PainWeek®

The Big Squeeze: Cervical Spondylotic Myelopathy

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Disclosure

- Nothing to disclose

Learning Objectives

- Describe the multiple causes of myelopathy
- Describe the approach to making the diagnosis of myelopathy
- Describe available treatments of myelopathy

Differential Diagnosis

Acute: Differential Diagnosis- Compression

- Trauma
- Epidural abscess/hematoma
- Epidural neoplasm (primary or metastasis)
- Vertebral compression fracture
- Disc hernation
- Spinal subluxation/spondylolisthesis

Acute: Differential Diagnosis- Vascular

- Stroke
- Arteriovenous fistula of the dura
- Arteriovenous malformation
- Cavernous malformation

Acute: Differential Diagnosis- Infection
VIRAL: GRAY MATTER

- Poliovirus
- Enterovirus
- Coxsackie virus A and B
- West Nile Virus
- Japanese Encephalitis
- Tick-borne encephalitis

Acute: Differential Diagnosis- Infection
VIRAL: White Matter

- Herpes simplex virus
- Varicella-zoster virus
- Cytomegalo virus
- Epstein-Barr virus
- Influenza

Acute: Differential Diagnosis- Infection Bacterial

- Mycoplasma pneumoniae
- Syphilis
- Tuberculosis
- Lyme

Acute: Differential Diagnosis- Infection Fungal

- Crytococcus neoformans
- Coccidioides immitis
- Blastomyces dermatitidis
- Candida species
- Aspergillus species
- Zygomycetes
- Histoplasma capsulatum

Acute: Differential Diagnosis-Inflammatory

- Multiple sclerosis
- Neuromyelitis optica
- Transverse myelitis
- Acute disseminated encephalomyelitis
- Sarcoidosis
- Paraneoplastic

Acute: Differential Diagnosis-Inflammatory (continued)

- Systemic lupus erythematosus
- Antiphospholipid antibody syndrome
- Sjogren syndrome
- Mixed connective tissue disease
- Behcet disease

Acute: Differential Diagnosis-Toxic/metabolic

- Heroin
- Konzo
- Arachnoiditis after contrast agents used
- Methotrexate toxicity
- Cytarabine toxicity
- Amphotericin B toxicity

Chronic: Differential Diagnosis-Infection

- HIV
- HTLV (Human T-lymphotropic virus)
- Syphilis
- Tuberculosis

Chronic: Differential Diagnosis-Toxic/metabolic

- Vitamin B12 deficiency
- Thiamine deficiency
- Folate deficiency
- Vitamin E deficiency
- Copper
- Cyanide poisoning (cassava plant)
- Hexacarbon toxicity (glue sniffing)

Chronic: Differential Diagnosis Genetic

- Hereditary spastic paraplegia
- Adrenomyeloneuropathy
- Krabbe disease
- Metachromatic leukodystrophy
- Methylene tetrahydrofolate reductase deficiency
- Cobalamin C

Chronic: Differential Diagnosis Genetic (continued)

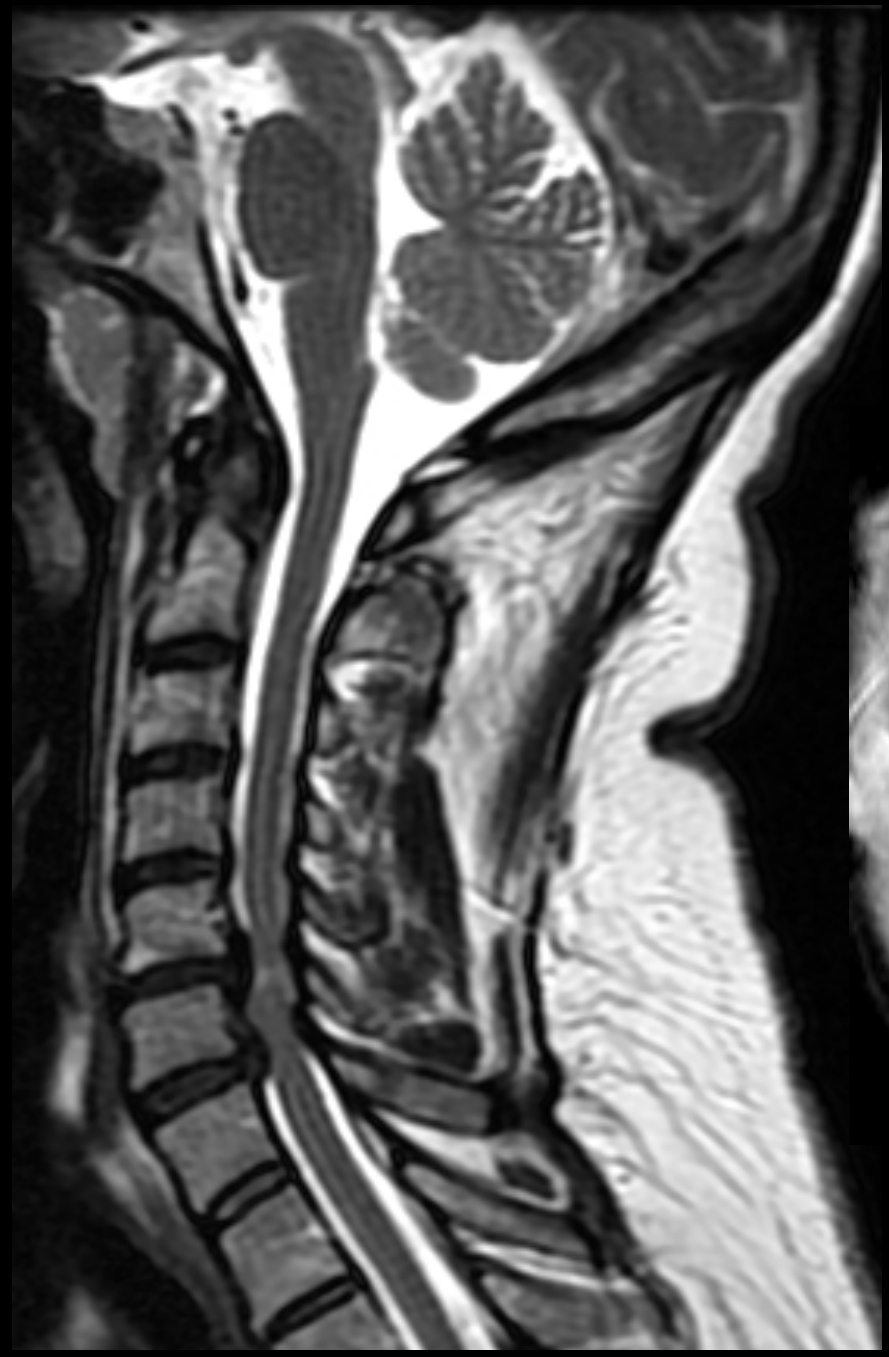
- Arginase deficiency
- Abetalipoprotenemia
- Spinocerebellar degeneration
- Spinal muscular atrophy

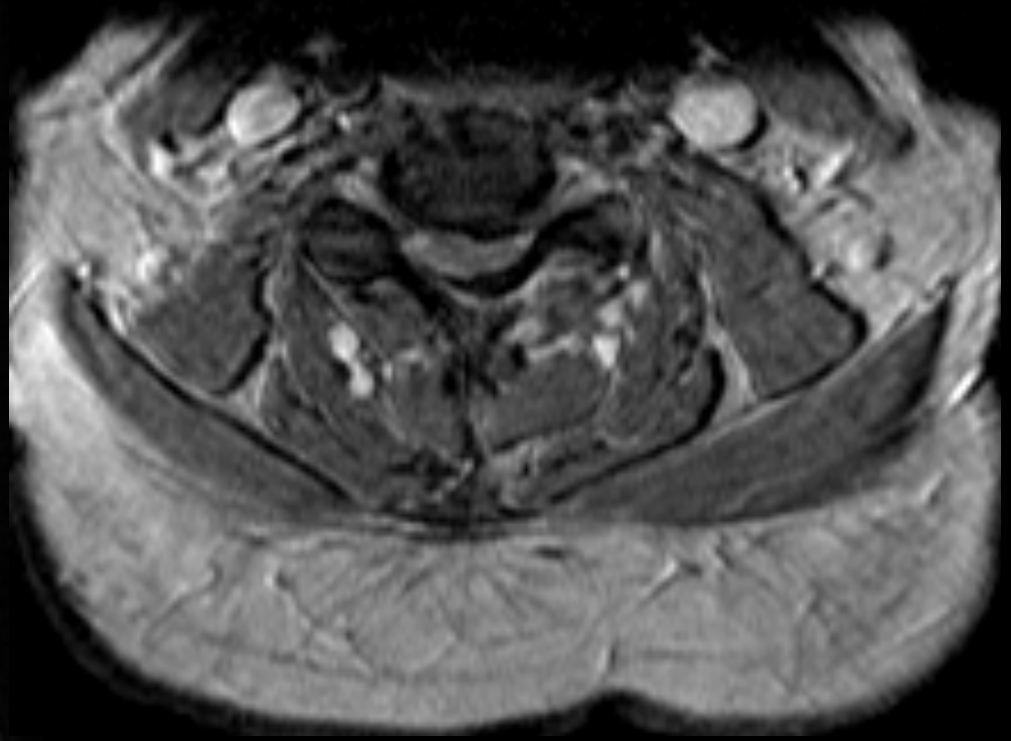
Chronic: Differential Diagnosis Motor Neuron Disease

- Amyotrophic lateral sclerosis
- Primary lateral sclerosis
- Spinobulbar muscular atrophy (Kennedy syndrome)

What ?

- “ However, it has been reported that as many as 5% of patients with amyotrophic lateral sclerosis have been diagnosed with cervical spondyltic myelopathy and have been treated surgically [15]. “





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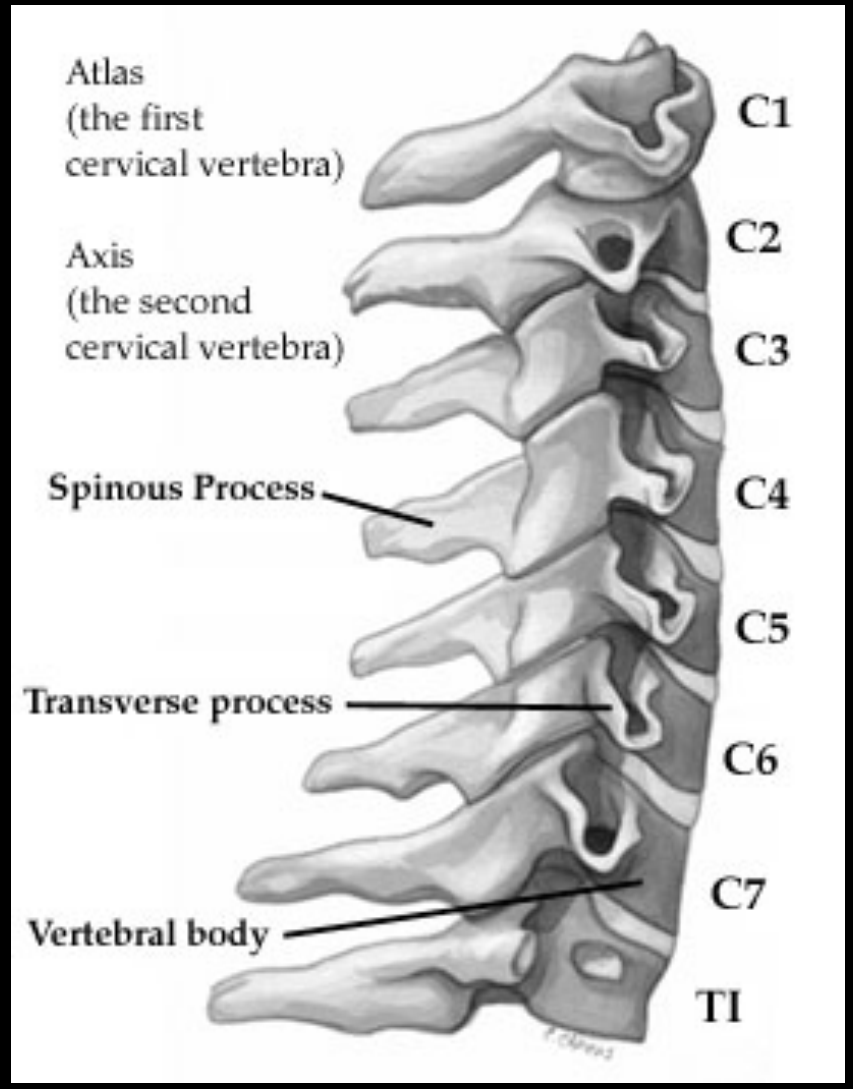
Cervical Spondylotic Myelopathy: Definitions

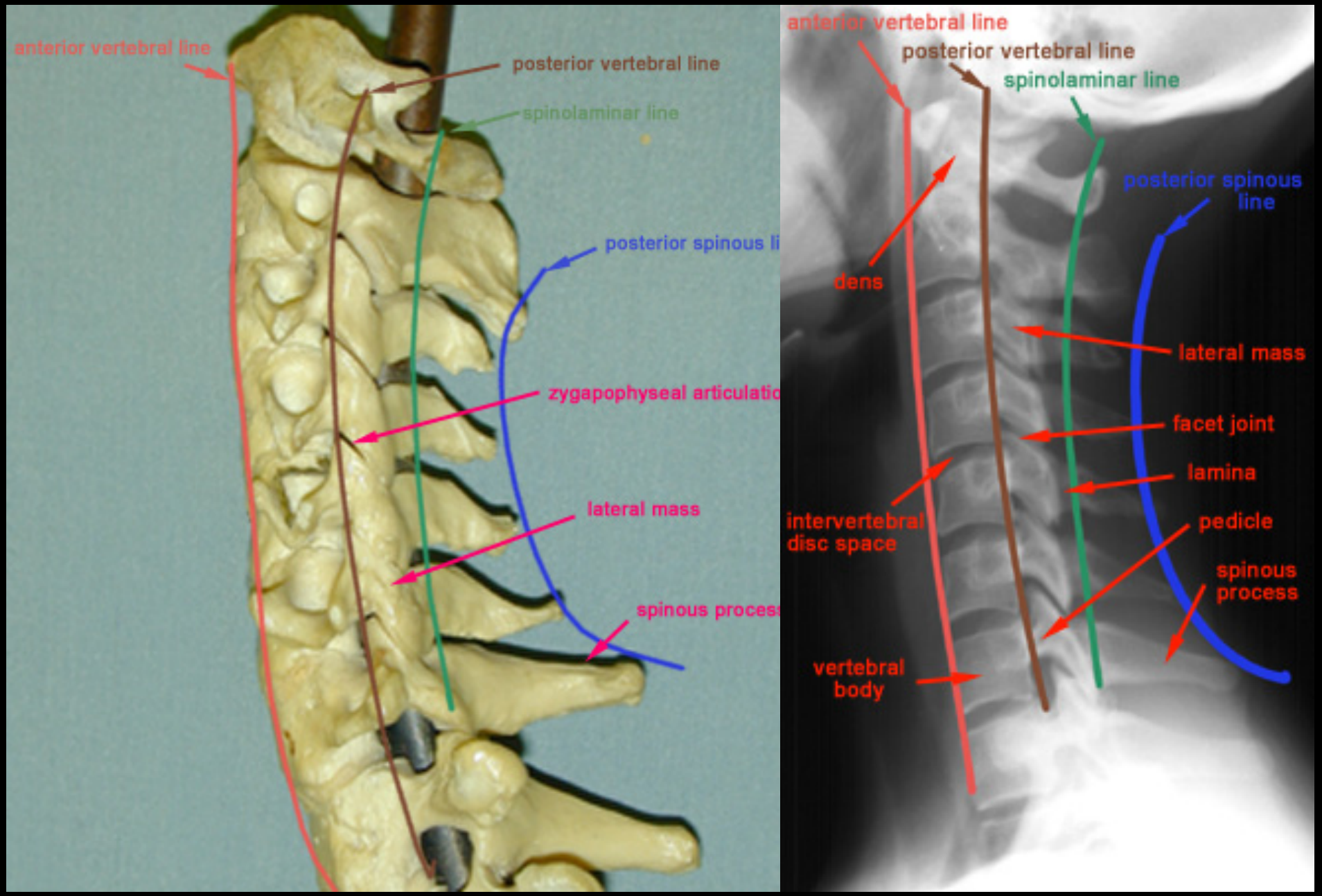
- Cervical: [L. cervicalis, from cervix neck] pertaining to the neck, or to the neck of any organ or structure

- Spondylosis: ankylosis of a vertebral joint; also, a general term for degenerative changes due to osteoarthritis

- Myelopathy: [myelo- + Gr. Pathos disease] 1. a general term denoting functional disturbances and/or pathological changes in the spinal cord; the terms often used to designate nonspecific lesions, in contrast to inflammatory lesions (myelitis) 2. pathological changes in the bone marrow

Cervical Anatomy

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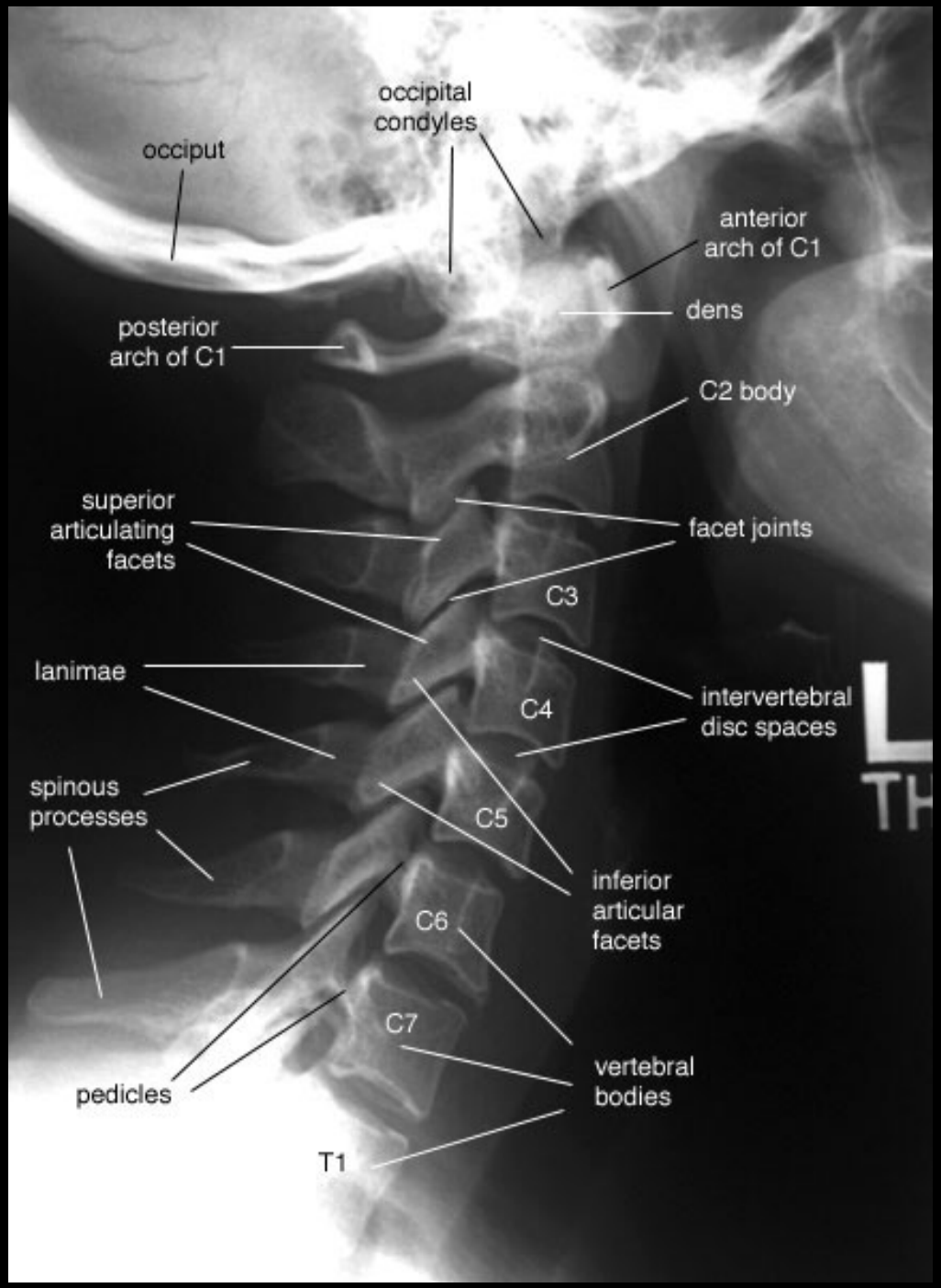
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facet joints
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C4
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spinous processes
C5
inferior articular facets
C6
C7
vertebral bodies
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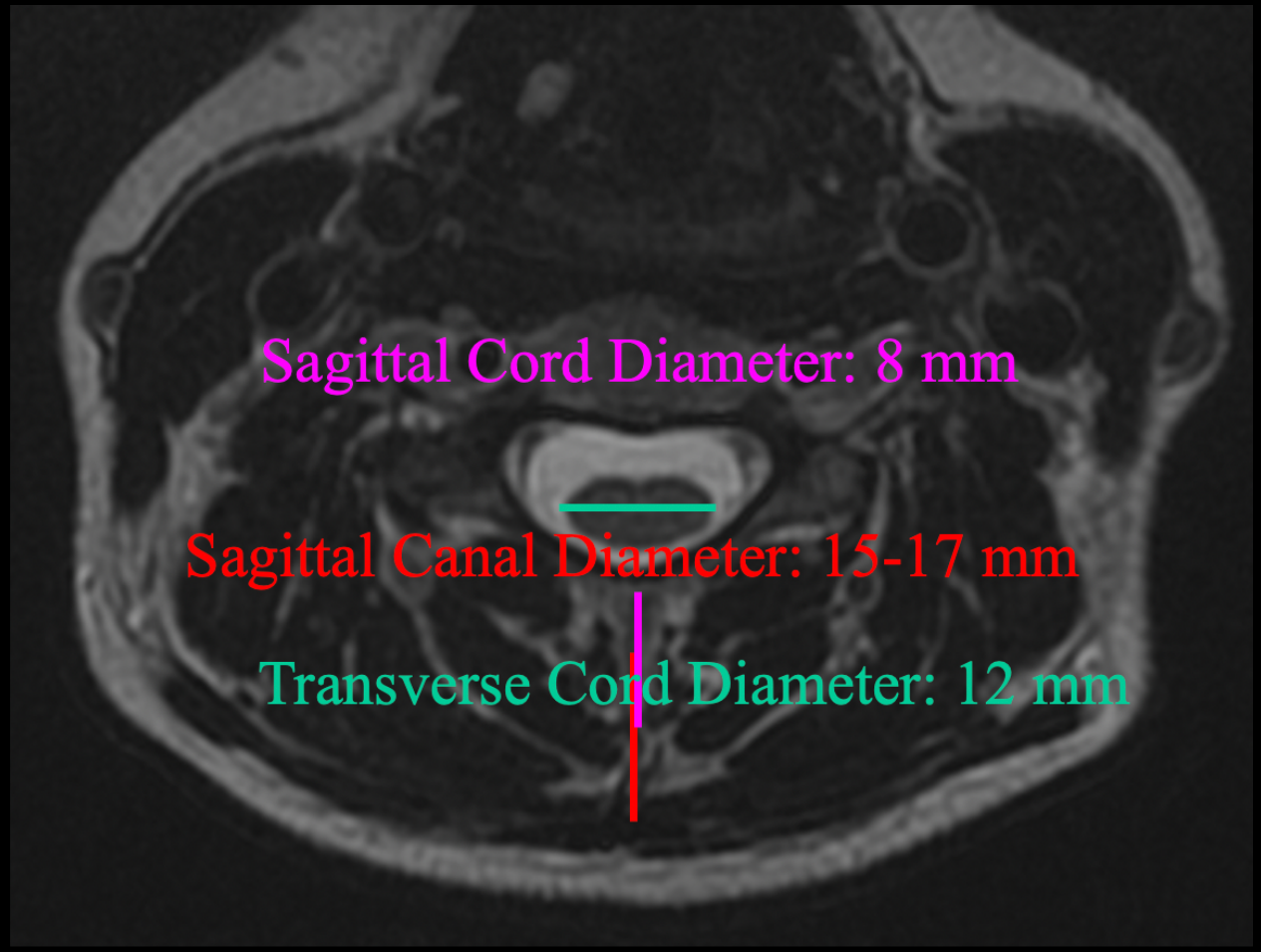
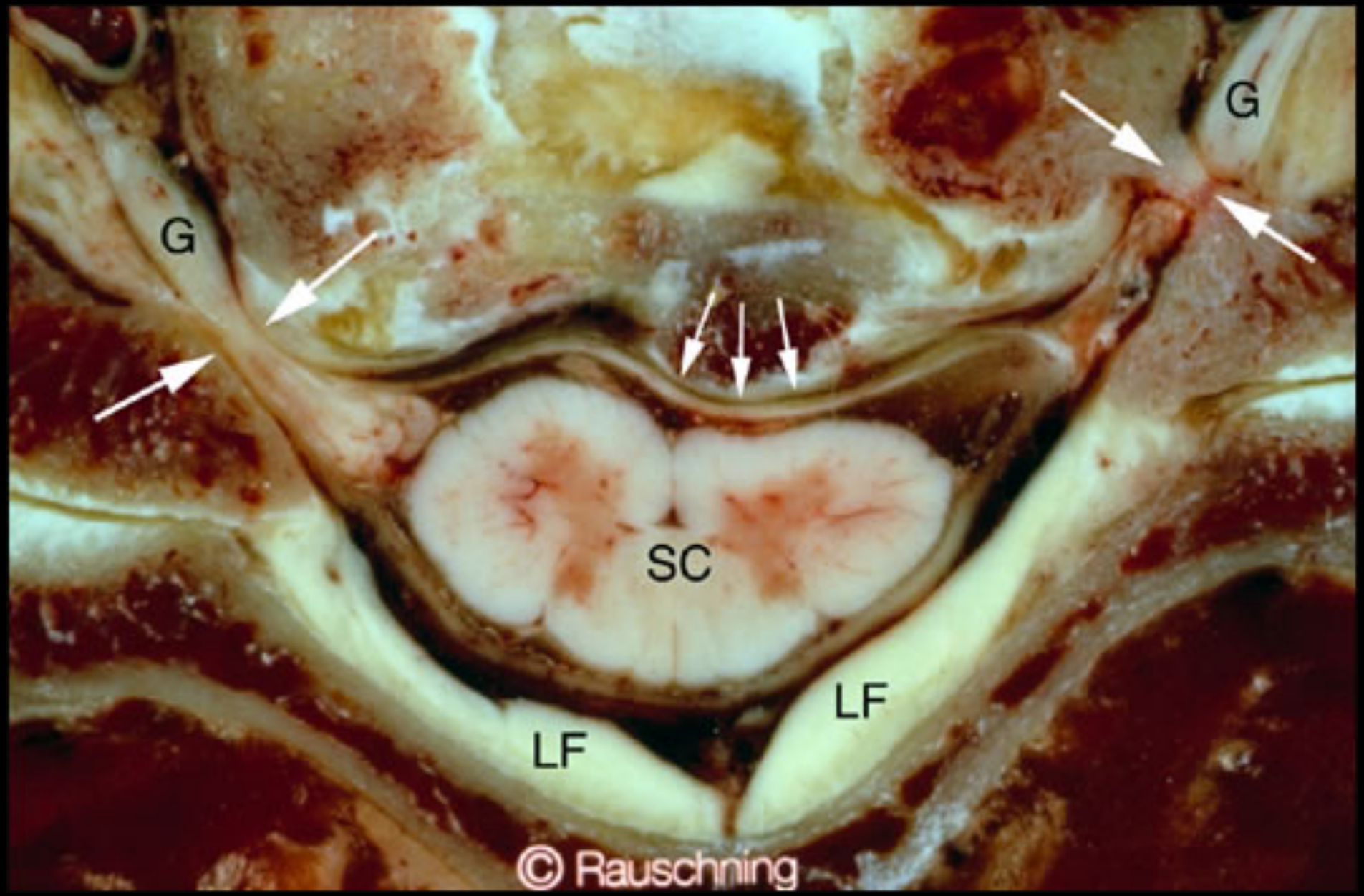
Normal Canal & Cord Dimensions



Spondylosis Related Cord Compression

- Ventral spinal cord compression by disk-osteophyte complexes
- Dorsal spinal cord compression by thickened soft tissues (ligamentum flavum) and tips of spinous process
- Lateral spinal cord compression by hypertrophied facet joints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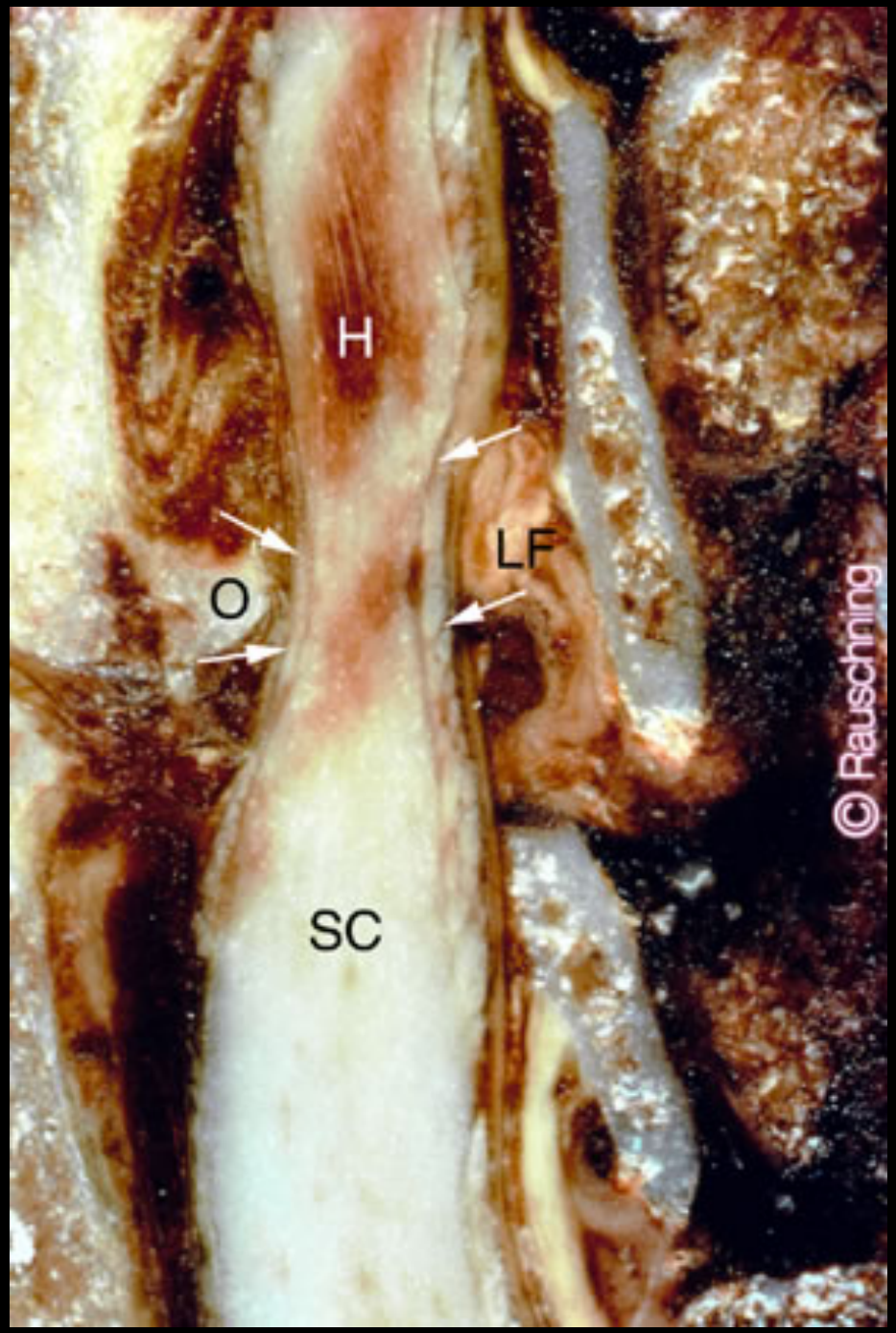


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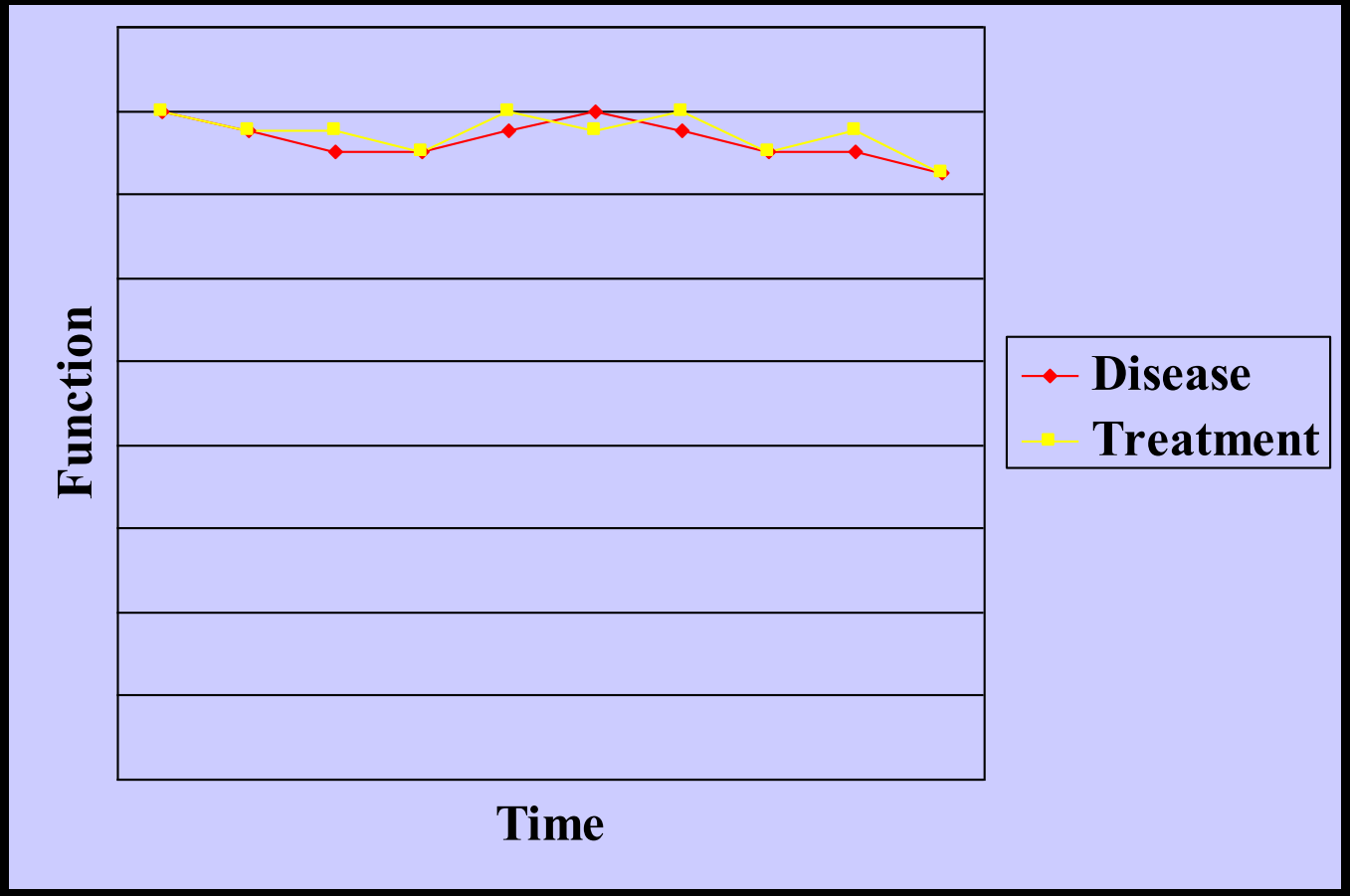
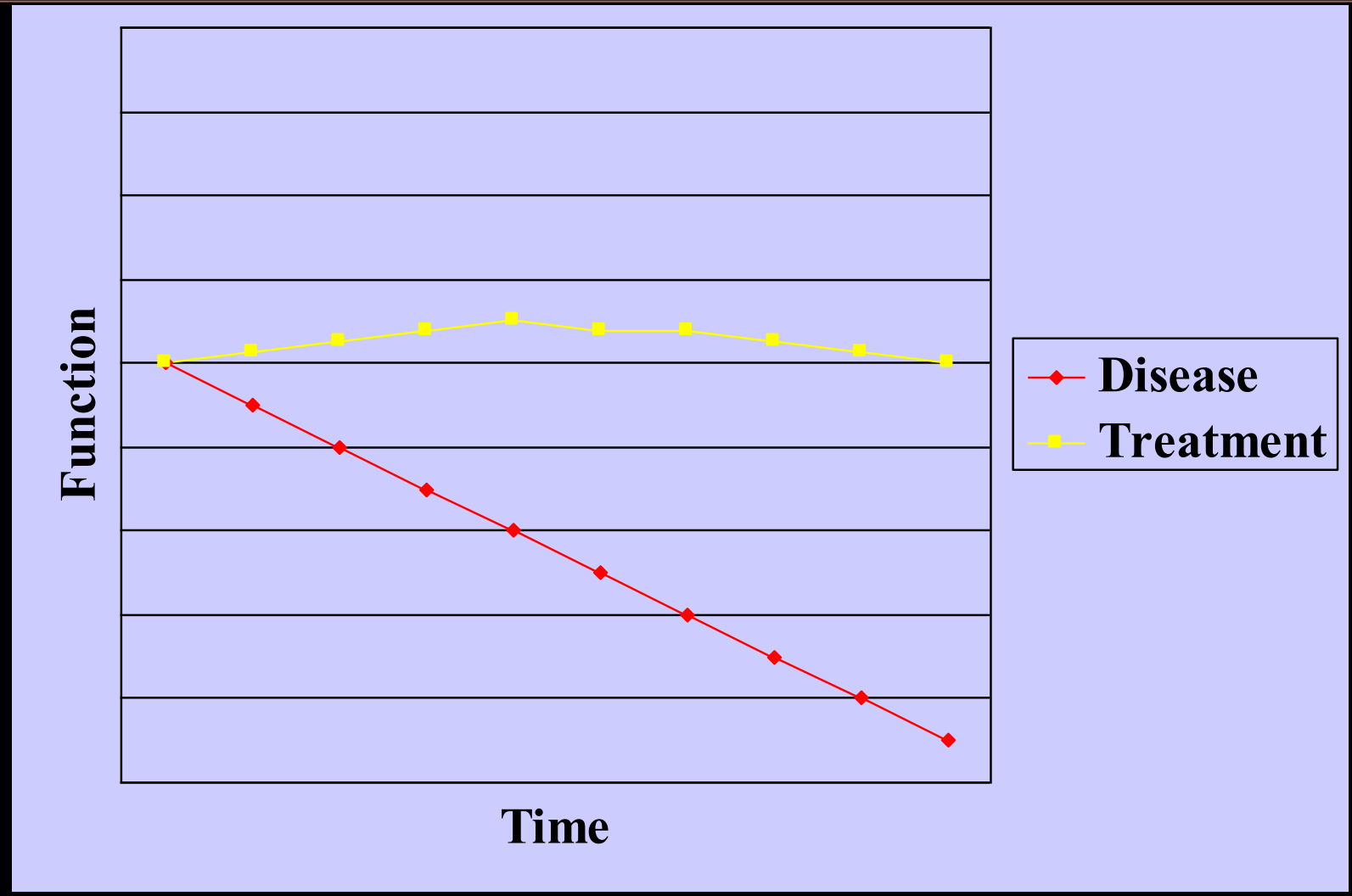
Practical Questions Regarding Cervical Stenosis

- What is the risk of developing myelopathy?
- What is the risk of spinal cord injury?
- Do these risks warrant prophylactic surgical intervention?

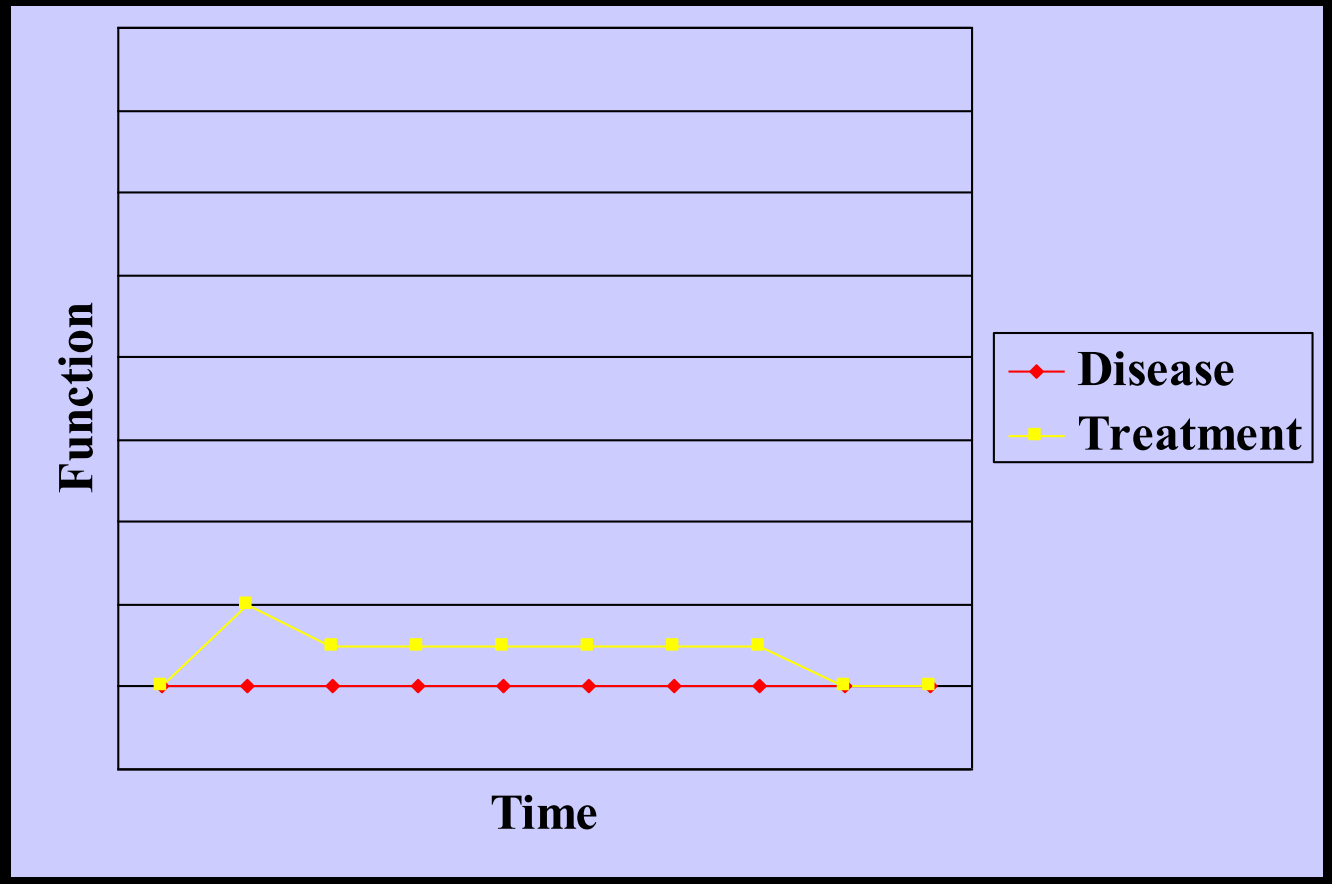
Therapeutic Gain: Mild Myelopathy



Therapeutic Gain: Moderate Myelopathy

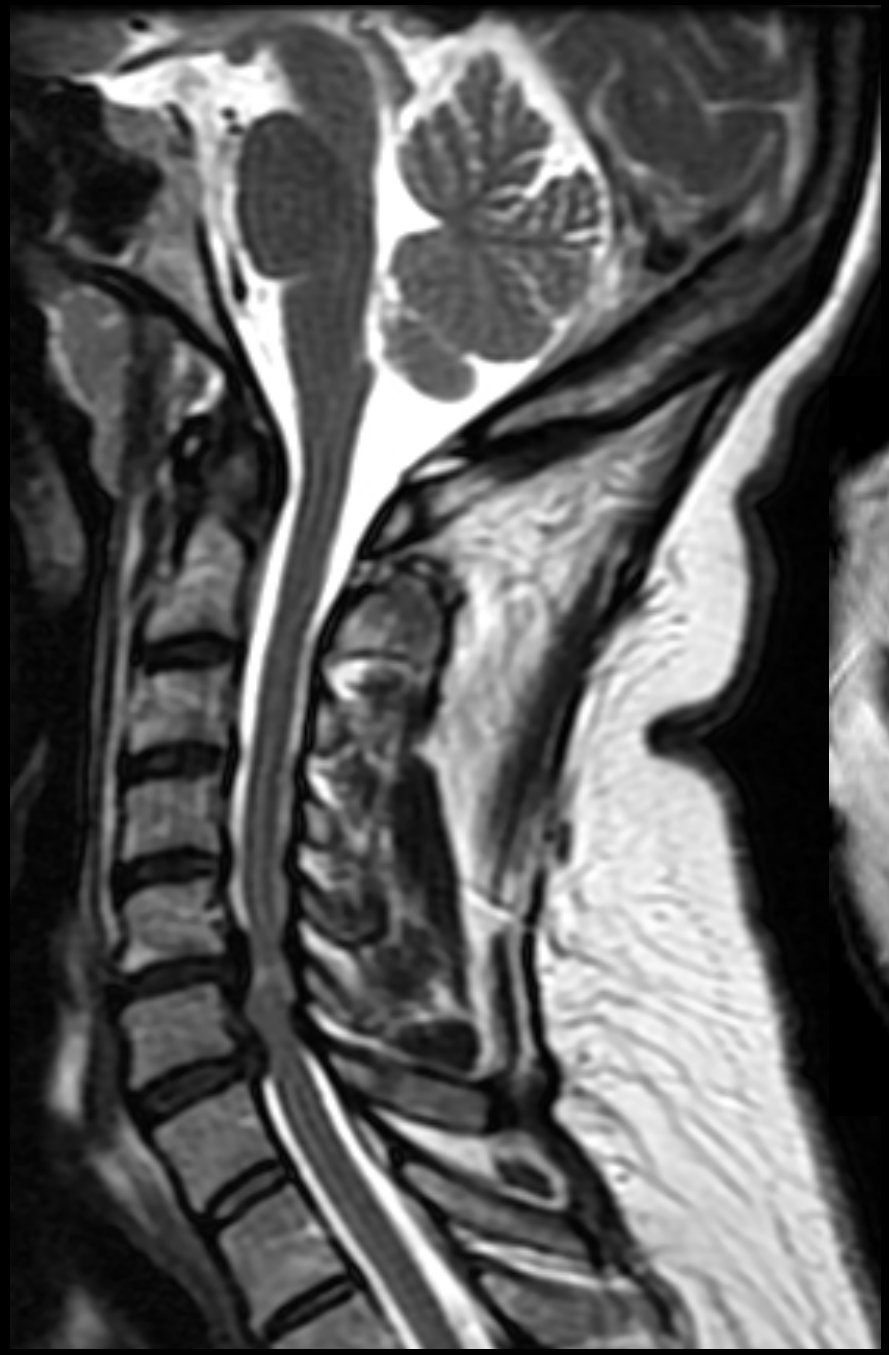


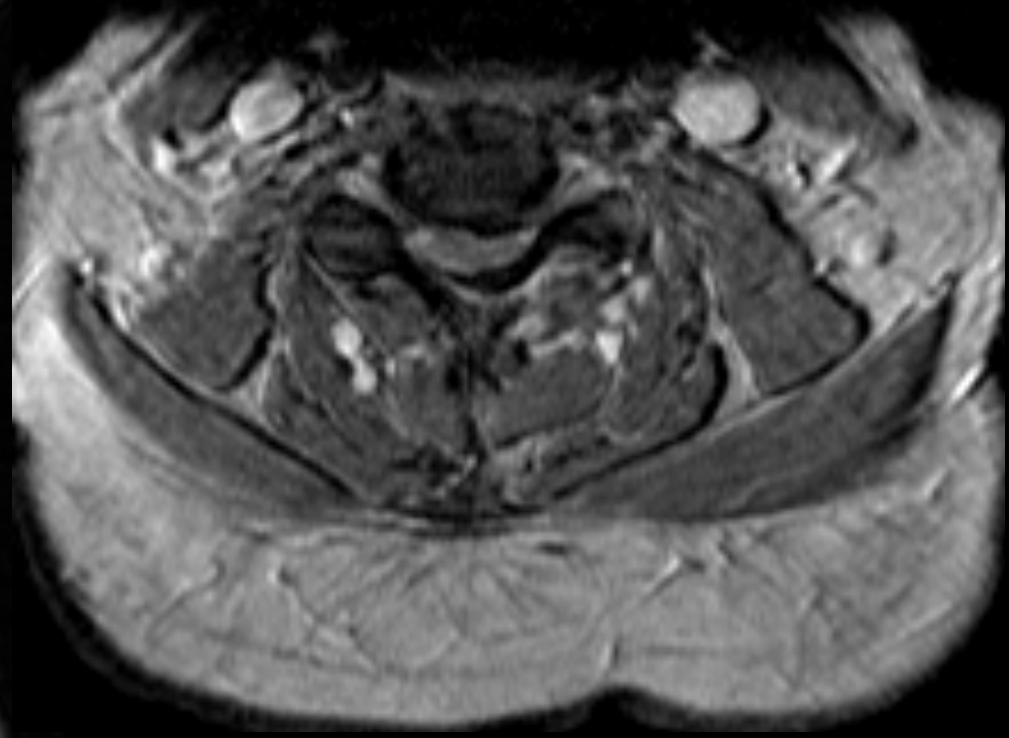
Therapeutic Gain: Severe Myelopathy



Take Home Messages

- Stenosis remains a radiographic diagnosis
- Prophylactic surgical intervention is probably not warranted in patients presenting with mild myelopathy





Myelopathy: Pathology

- The spinal cord is flattened in the AP but not the transverse plane at the level of the disk-osteophyte complex
- The lateral columns are most severely affected with demyelination and gliosis of the white matter and loss of neurons and gliosis of the grey matter
- Wallerian degeneration of the posterior columns above the level of compression and of the lateral columns below it

Pathology

- Ito T et al. (1996) examined seven specimens from patients diagnosed with CSM:

  – " The anterior horns & intermediate zones of the gray matter in the compressed segments were affected in all 7 patients "

  – " …the posterior and lateral funiculi were affected in patients with relatively slight damage…"

  – " …whereas the anterior & anterolateral funiculi were affected in severely damaged patients."

Myelopathy: Pathophysiology

- Compression1, 2
  - Spinal cord compressed between the disk-osteophyte complex and the ligamentum flavum
  - Compression maximized with extension when the ligamentum bulges into the canal and the spinal cord diameter increases

1 Levine DN. J Neurol Neurosurg Psychiatry 1997;62:334-340.
2 Stookey B. Arch Neurol Psychiatry 1928;20:275-91.

Myelopathy: Pathophysiology

- Tension1, 2
  - Spinal cord tension increases as the spinal cord is tethered by the dentate ligaments over the disk-osteophyte complex
  - Tension maximized with flexion when the dura is unfolded and the nerve roots and dentate ligaments are tight

1 Levine DN. J Neurol Neurosurg Psychiatry 1997;62:334-340.
2 Kahn EA: The role of the dentata ligaments in spinal cord compression and the syndrome Of lateral sclerosis. J. Neurosurg. 1947;4:191-99.

Myelopathy: Pathophysiology

- Vascular
  - Assumed inability of the two mechanical hypotheses to explain the pathological changes
  - Compression of the anterior spinal artery, radicular arteries, and the epidural veins have all been inviked

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The Spine Journal 3 (2003) 510–519

THE SPINE JOURNAL

Review Article

Molecular biology of cervical myelopathy and spinal cord injury: role of oligodendrocyte apoptosis

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Received 15 August 2002; accepted 2 April 2003

Abstract

BACKGROUND CONTEXT: Rational design of treatment strategies for cervical myelopathy and spinal cord injury requires a working knowledge of the molecular biology underlying these pathological processes. The cellular process of apoptosis is an important component of tissue and organ development as well as the natural response to disease and injury. Recent studies have convincingly demonstrated that apoptosis also plays a pivotal role in numerous pathological processes, contributing to the adverse effects of various diseases and traumatic conditions. A growing body of evidence has implicated apoptosis as a key determinant of the extent of neurological damage and dysfunction after acute spinal cord injury and in chronic cervical myelopathy.

PURPOSE: To provide clinicians and research investigators interested in spinal cord injury and myelopathy with a practical and up-to-date basic science review of cellular apoptosis in the context of spinal cord pathology.

STUDY DESIGN/SETTING: A review of recently published or presented data from molecular biological, animal model and human clinical studies.

METHODS: A computer-based comprehensive review of the English-language scientific and medical literature was performed in order to identify relevant publications with emphasis given to more recent studies.

RESULTS: Investigation into the role of apoptosis in spinal cord injury and myelopathy has drawn the interest of an increasing number of researchers and has yielded a substantial amount of new information.

CONCLUSIONS: Apoptosis is a fundamental biological process that contributes to preservation of health as well as development of disease. There is now strong evidence to support a significant role for apoptosis in secondary injury mechanisms after acute spinal cord injury as well in the progressive neurological deficits observed in such conditions as spondylotic cervical myelopathy.

Keywords: Spinal cord injury; Cervical myelopathy; Apoptosis; Molecular biology; Oligodendrocyte; Pathophysiology

“ The natural history of the disease is especially important in relation to myelopathy. Without knowledge of it we cannot put treatment, whether conservative or operative, into proper perspective.”

A Clinical Trial Is Unethical Because:

- Myelopathy is recognized clinically
- Cord compression may be confirmed from imaging
- Surgery provides decompression & stabilization of the diseased spinal segments
- Surgery prevents clinical worsening & improves function anecdotally
- A clinical study would be unethical because it would withhold surgical therapy from patients

Natural History: Conclusions

- The natural history of CSM is not well understood especially when referenced to presenting neurological status
- Mild to moderate static myelopathy is not an indication for surgical intervention
- Progressive moderate myelopathy is the best indication for surgical intervention

The Big Question

- When, if ever, is surgery indicated for the management of cervical myelopathy?

- Is non-operative management ever indicated?

Functional Outcomes

- when a level of ‘no disability’ is targeted as a goal, the only candidates for conservative treatment are patients with mild disability.”

- “improved function was maintained in >90% of the patients at least during the three year follow-up.”

Conclusions

- Multiple causes of myelopathy, a term used to describe pathology of the spinal cord are known
- A detailed assessment process should be carried out when assessing the person who is suspected of experiencing myelopathy
- Treatment is dependent on the etiology of the myelopathy and needs to be individualized

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