeloma?





## TABLE 1: COMMON SYMPTOMS ASSOCIATED WITH MULTIPLE MYELOMA

Bone pain (typically in the back and thorax)

Weakness, malaise

Anemia, bleeding

Hypercalcemia

Spinal cord compression

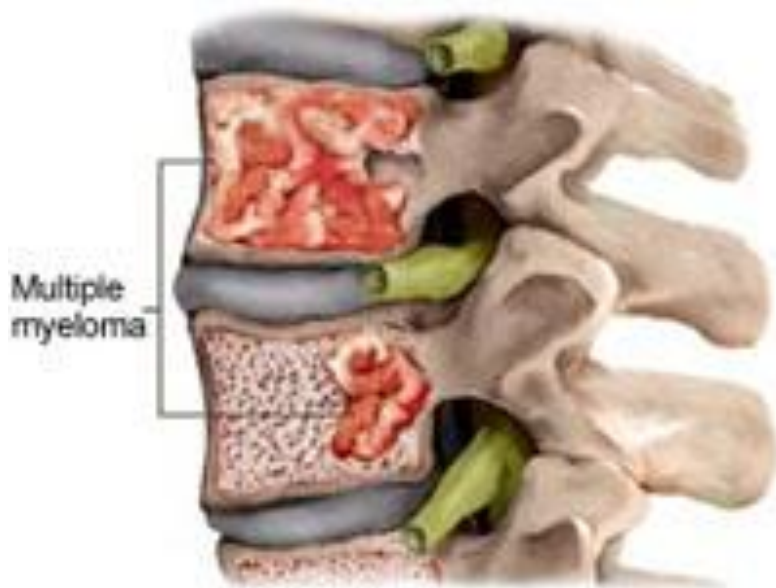
Pathologic fractures

Infections (often pneumococcal)

Renal failure

Neuropathies

Adapted from references 1-4, 9-11.





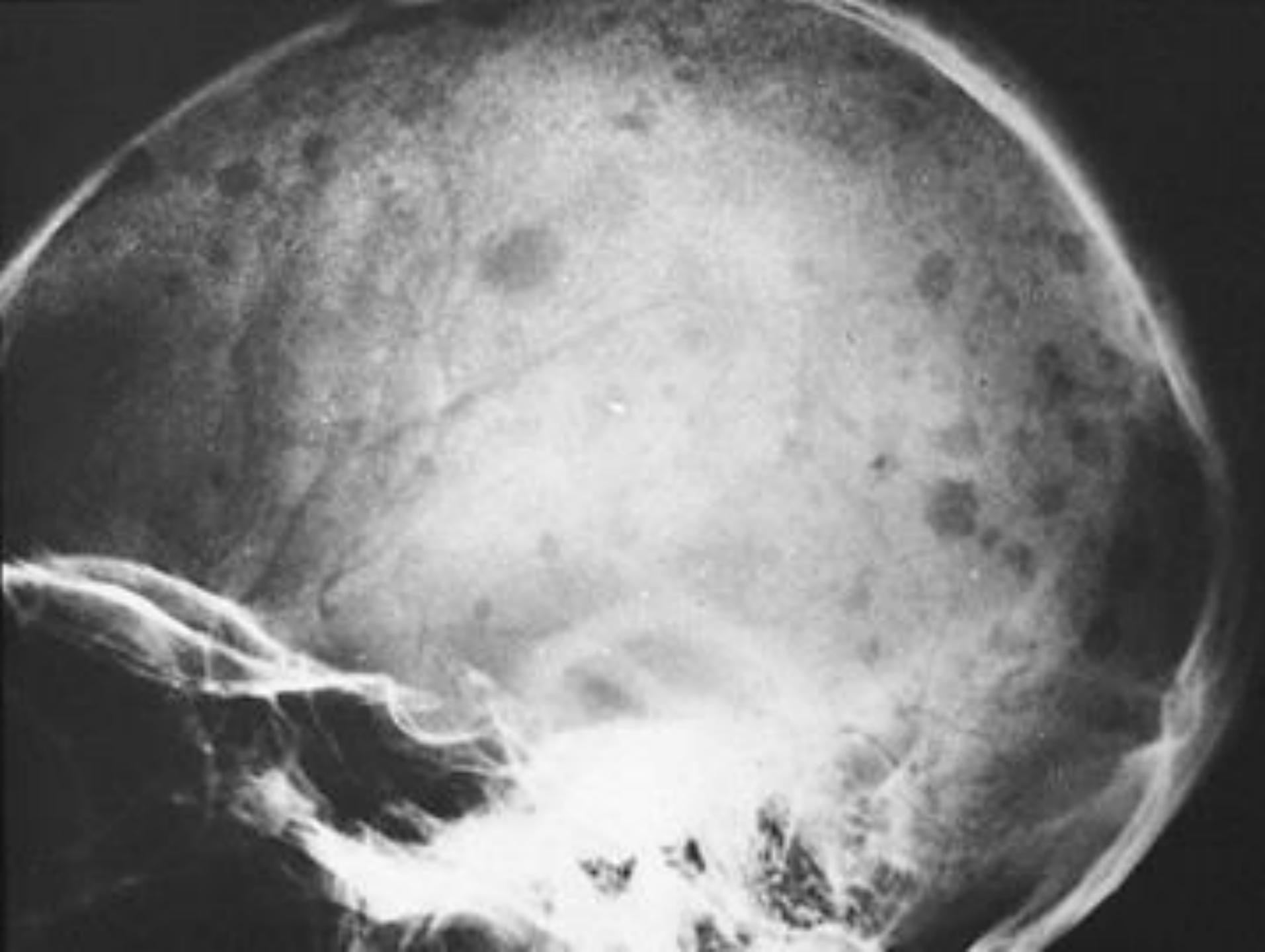
# CRAB Criteria

Table 3: Definition of Multiple Myeloma

<b>“Smoldering” or Asymptomatic Myeloma</b>	<b>Active Multiple Myeloma</b>
<ul style="list-style-type: none"><li>• M-protein in serum <math>\geq 30</math> g/L <i>and/or</i></li><li>• Bone marrow clonal plasma cells <math>&gt; 10\%</math></li><li>• No related organ or tissue impairment (no end organ damage, including bone lesions) or symptoms</li></ul>	Requires one or more of the following <sup>a</sup> : <ul style="list-style-type: none"><li>• Calcium elevation (<math>&gt; 11.5</math> g/dL)</li><li>• Renal insufficiency (creatinine level <math>&gt; 2</math> mg/dL)</li><li>• Anemia (hemoglobin <math>&lt; 10</math> g/dL or <math>2</math> g/dL <math>&lt;</math> normal)</li><li>• Bone disease (lytic or osteopenic)</li></ul>

<sup>a</sup>“CRAB” criteria.

Information from References 8,43.







# Causes of death in multiple myeloma

- Progressive myeloma 45%
- Sepsis 25%
- Renal failure 10%
- Other (old age) 20%

# Spinal Infection

## “Discitis”



- Acute onset of neck or back pain
- HX of infection
- Current fever
- Elevated SED rates or WBC count
- Frequently misdiagnosed in ER
- MRI indicated

# Staph Infection of Spine and Osteomyelitis



- Recent spinal procedure
- Focal severe pain not relieved with rest

# Central Canal Spinal Stenosis



**Lumbar  
Stenosis**

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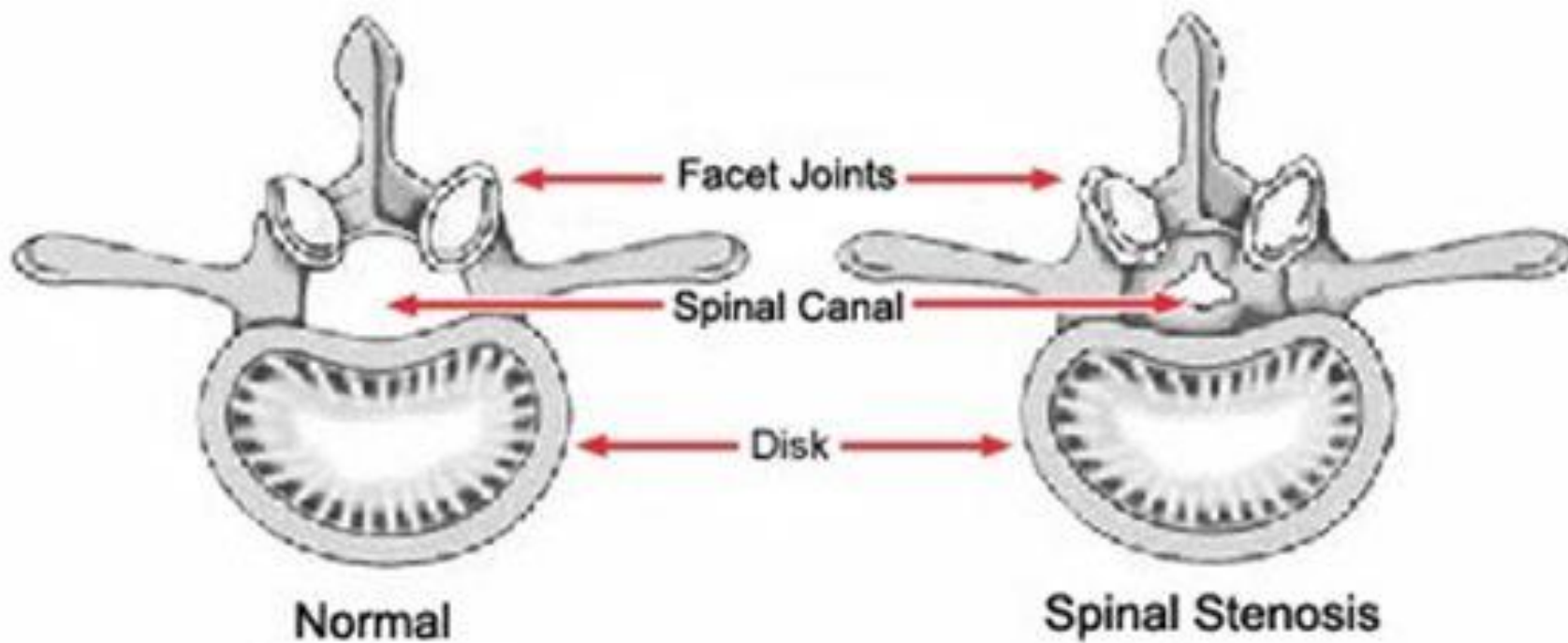


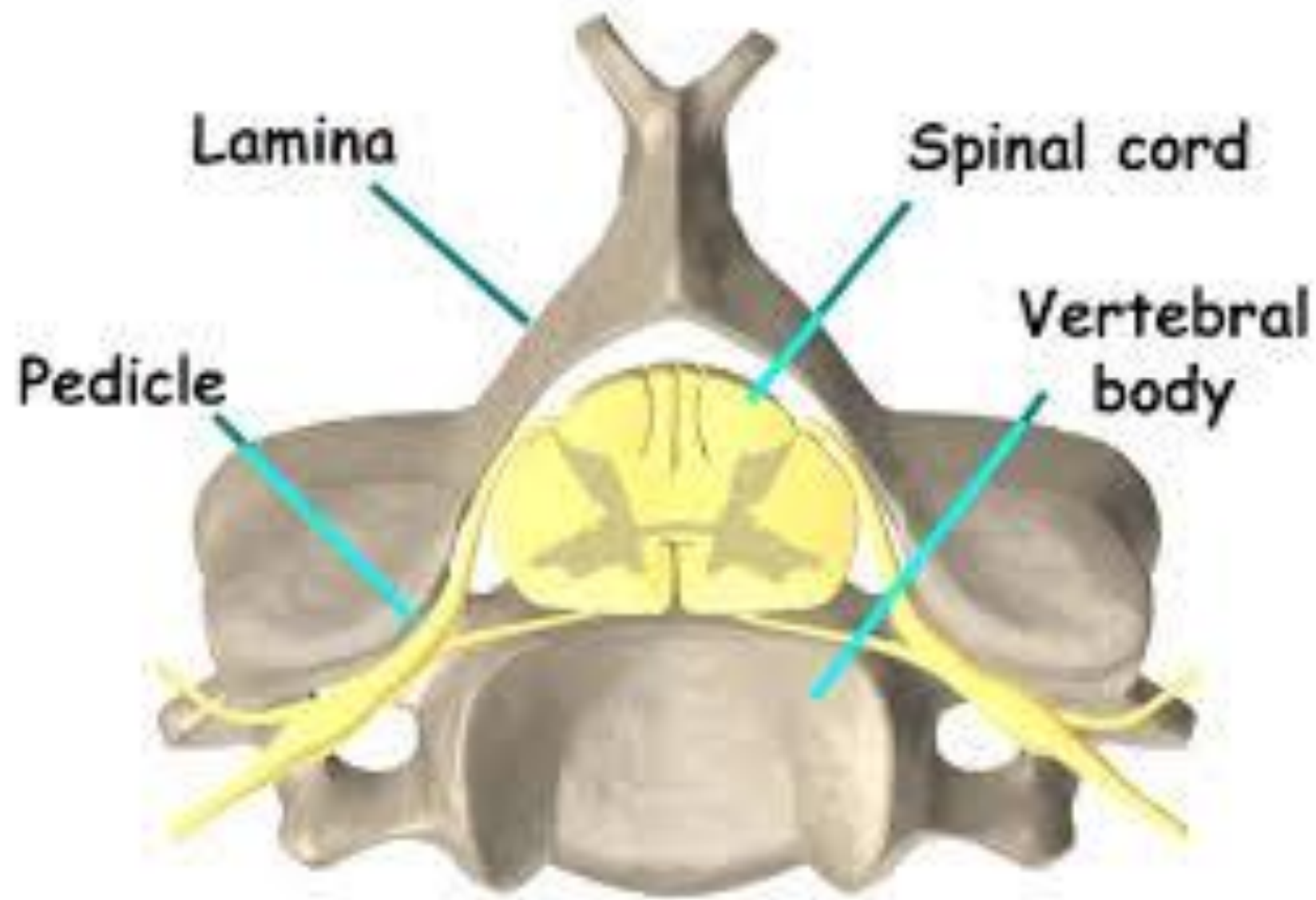
**Cervical  
Spinal  
Stenosis**

MMG 2000

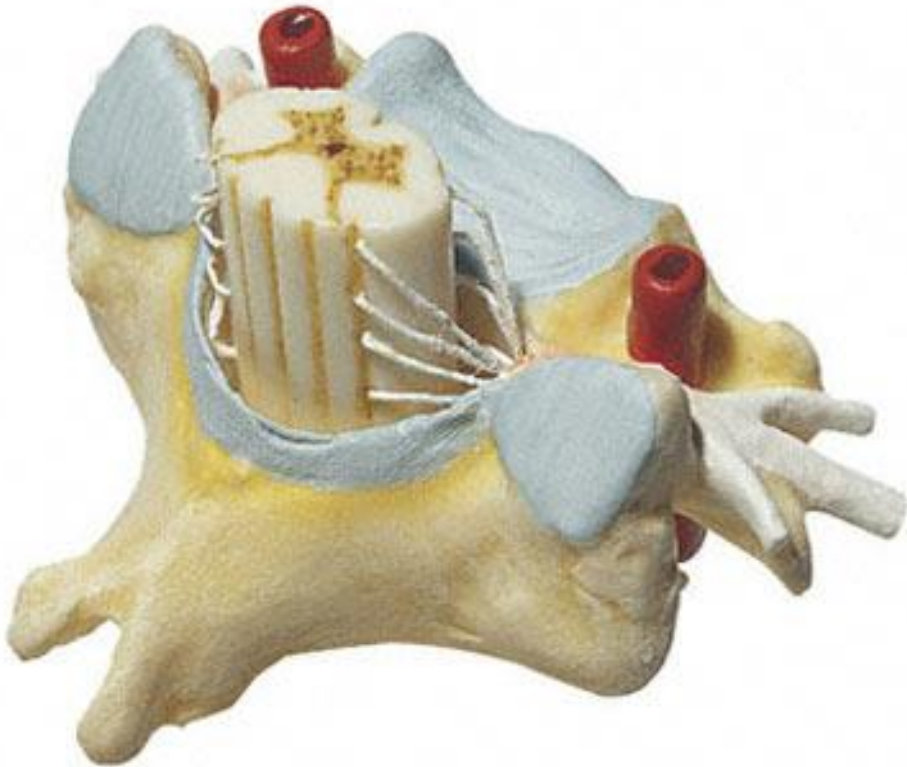


# Vertebral Anatomy

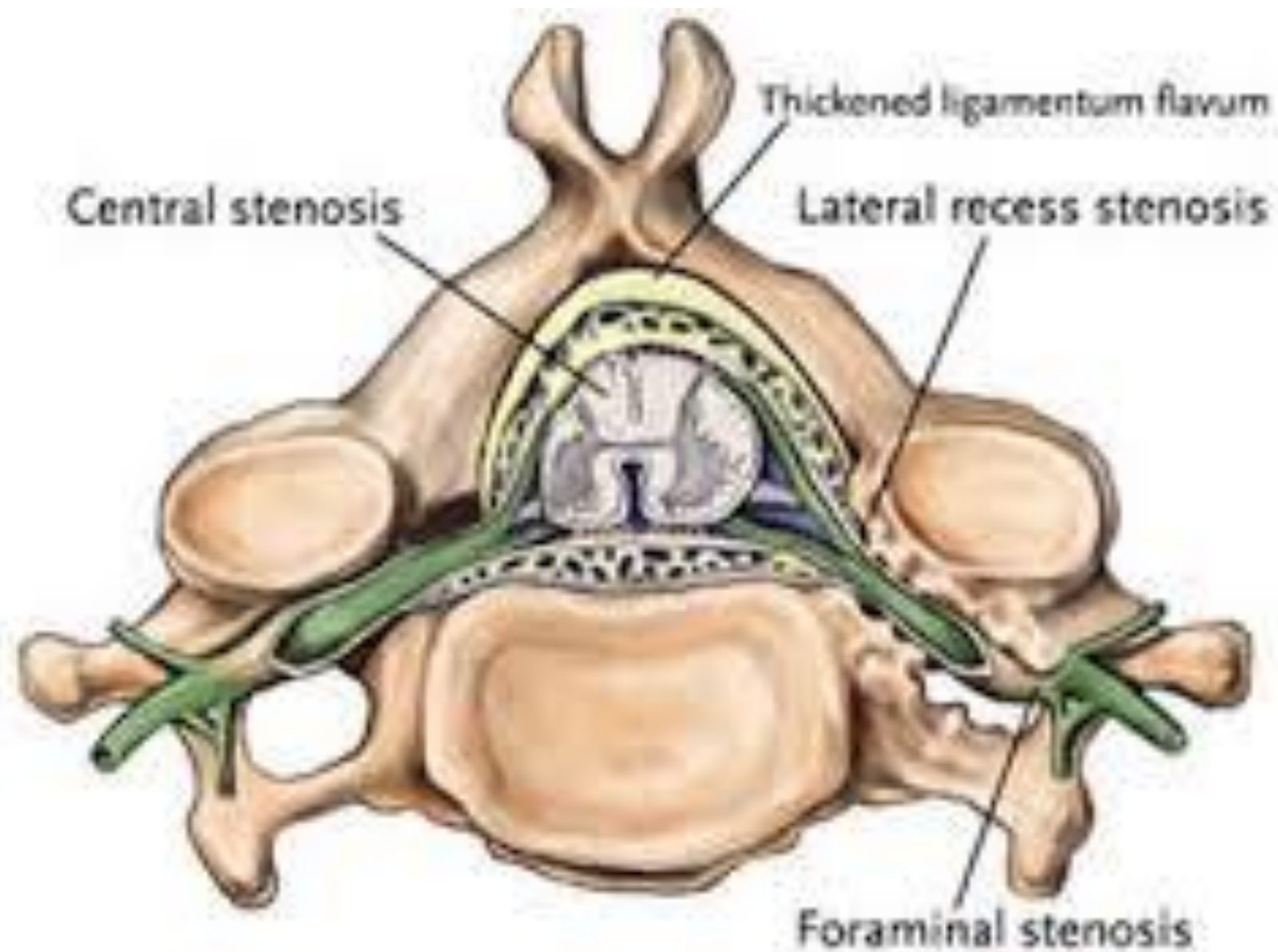




# Cervical Vertebra



- Vertebral artery
- Spinal cord
- Zygapophyseal joints
- Spinal nerve roots



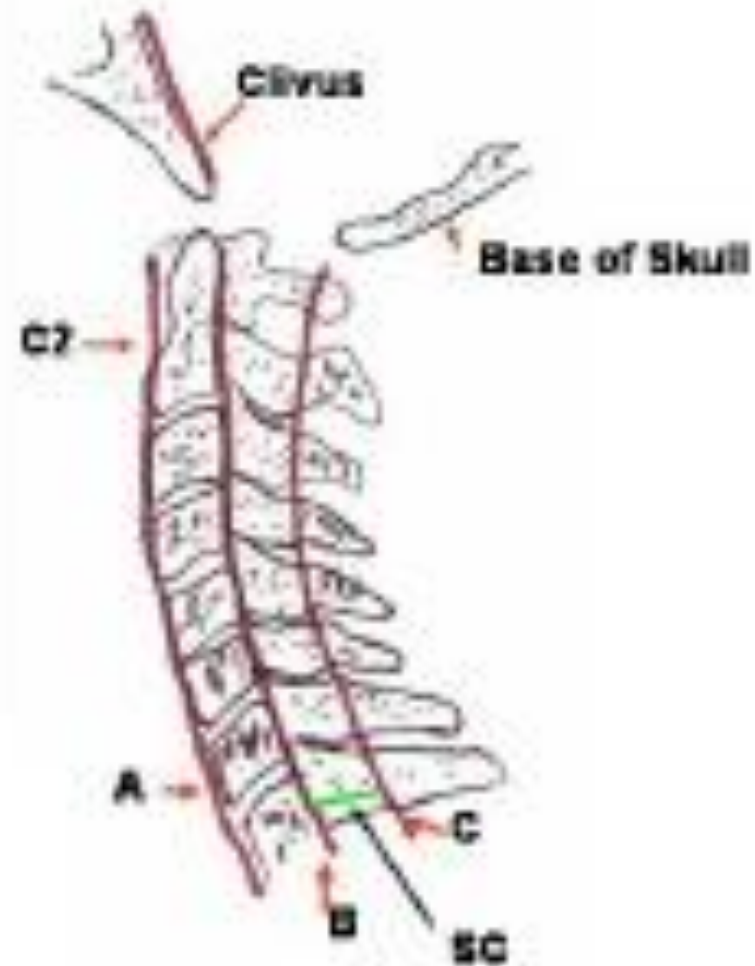
# Spinal Canal Measuring

## Pavlov's ratio

Ratio of sagittal dimension of canal and vertebral body

Less than 0.82 is significant for stenosis

Removes effects of radiographic magnification

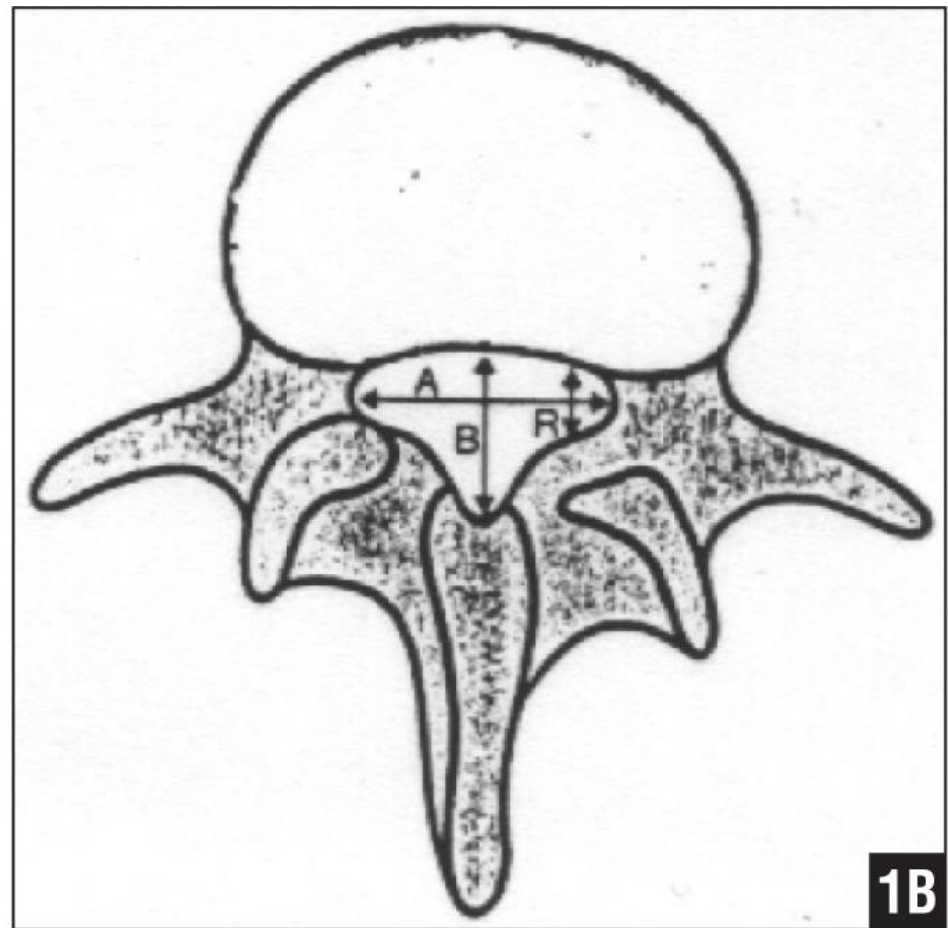
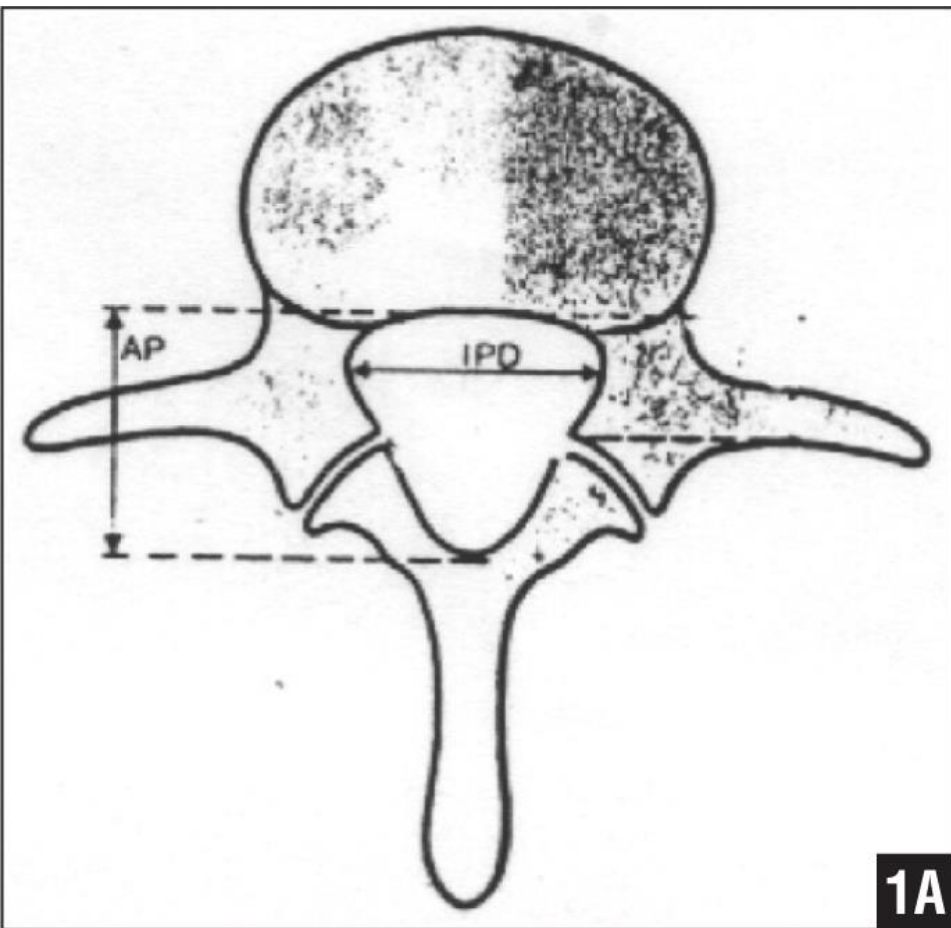


Schematic lateral view of the cervical spine showing: A=anterior spinal line; B=posterior spinal line; C=spinolaminar line, SC=spinal canal

# Congenital Spinal Stenosis









Neck

Head

Spinal  
Cord

Normal Spinal  
Segment

Spinal Stenosis at  
Multiple level due to  
Disc bulge and bone  
spurs

Bone spur pressing  
on spinal cord

Disc

Vertebrae

MRI of Cervial Spine Showing Multilevel Spinal Stenosis





**Myelomalacia at C3-4**

**Shimspine.com**

# Myelomalacia

- Post-traumatic softening of spinal cord due to hemorrhage or inadequate circulation to cord.
- Initially, LMNL signs followed by UMNL signs
- Often subtle signs initially
- Frequently, misdiagnosed
- MRI indicated
- Spinal decompression might be of benefit

Diagnosis is the  
key to successful  
treatment...



# Primum Non Nocere



- CT scan showing C5 pedicle and facet fracture.

# Signs of Cervical Myelopathy (CSM)

- Unsteady walking
- Disuse of hands
- Numbness in the arms and hands
- Atrophy
- Twitching reflexes or muscles.

# Unsteady walking

- Everyday walking is a complex process that is a combination of brain and spinal cord input.
- With cervical cord compression, an unsteady walking pattern can develop.
- Some people can develop a wide based gait. Early signs of this can be tested in the office with tandem gait observation.

# Disuse of hands

- Another sign of cervical spondylotic myelopathy (CSM) will present itself with hand dysfunction. Ask if patient has a difficult time holding a cup of coffee or buttoning their clothes.

# Numbness in the arms and hands

- As the cervical spinal cord is compressed, the spinal nerves will be impacted. This can lead to numbness in the arms and hands (paresthesias).
- Unlike carpal tunnel syndrome, cervical myelopathy will often involve numbness throughout the arm and hand.
- Cervical radiculopathy can cause numbness in the arms and hands but is usually limited to specific dermatomes.



# Atrophy

- With continued compression of the cervical spinal cord, the innervation to the muscles in the arms and hands can be diminished. As a result, the muscles can diminish in size and demonstrate atrophy of the involved musculature.

# Twitching reflexes of muscles

- Hyperreflexia is described by the patient as a twitching of the muscles.
- The upper and lower extremity reflexes are mediated by the corticospinal tract.
- The loss of inhibition results in hyperreflexia and the presence of pathological reflexes.

# **Cervical Spondylotic Myelopathy: A Common Cause of Spinal Cord Dysfunction in Older Persons**

WILLIAM F. YOUNG, M.D., Temple University  
Hospital, Philadelphia, Pennsylvania

*Am Fam Physician.* 2000 Sep 1;62(5):1064-1070.

# Cervical Spondylotic Myelopathy

- Cervical spondylotic myelopathy (CSM) is the most common spinal cord disorder in persons more than 55 years of age in North America and perhaps in the world.



# Cervical Spondylotic Myelopathy



- The aging process results in degenerative changes in the cervical spine that, in advanced stages, can cause compression of the spinal cord.

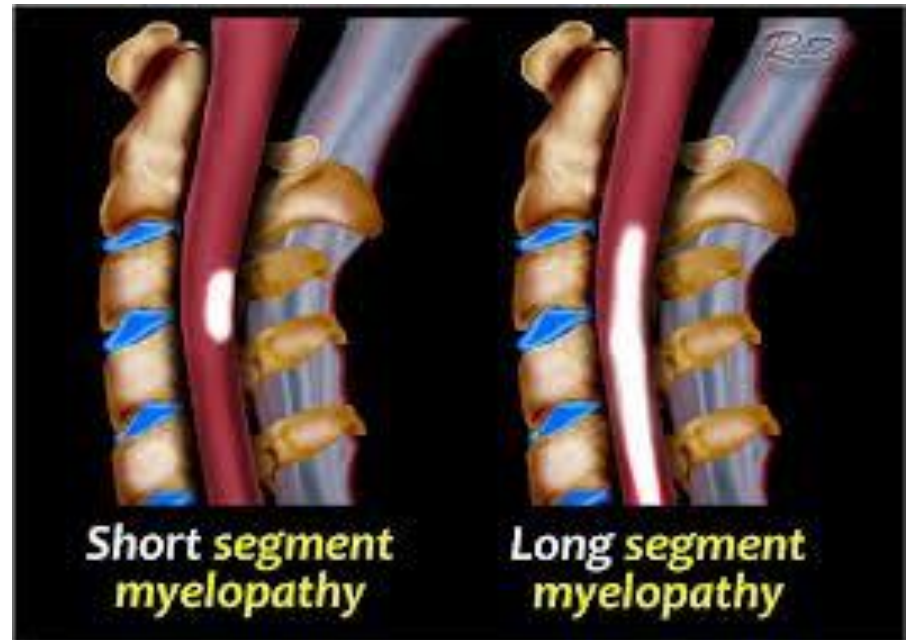
# Cervical Spondylotic Myelopathy

- Symptoms often develop insidiously and are characterized by neck stiffness, arm pain, numbness in the hands, and weakness of the hands and legs.



# Cervical Spondylotic Myelopathy

- The differential diagnosis includes any condition that can result in myelopathy, such as multiple sclerosis, amyotrophic lateral sclerosis and masses (such as metastatic tumors) that press on the spinal cord.



# Cervical Spondylotic Myelopathy

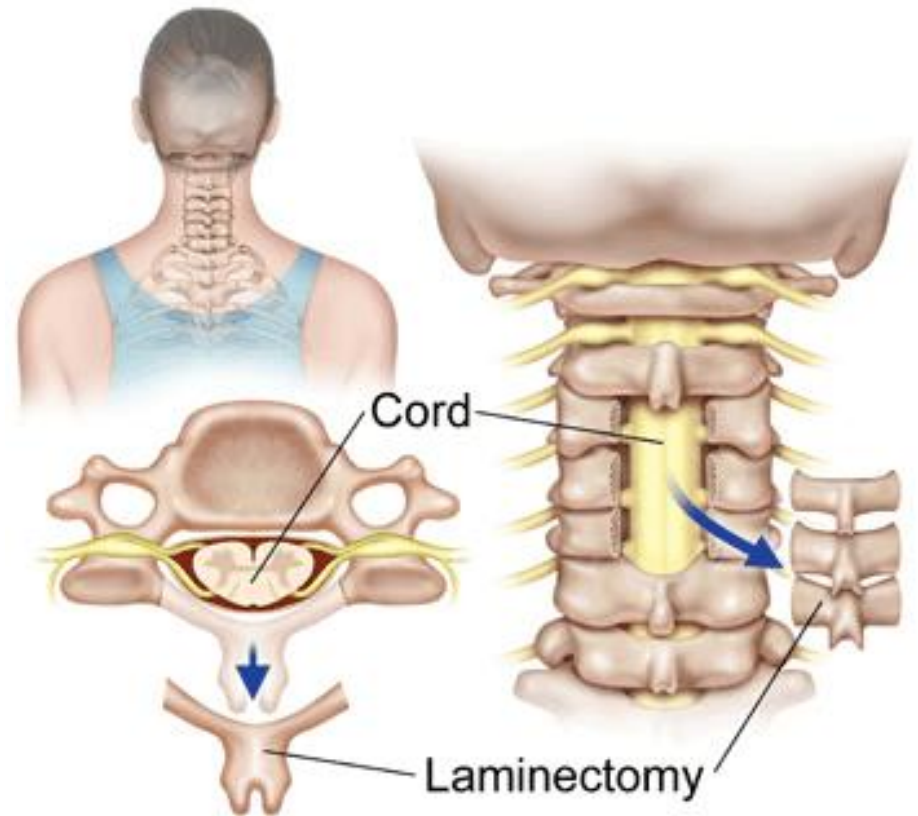


- The diagnosis is confirmed by magnetic resonance imaging that shows narrowing of the spinal canal caused by osteophytes, herniated discs and ligamentum flavum hypertrophy.



# Cervical Spondylotic Myelopathy

- Choice of treatment remains controversial, surgical procedures designed to decompress the spinal cord and, in some cases, stabilize the spine are successful in many patients.



WILLIAM F. YOUNG, M.D Cervical Spondylotic Myelopathy: A Common Cause of Spinal Cord Dysfunction in Older Persons. *Am Fam Physician*. 2000 Sep 1;62(5):1064-1070.

# Cervical Cord Compression



- Cervical compression tests and active cervical flexion may elicit signs of myelopathy rather than radiculopathy

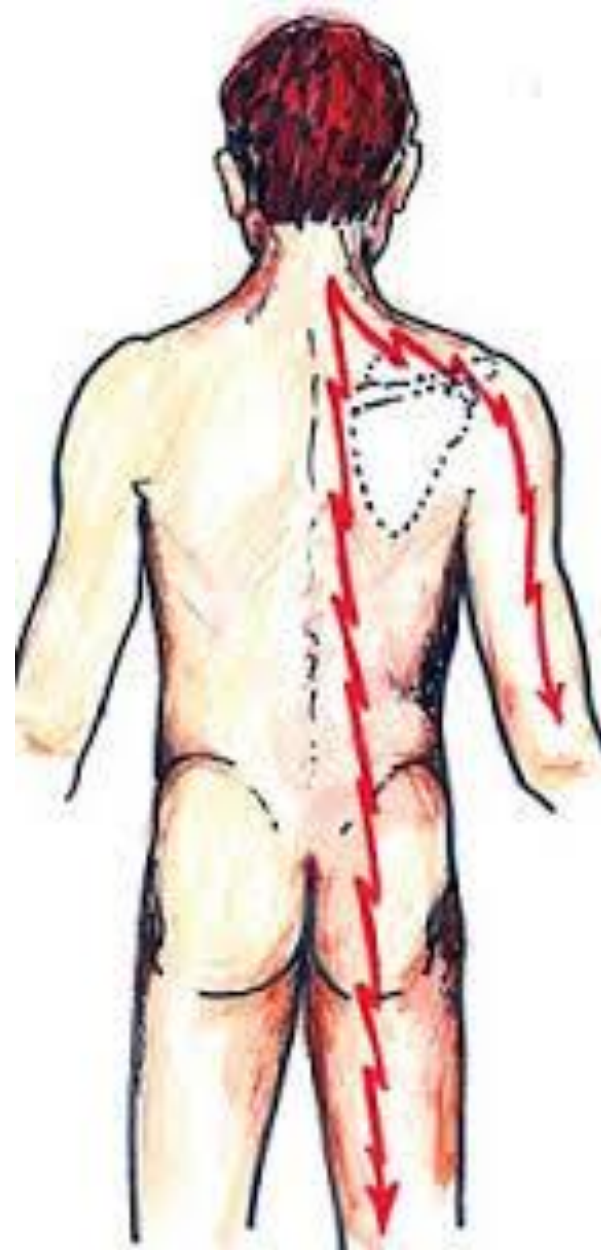
# Lhermitte's Sign

Patient may report an electrical shock-like sensation shooting down the spine and any combination of extremities with certain head movements or postures, especially active cervical flexion.



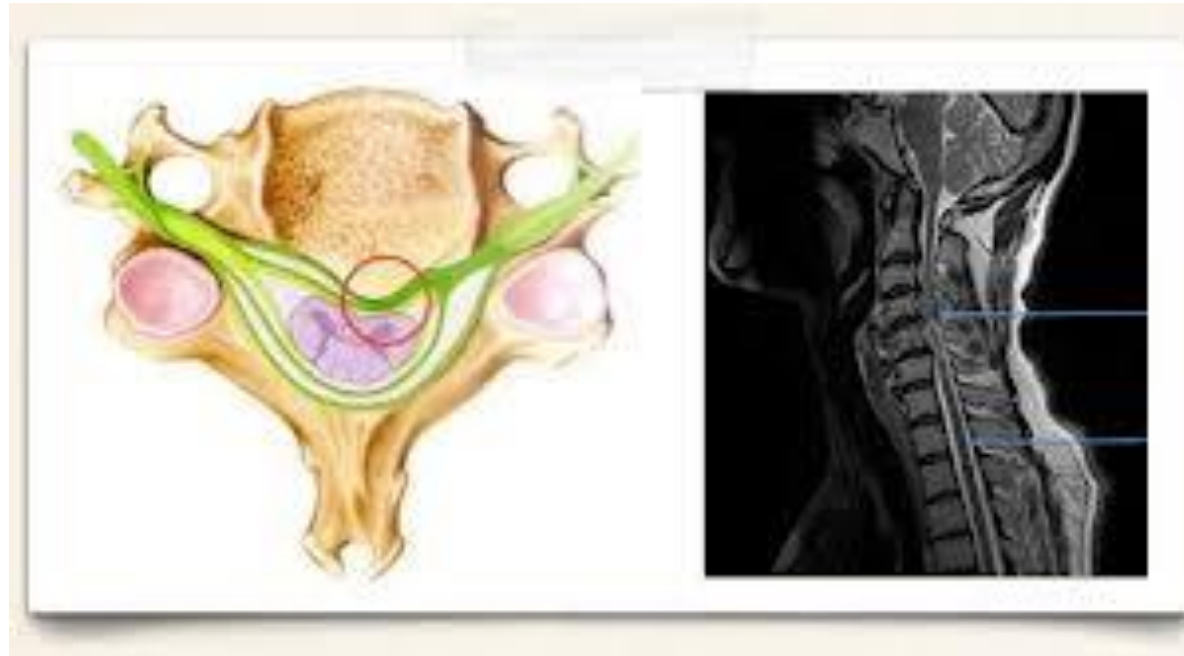
# Lhermitte's Sign

The sign suggests a lesion of the dorsal columns of the cervical cord or of the caudal medulla.



# Lhermitte's Sign

Although often considered a classic finding in multiple sclerosis, it can be caused by compression of the spinal cord in the neck from any cause such as cervical spondylosis, disc herniation, tumor, and Arnold-Chiari malformation.



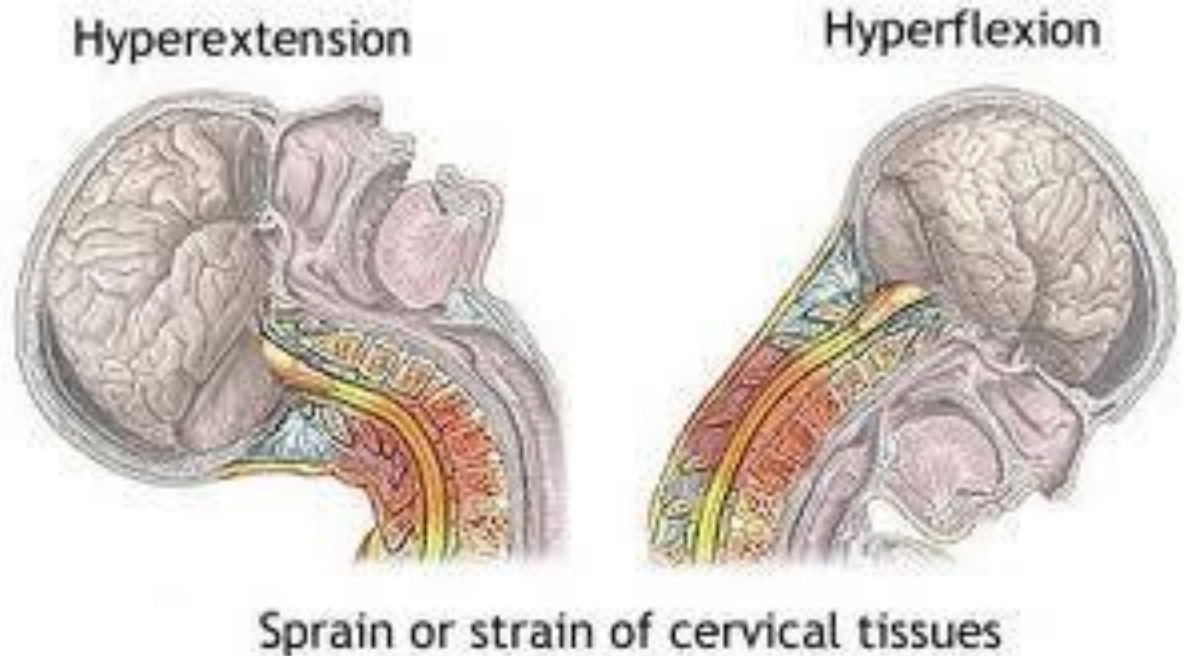




Delayed onset  
Lhermitte's sign has  
been reported  
following head and/or  
neck trauma.

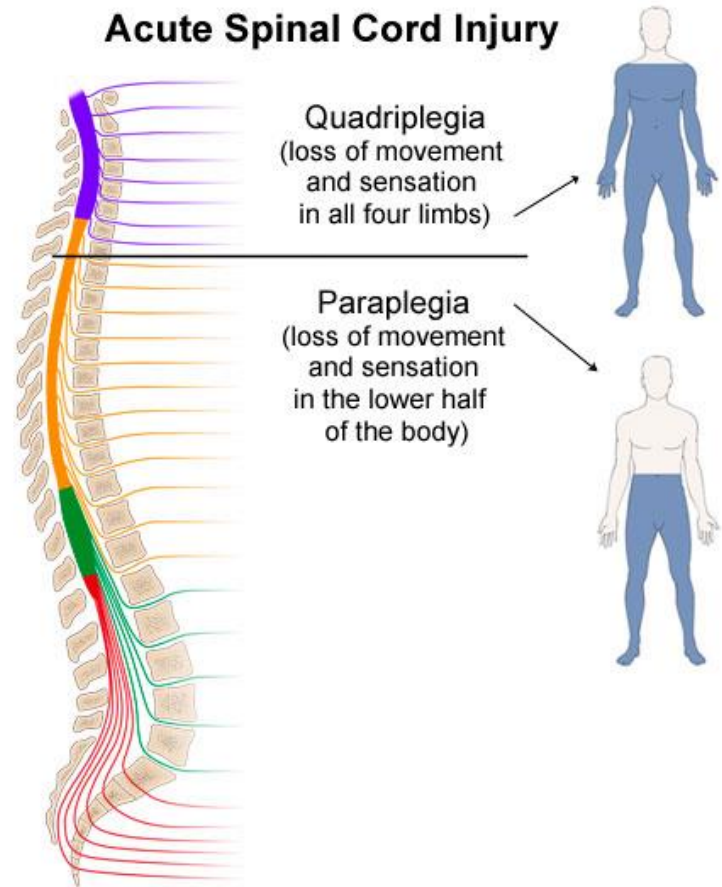
This occurs ~2 1/2  
months following  
injury, without  
associated  
neurological  
symptoms or pain,  
and typically resolves  
within 1 year.

Chan RC. & Steinbock P. (1984). "Delayed  
onset of Lhermitte's sign following head  
and/or neck injuries. Report of four cases." [Neurosurg](#) 60 (3): 609–12.



# Upper Motor Neuron Lesion

- Injury of upper motor neurons is common because of the large amount of cortex occupied by the motor areas, and because motor pathways extend all the way from the cerebral cortex to the lower end of the spinal cord.





# Upper Motor Neuron Lesion

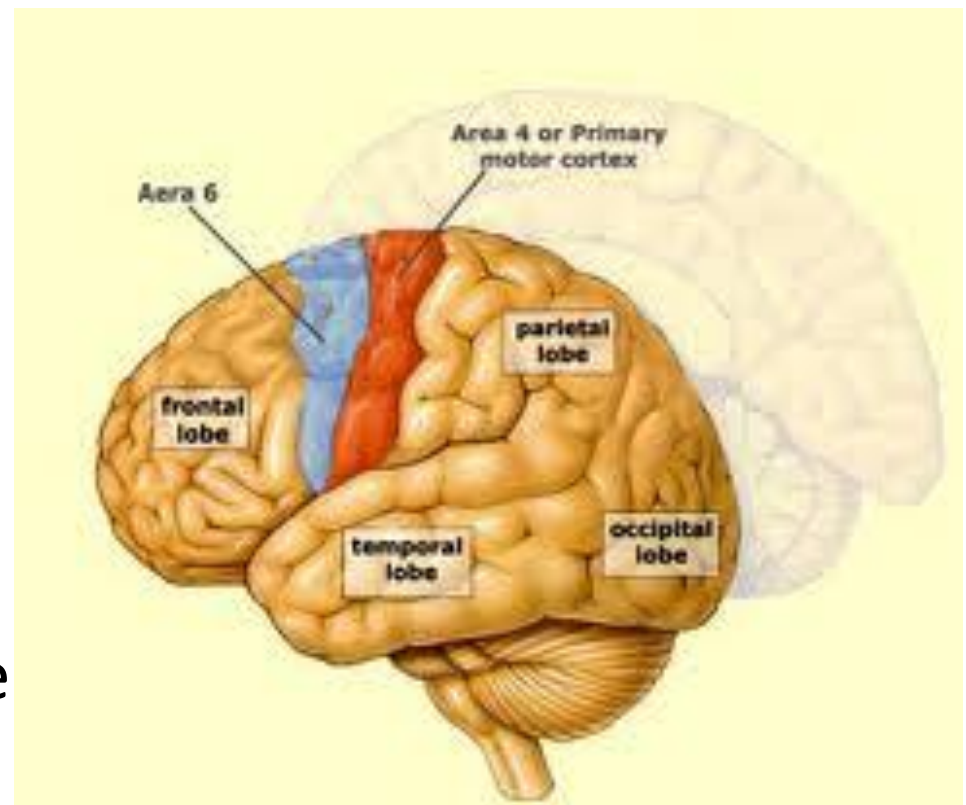
- Damage to the descending motor pathways anywhere along this trajectory gives rise to a set of symptoms called the upper motor neuron syndrome.



- Damage to Descending Motor Pathways: The Upper Motor Neuron Syndrome. Neuroscience. 2nd edition. Purves D, Augustine GJ, Fitzpatrick D, et al., editors. Sunderland (MA): Sinauer Associates; 2001.

# Upper Motor Neuron Lesion

- Damage to the motor cortex or the descending motor axons in the internal capsule causes an immediate flaccidity of the muscles on the contralateral side of the body and face.

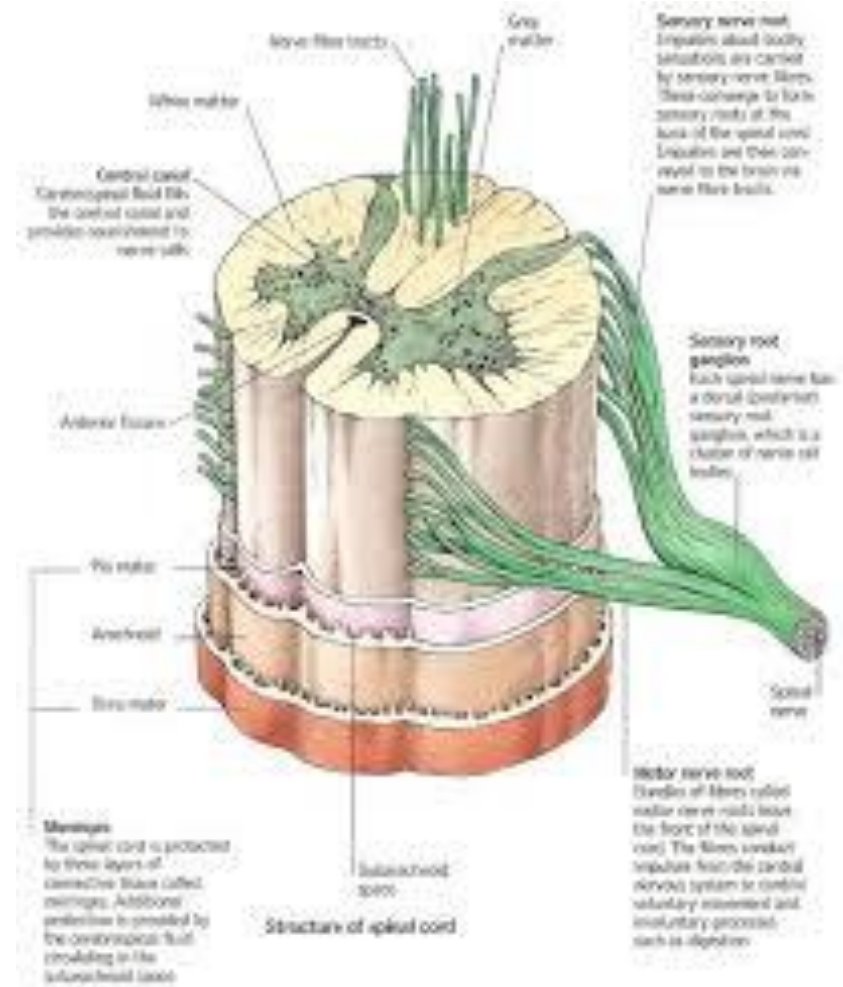


# Upper Motor Neuron Lesion

- This initial period of “hypotonia” after upper motor neuron injury is called spinal shock, and reflects the decreased activity of spinal circuits suddenly deprived of input from the motor cortex and brainstem.
- Damage to Descending Motor Pathways: The Upper Motor Neuron Syndrome. Neuroscience. 2nd edition. Purves D, Augustine GJ, Fitzpatrick D, et al., editors. Sunderland (MA): Sinauer Associates; 2001.

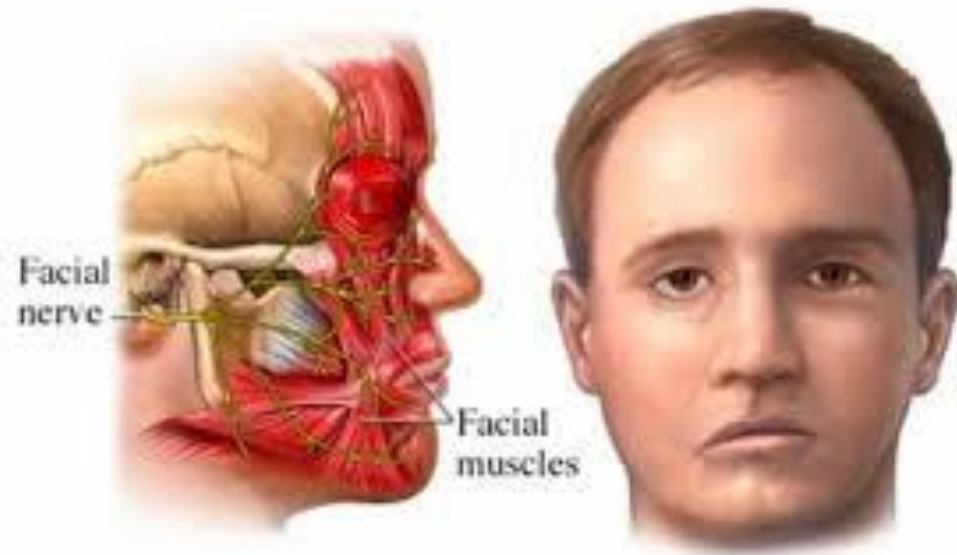
# Lower Motor Neuron Lesion

- The symptoms that arise from damage to the lower motor neurons of the brainstem and spinal cord are referred to as the “lower motor neuron syndrome.”



# Lower Motor Neuron Lesion

- Damage to lower motor neuron cell bodies or their peripheral axons results in paralysis (loss of movement) or paresis (weakness) of the affected muscles.



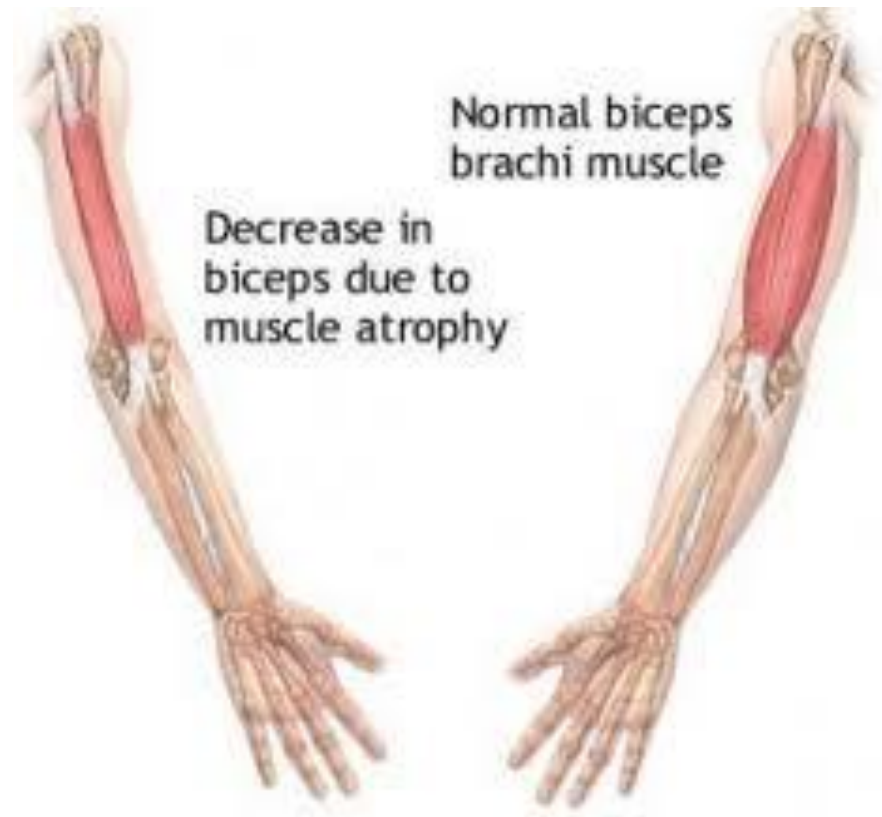
# Lower Motor Neuron Lesion

- In addition to paralysis and/or paresis, the lower motor neuron syndrome includes a loss of reflexes (areflexia) due to interruption of the efferent (motor) limb of the sensory motor reflex arcs.



# Lower Motor Neuron Lesion

- Damage to lower motor neurons also entails a loss of muscle tone, since tone is in part dependent on the monosynaptic reflex arc that links the muscle spindles to the lower motor neurons



# Lower Motor Neuron Lesion

- A somewhat later effect is atrophy of the affected muscles due to denervation and disuse.





# Lower Motor Neuron Lesion

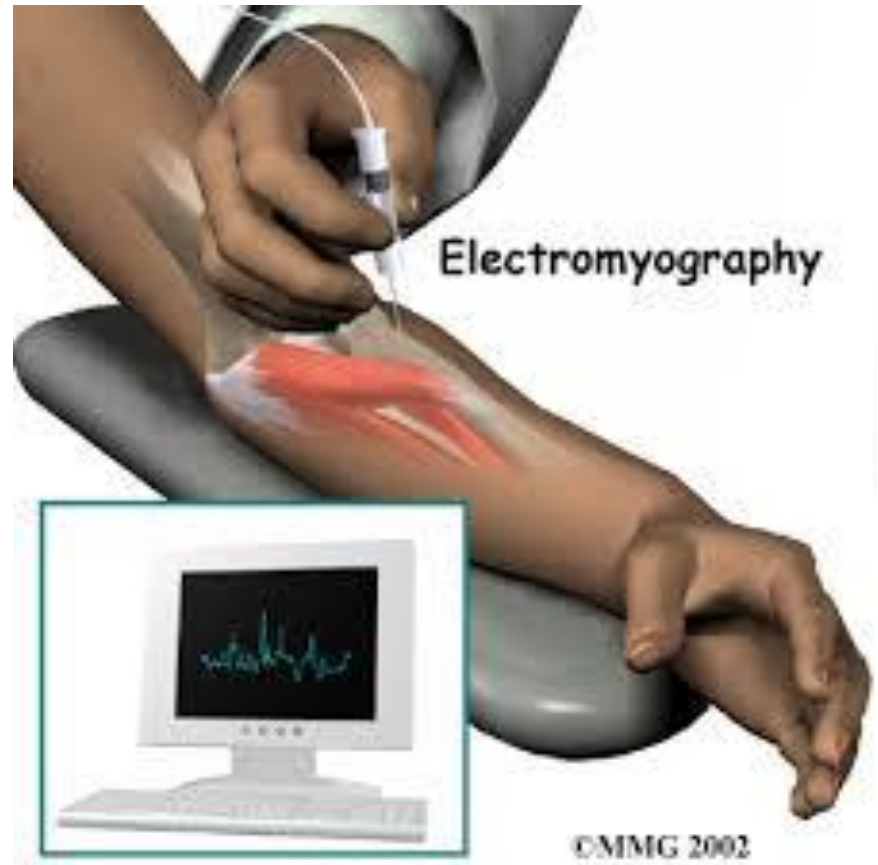
- The muscles involved may also exhibit fibrillations and fasciculations, which are spontaneous twitches characteristic of single denervated muscle fibers or motor units, respectively.

# Lower Motor Neuron Lesion

- These phenomena arise from changes in the excitability of denervated muscle fibers in the case of fibrillation, and from abnormal activity of injured  $\alpha$  motor neurons in the case of fasciculations.

# Lower Motor Neuron Lesion

- These spontaneous contractions can be readily recognized in an electromyogram, providing an especially helpful clinical tool in diagnosing lower motor neuron disorders
- Purves D, Augustine GJ, Fitzpatrick D, et al., editors. The Lower Motor Neuron Syndrome. Neuroscience. 2nd edition. Sunderland (MA): Sinauer Associates; 2001.

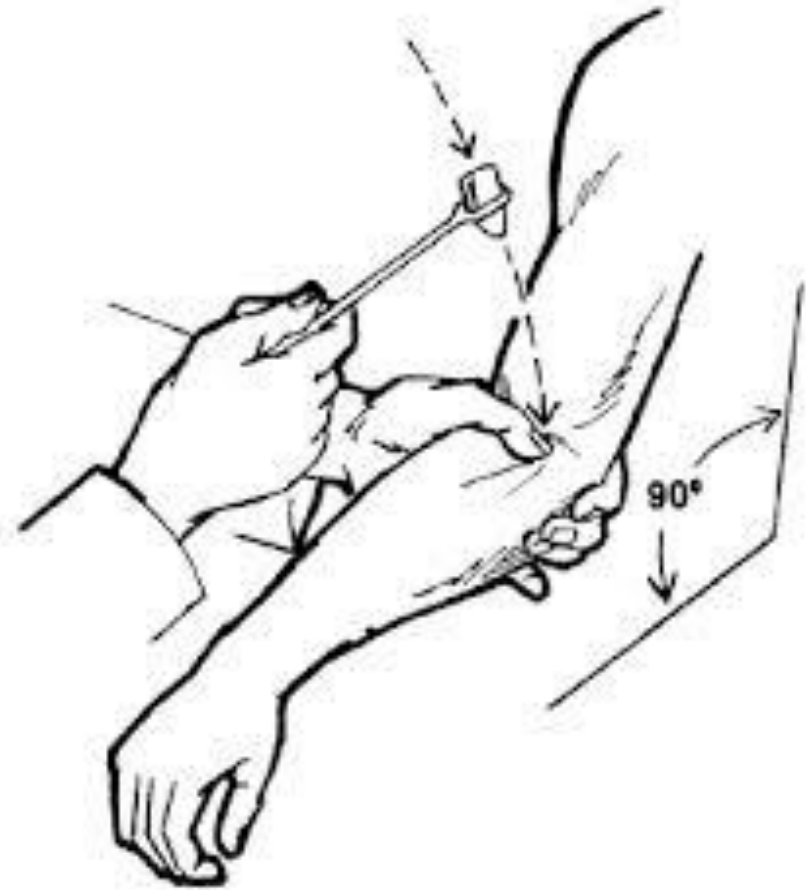


# Characteristics of Motor Neuron Lesions

- **Upper (UMNL)**
  - Hyper-reflexia
  - Pathological reflexes
  - Increased tone
  - Spastic paralysis
  - Clonus
- **Lower (LMNL)**
  - Hypo-reflexia
  - Flaccid paralysis/paresis
  - Loss of tone
  - Atrophy
  - Fasciculations
  - Fibrillations
  - Reaction of degeneration

# Three Part Peripheral Nervous System Examination

- Deep Tendon Reflex Testing (Myotatic)
- Motor Testing for Strength
- Sensory Testing



# Active Learning Task

- Form groups of 4-5 learners
- Select spokesperson
- Create a putative SOAP note (10 minutes)
- Present your case (2 minutes)

# Engaged Learning Exercise

- Create a putative SOAP note for a patient presenting with cervical spondylotic myelopathy (CSM).
- Please write a narrative for subjective data gleaned from history
- List examination procedures and anticipated objective findings
- Assessment is CSM
- Plan should include your management

# References

- Spinal cord emergencies: False reassurance from reflexes. *Acad Emerg Med* 1998.
- WILLIAM F. YOUNG, M.D Cervical Spondylotic Myelopathy: A Common Cause of Spinal Cord Dysfunction in Older Persons. *Am Fam Physician*. 2000 Sep 1;62(5):1064-1070
- Chan RC. & Steinbock P. (1984). "Delayed onset of Lhermitte's sign following head and/or neck injuries. Report of four cases.". [\*J Neurosurg\*](#) **60** (3): 609–12.
- Damage to Descending Motor Pathways: The Upper Motor Neuron Syndrome. Neuroscience. 2nd edition. Purves D, Augustine GJ, Fitzpatrick D, et al., editors. Sunderland (MA): Sinauer Associates; 2001.
- Purves D, Augustine GJ, Fitzpatrick D, et al., editors. The Lower Motor Neuron Syndrome. Neuroscience. 2nd edition. Sunderland (MA): Sinauer Associates; 2001.



# Suggested Readings

- Cervical Spondylotic Myelopathy.  
<http://www.aafp.org/afp/2000/0901/p1064.html>
- Recognizing Spinal Cord Emergencies.  
<http://www.aafp.org/afp/2001/0815/p631.html>

obrigado

Dank U

Merci

mahalo

Köszi

спасибо

Grazie

Thank  
you

mauruuru

Takk

Gracias

Dziękuję

Děkuju

danke

Kiitos