Degenerative Cervical Spine

Johns Hopkins Orthopaedic Surgery Review Course

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45. A 65-year-old man has low back pain and leg pain with standing. Walking endurance is limited to two blocks due to leg cramping. He has a wide-based, unsteady gait and hyperreflexia. Lumbar radiographs reveal a degenerative spondylolisthesis at L4-5, and an MRI scan shows moderate spinal stenosis at this level. The next step in his care should include

1- lumbar epidural steroid injections.
2- lumbar decompression with fusion.
3- a lumbar epidurogram.
4- interspinous distraction.
5- cervical MRI.

OITE, 2007

Disclosures

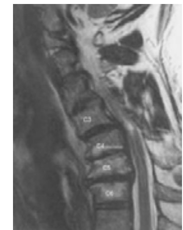
<u>Consultant/Teaching</u>
Zimmer Spine
Kyphon, Inc./Medtronic
OrthoFix/Blackstone Medical

<u>Speaker Bureau</u>
AO Spine North America

<u>Equity</u>
New Era Orthopaedics, LLC

180. A 60-year-old man has neck pain, numbness, and loss of dexterity in both hands, and mild difficulty with balance. Examination reveals an ataxic gait pattern and marked hyperreflexia in the upper and lower extremities. A T_2-weighted MRI scan is shown in Figure 67. What is the most appropriate treatment for this patient?

1- Drainage of the cyst within the spinal cord
2- Laminoplasty at C3-C7 without hardware
3- Laminoplasty at C3-C7 with plate fixation
4- Multilevel anterior cervical decompression with fusion and stabilization
5- Multilevel laminectomy



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Key Points

1. Disc Biology
2. Definition of Absolute and Relative Stenosis
3. Pavlov's (Torg's Ratio)
4. Recognition of Myelopathy
5. False Positive Rate on MRI
6. Complications Relating to ACDF
7. Indications for Surgery in RA
8. Ranawat Classification and Significance
9. Diagnosis of Basilar Invagination
10. Importance of MRI in Ankylosing Spondylitis

224. In the application of a halo fixator, misplacement of the anterior pins may endanger a number of structures. In Figure 84, the arrow is pointing to which of the following structures?

1- Supraorbital nerve
2- Supratrochlear nerve
3- Superior laryngeal nerve
4- Facial nerve
5- Supraorbital artery

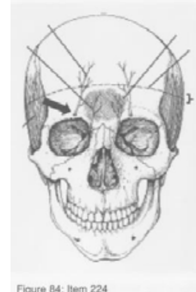


Figure 84: Item 224

OITE, 2007

146. A 58-year-old woman with rheumatoid arthritis reports progressive neck pain and difficulty with fine motor movements, including playing cards and handling coins. Examination revealed hyperreflexia without objective weakness. What is the most important radiographic factor that may predict neural recovery after decompressive surgery?

1- Basilar invagination of less than 1 cm
2- Atlanto-dens interval of less than 5 mm
3- Posterior atlanto-dens interval of greater than 13 mm
4- Subaxial subluxation of less than 3.5 mm
5- Rotatory subluxation of less than 10°

OITE, 2007

272. Following a left-sided approach for surgery on the anterior cervical spine, the patient reports a drooping left upper eyelid and dryness on the left side of the face. Which of the following structures has most likely been injured?

1- Recurrent laryngeal nerve
2- Superior laryngeal nerve
3- Hypoglossal nerve
4- Phrenic nerve
5- Sympathetic chain

OITE, 2001

16. Respiratory compromise following anterior cervical spine procedures is most closely associated with

1- multilevel approaches above C4.
2- a surgical time of less than 3 hours.
3- obesity.
4- smoking.
5- diabetes mellitus.

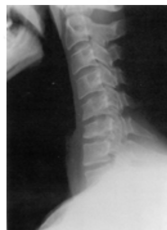
OITE, 2003

A patient reports changes in vocal quality after undergoing a right-sided anterior cervical approach to C6. Which of the following nerves has most likely been injured?

1- Vagus
2- Phrenic
3- Hypoglossal
4- Recurrent laryngeal
5- Inferior thyroid

169. A 37-year-old man has neck pain and stiffness following a motor vehicle accident 1 week ago. Examination reveals decreased active range of motion in all planes of the cervical spine, weakness of grip strength, and a bilateral Hoffmann's sign. A lateral radiograph is shown in Figure 58. Further evaluation should include

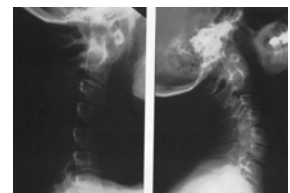
1- electromyography and nerve conduction velocity studies of the upper extremity.
2- MRI of the lumbar spine.
3- MRI of the cervical spine.
4- flexion-extension radiographs.
5- a bone scan.



OITE, 2003

Which of the following conditions associated with rheumatoid arthritis of the cervical spine is shown in the flexion-extension views?

1- Cranial settling
2- Cranial subluxation
3- Odontoid fracture
4- Lysis of the arch of the atlas
5- Atlantoaxial subluxation

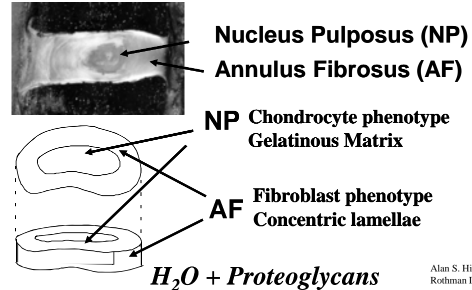


What is the most common cause of injury to the vertebral artery during anterior cervical decompression surgery?

1- Excessive retraction of the vertebral artery
2- Over distraction of the cervical spine
3- Lateral bone removal with an air drill
4- Kyphotic kinking of the vertebral artery
5- Malalignment of the anterior strut graft

Pathophysiology

Intervertebral Disc Anatomy



Alan S. Hilibrand, MD
Rothman Institute

Examination of a patient with long-standing juvenile rheumatoid arthritis will most likely reveal what abnormality of the cervical spine?

1- Os odontoideum
2- Subaxial subluxation
3- Spontaneous ankylosis
4- Scoliosis
5- Torticollis

Pathophysiology

Age-Related Disc Degeneration

- Decrease disc hydration
  - ↓ **chondroitin sulfate chains**
  - ↑ **keratan sulfate chains**
- Decreased gene expression
- Decreased cell number (apoptosis)

CTQ

Cervical Spondylosis

- Chronic disc degeneration and associated facet arthropathy
- Resultant Syndromes
  - Discogenic neck pain (mechanical pain)
  - Radiculopathy
  - Myelopathy
  - Combinations of above
- Typically begins at 40-50 yoa
- By age 70 years:
  - 70% of women
  - 95% of men

Heller JG. OKU: Spine 2, 2002
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

Pathophysiology

Age-Related Disc Degeneration

- Changes in annulus fibrosus
  - loss of lamellar organization
  - fissures and tears
  - loss of shock absorption

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Pathophysiology

Age-Related Disc Degeneration

- Further mechanical effects
  - annulus fibrosus tears
  - loss of nucleus pulposus ("herniated disc")
  - release of inflammatory mediators (IL's)
  - collapse of disc space

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Rothman Institute

Cervical Stenosis

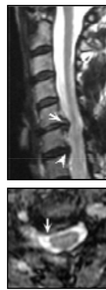
- **Pavlov's (Torg's) Ratio**
  - Canal/Vertebral Body Width
  - Normal = 1.0
  - Ratio < 0.8 or sagittal diameter < 13 mm
    - Complete Injuries (10.5 mm)
    - Incomplete Injuries (13.1 mm)
    - Isolated Nerve Root Injuries (15.9 mm)
    - No Neurologic Deficit (16.7 mm)

CTQ

Kang JD, Figgie MP, Bohlman HH. JBJS, 1994.
Tay, Eismont. OKU: Spine 2, 2002

Cervical Spondylosis

- Most common at C5-6
  - followed by C6-7 and C4-5
- Risk Factors
  - Frequent lifting
  - Smoking
  - History of excessive driving



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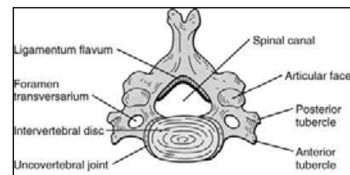
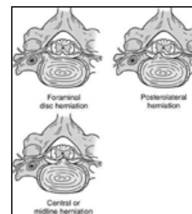




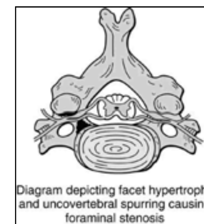
Chapman, 3rd Edition, 2001.

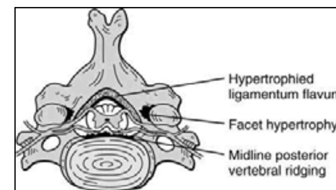
Cervical Stenosis

- Congenital
- Acquired
  - Traumatic
  - Degenerative
- Absolute Stenosis
  - Anteroposterior canal diameter (< 10 mm)
- Relative Stenosis
  - 10-13 mm
- PADI < 14 mm

CTQ

Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.





Chapman, 3rd Edition, 2001.

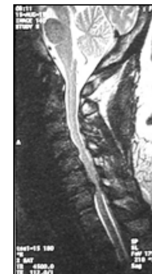
Cervical Spondylosis: Pathoanatomy

- **Radiculopathy**
  - soft disc herniation
  - usually posterolateral between posterior edge of uncinate process and lateral edge of PLL
- **Myelopathy**
  - large central disc herniation or
  - spondylotic bars with congenitally narrow canal

Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

Cervical Spondylosis: Signs and Symptoms

- Myelopathy
  - "Myelopathy Hand" and "Finger Escape Sign"
    - Small finger spontaneously abducts d/t weak intrinsics
  - May also have upper motor neuron findings
  - In addition, may have radicular symptoms



Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

Cervical Spondylosis: Signs and Symptoms

- Degenerative discogenic neck pain
  - insidious onset of neck pain w/o neurologic signs or symptoms
  - exacerbated by motion
- Occipital Headache Common
- Findings may overlap d/t intraneural intersegmental connections of sensory nerve roots.
- **Lower nerve root at a given level is usually affected (ie. C6 nerve root at C5-6)**

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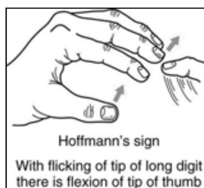
Cervical Radiculopathy: DDx

- C5: Frozen Shoulder
- C5: Subacromial Bursitis
- C8: Cubital Tunnel Syndrome
- C7: Carpal Tunnel Syndrome
- C8/T1: Thoracic Outlet Syndrome

CTQ

Cervical Spondylosis: Signs and Symptoms

- Myelopathy
  - weakness (upper > lower)
  - decreased manual dexterity
  - ataxic, broad-based shuffling gait
  - sensory changes
  - spasticity
  - urinary retention
- Most worrisome complaint: Lower extremity weakness (corticospinal tracts)



Hoffmann's sign

With flicking of tip of long digit there is flexion of tip of thumb

CTQ

Guyer RD, Burton DC. OKU: Spine 2, 2002
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.
Chapman's Operative Orthopaedics, 3rd Edition, 2001.

Cervical Spondylosis: Diagnosis

- Mostly based on H & P
- Radiographic changes may not correlate w/ symptoms
  - 70% of patients > 70 yoa will have degenerative changes on radiographs
  - **False-positive findings common on MRI**
    - 25% of assymptomatic patients < 40 yoa will have either HNP or foraminal stenosis on C-Spine MRI
    - 60% of patients > 40 yoa
    - Thus, must correlate w/ H&P

CTQ

Boden SD. JBJS, 1991.
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

Cervical Spondylosis: Treatment

- Discogenic Neck Pain and Radiculopathy
  - NSAIDs
  - Moist Heat
  - Exercises
  - C-Collar (?)
  - Traction (?)
  - Pain Clinic Modalities

Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

ACDF: Complications

CTQs

- Fact: Recurrent Laryngeal Nerve at Risk
  - Lower Levels (C6-7) → Increased Risk
  - Uncertainty: Difference Left vs. Right Approach
- Increased Dysphagia Risk at higher levels (C3-4)
- Increased risk of airway obstruction with multiple levels
- Nonunion Rate
  - Increasing Rate with Increased # of Levels
  - 12% for one-level (Miller)
  - 30% for multilevel (Miller)

Heller JG. OKU: Spine 2, 2002

Cervical Spondylosis: Treatment

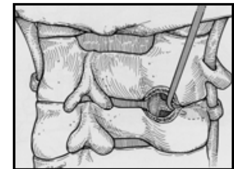
- Indications for Surgery
  - Myelopathy with motor/gait impairment
  - Radiculopathy with persistent disabling pain and weakness
  - Discogenic neck pain (surgery less rewarding)

Heller JG. OKU: Spine 2, 2002
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

Posterior ("Keyhole") Foraminotomy

- Preserve >50% of Facet Joint

CTQ

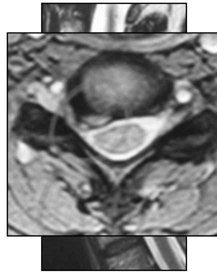


- Elevate Nerve Root Superiorly
- Risk: Air Embolism

Heller JG. OKU: Spine 2, 2002

Cervical Spondylosis: Treatment

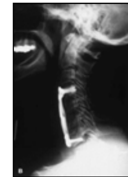
- Techniques
  - ACDF with allograft or autograft & instrumentation
  - Posterior foraminotomy useful for single-level radiculopathy with lateral soft-disc herniation



Heller JG. OKU: Spine 2, 2002
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

Cervical Spondylosis: Treatment

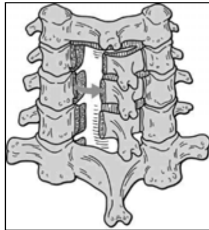
- Multilevel disease
  - anterior approach
    - multiple vertebrectomies
    - strut graft
    - +/- instrumentation
  - anterior plating
    - increases fusion rate in multilevel discectomies
    - protects strut graft in multilevel corpectomies



Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.
Chapman's Operative Orthopaedics, 3rd Edition, 2001.

Cervical Spondylosis: Treatment

- **Laminoplasty**
  - Commonly used for OPLL
  - Decreases incidence of instability associated w/ multilevel laminectomy
  - Overall alignment must be lordotic for this technique to be successful



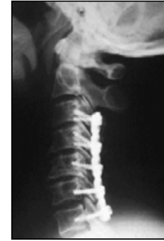
CTQ

- KYPHOTIC Patient
  - → Don't pick Laminoplasty

Heller JG. OKU: Spine 2, 2002
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.
Chapman's Operative Orthopaedics, 3rd Edition, 2001.

Cervical Spondylosis: Treatment

- Multilevel Laminectomy
  - may fail due to:
    - failure to adequately relieve anterior compression
    - progressive kyphosis
      - may require anterior decompression and fusion w/ strut graft



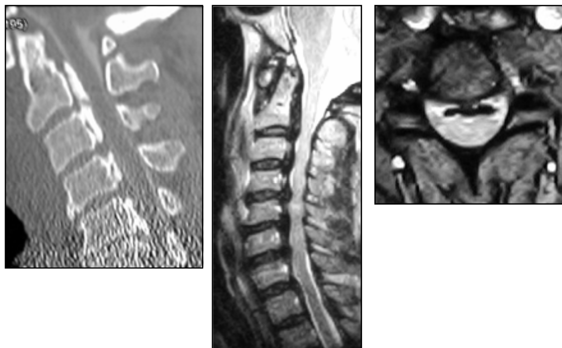
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.
Chapman's Operative Orthopaedics, 3rd Edition, 2001

Ossification of the PLL (OPLL)

- OPLL
  - may result in cervical stenosis
  - more common in Asians
  - also seen in non-Asians

Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

Rheumatoid Spondylitis



Rheumatoid Spondylitis

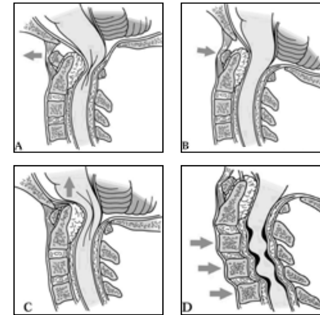
- Cervical spine involvement common in RA
  - up to 90% of patients
  - more common w/ long-standing disease and multiple joint involvement
  - Neurologic involvement usually occurs gradually
    - Thus, often overlooked in patients with multi-joint involvement

Rheumatoid Spondylitis

- Damage to Transverse, Alar, Apical Ligaments, C1-2 Capsular Ligaments
- Instability & Pannus Formation
- Neurologic Compromise
- Subaxial Subluxation
- Basilar Invagination

Fischgrund, JS. OKU: Spine 2, 2002

RA: Atlantoaxial Subluxation



Chapman's Operative Orthopaedics, 3rd Edition, 2001.

Rheumatoid Spondylitis

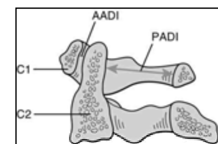
CTQs

- Relative Indications for surgical stabilization:
  - Instability
  - Posterior Atlando-dens interval < 14 mm
  - Atlantoaxial subluxation and > 5 mm Basilar Invagination
  - Subaxial Subluxation & Sagittal Diameter < 14 mm
  - Cervicomedullary angle < 135 degrees
  - Impending neurologic deficit
- RA patients
  - always check flex/ex views before elective surgery

Fischgrund, JS. OKU: Spine 2, 2002
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

RA: Atlantoaxial Subluxation

- Radiographs
  - patient-controlled flex-ex views
  - determine atlanto-dens interval
  - determine SAC (posterior atlantodens interval)

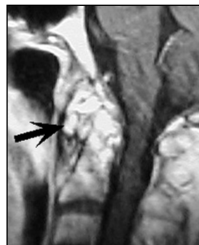


- Instablity= 3.5 mm A-D interval difference on flexion and extension views
  - alone, is not an indication for surgery

Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.
Chapman's Operative Orthopaedics, 3rd Edition, 2001.

RA: Atlantoaxial Subluxation

- Present in 50-80% of cases
- result of pannus formation at synovial joints b/w dens and ring of C1
  - leads to destruction of transverse ligament, dens or both
- Anterior subluxation of C1 on C2= most common
  - May also have posterior or lateral subluxation



Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

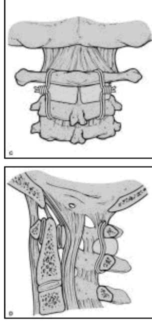
RA: Atlantoaxial Subluxation

- 7 mm difference
  - may imply disruption of alar ligaments
- >9-10 mm or SAC < 14 mm
  - associated w/ increased risk of neurologic injury
  - usually requires surgical stabilization

CTQ

Fischgrund, JS. OKU: Spine 2, 2002.
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

RA: Atlantoaxial Subluxation



- Progressive neurologic impairment and progressive instability
  - also indication for surgery
  - usually posterior C1-2 fusion and wiring w/ halo-vest
  - **transarticular screw fixation (Magerl) across C1-2**
    - may eliminate the need for halo

Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.
Chapman's Operative Orthopaedics, 3rd Edition, 2001.

RA: Basilar Invagination

- Cranial migration of dens from erosion and bone loss between occiput and C1-2
- Multiple measurement techniques
  - **Ranawat's line**= most reproducible
    - Normal= 17 +/- 2 mm in males (15 mm in females)
  - **McRae's Line** = easiest to remember
- Progressive cranial migration (> 5 mm) or neurologic compromise
  - may require operative intervention (occiput-C2 fusion)

CTQ

Fischgrund, JS. OKU: Spine 2, 2002.
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

Neurologic Impairment with RA

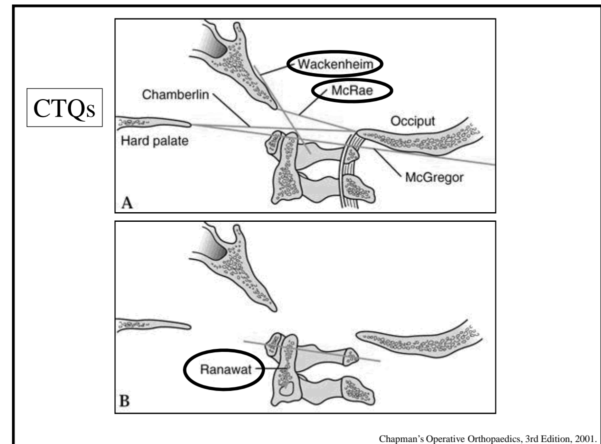
Classified by Ranawat

CTQ

I Subjective Paresthesias
II Subjective Weakness, UMN Findings
III Objective Weakness, UMN Findings
(A= Ambulatory, B= Nonambulatory)

Pellicci PM, Ranawat CS. JBJS 1981.
Casey AT, et al. J Neurosurgery, 1996.

CTQs



Chapman's Operative Orthopaedics, 3rd Edition, 2001.

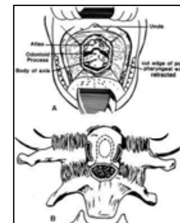
Rheumatoid Spondylitis

- Surgery less successful with severe (Ranawat IIIB) neurologic deficits
- Complications
  - pseudarthrosis (20%)
  - recurring myelopathy
- Pseudoarthrosis rate lessened by extending fusion to occiput.

CTQ

Casey AT, et al. J Neurosurgery, 1996.
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

RA: Basilar Invagination



- Significant brainstem compromise with functional impairment
  - Transoral odontoid resection or
  - Anterior retrophayngeal odontoid resection

Chapman's Operative Orthopaedics, 3rd Edition, 2001.
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

RA: Lower Cervical Spine

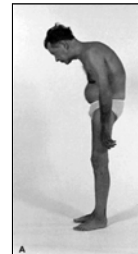
- Involvement in 20% of cases
- Joints of Luschka and facet joints affected by RA
  - thus, subluxation can occur at multiple levels
- Lower C-Spine involvement more common in:
  - males
  - steroid use
  - seropositive RA
  - patients with rheumatoid nodules
  - patients with severe RA

CTQ

Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

Ankylosing Spondylitis

- Can cause severe flexion deformities of C-Spine
- Must carefully evaluate for "silent" fractures
  - due to potential for pseudarthrosis and progressive deformity
- Severe chin-on-chest deformity
  - inability to look straight ahead
  - associated w/ hip flexion contractures & flexion deformity of lumbar spine.



Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.
Chapman's Operative Orthopaedics, 3rd Edition, 2001.

Ankylosing Spondylitis

- HLA-B27
- Acute Anterior Uveitis
- Renal Amyloidosis
- Cardiac Conduction Disturbances
- Cardiac Valve Dysfunction

CTQs

- **MRI Examination Critical– ESPECIALLY IN TRAUMA PATIENTS**

Fischgrund, JS. OKU: Spine 2, 2002.

Ankylosing Spondylitis: Treatment

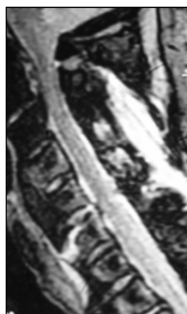
- Begins by addressing hip and lumbar disorder first
- May require cervicothoracic laminectomy, osteotomy and fusion
- Occasionally require traction, surgical release of contracted SCM muslces and PSF for severe neuromyopathic conditions.

Fischgrund, JS. OKU: Spine 2, 2002.
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

Ankylosing Spondylitis: MRI

- Diagnostic Clues
  - Intramedullary Edema
  - Disc Space Injury
  - Spinal Cord Injury
  - Epidural Hematoma

CTQ



Fischgrund, JS. OKU: Spine 2, 2002.

Key Points

1. Definition of Absolute and Relative Stenosis
2. Pavlov's (Torg's Ratio)
3. Recognition of Myelopathy
4. False Positive Rate on MRI
5. Complications Relating to ACDF
6. Indications for Surgery in RA
7. Ranawat Classification and Significance
8. Diagnosis of Basilar Invagination
9. Importance of MRI in Ankylosing Spondylitis

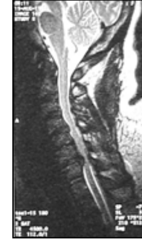
Cervical Stenosis

- Absolute Stenosis
  - Anteroposterior canal diameter (< 10 mm)
- Relative Stenosis
  - 10-13 mm

Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

Cervical Spondylosis: Signs and Symptoms

- Myelopathy
  - "Myelopathy Hand" and "Finger Escape Sign"



Cervical Stenosis

- **Pavlov's (Torg's) Ratio**
  - Canal/Vertebral Body Width
  - Normal = 1.0
  - Ratio < 0.8 or sagittal diameter < 13 mm
    - Complete Injuries (10.5 mm)
    - Incomplete Injuries (13.1 mm)
    - Isolated Nerve Root Injuries (15.9 mm)
    - No Neurologic Deficit (16.7 mm)

Kang JD, Figgie MP, Bohlman HH. JBJS, 1994.
Tay, Eismont. OKU: Spine 2, 2002

False Positive Rate with C-Spine MRI

- 25% of assymptomatic patients < 40 years of age will have either HNP or foraminal stenosis on C-Spine MRI
- 60% of patients > 40 yoa
- Thus, must correlate w/ H&P

Boden SD. JBJS, 1991.

Cervical Spondylosis: Signs and Symptoms

- Myelopathy
  - weakness (upper > lower)
  - decreased manual dexterity
  - ataxic, broad-based shuffling gait
  - sensory changes
  - spasticity
  - urinary retention
- Most worrisome complaint: Lower extremity weakness (corticospinal tracts)

Guyer RD, Burton DC. OKU: Spine 2, 2002
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.
Chapman's Operative Orthopaedics, 3rd Edition, 2001.

ACDF: Complications

- Fact: Recurrent Laryngeal Nerve at Risk
  - Lower Levels (C6-7) → Increased Risk
  - Uncertainty: Difference Left vs. Right Approach
- Increased Dysphagia Risk at higher levels (C3-4)
- Increased risk of airway obstruction with multiple levels
- Nonunion Rate: 2-10%
  - Increasing Rate with Increased # of Levels

Heller JG. OKU: Spine 2, 2002

Rheumatoid Spondylitis: Surgical Indications

- Relative Indications for surgical stabilization:
  - Instability
  - Posterior Atlando-dens interval < 14 m
  - Atlantoaxial subluxation and > 5 mm Basilar Invagination
  - Subaxial Subluxation & Sagittal Diameter < 14 mm
  - Impending neurologic deficit

Fischgrund, JS. OKU: Spine 2, 2002
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.

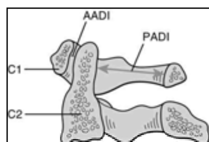
Neurologic Impairment with RA

Classified by Ranawat

I Subjective Paresthesias
II Subjective Weakness, UMN Findings
III Objective Weakness, UMN Findings
A= Ambulatory
B= Nonambulatory

Pellicci PM, Ranawat CS. JBJS 1981.
Casey AT, et al. J Neurosurgery, 1996.

RA: Atlantoaxial Subluxation

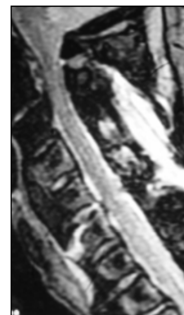


- Instablity= 3.5 mm A-D interval difference on flexion and extension views
  - alone, is not an indication for surgery

Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.
Chapman's Operative Orthopaedics, 3rd Edition, 2001.

Ankylosing Spondylitis: MRI

- Diagnostic Clues
  - Intramedullary Edema
  - Disc Space Injury
  - Spinal Cord Injury
  - Epidural Hematoma

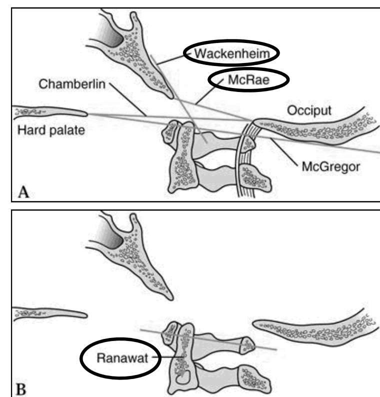


Fischgrund, JS. OKU: Spine 2, 2002.

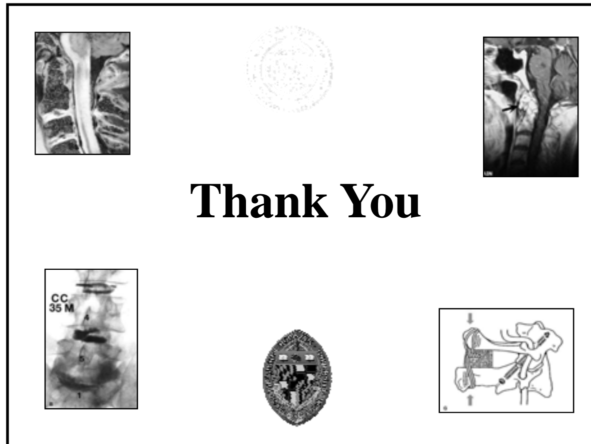
RA: Atlantoaxial Subluxation

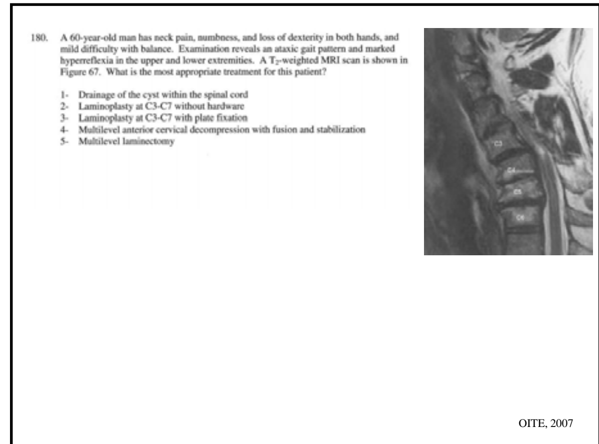
- 7 mm difference
  - may imply disruption of alar ligaments
- >9-10 mm or SAC < 14 mm
  - associated w/ increased risk of neurologic injury
  - usually requires surgical stabilization

Fischgrund, JS. OKU: Spine 2, 2002.
Miller, MD. Review of Orthopaedics, 3rd Edition, 2000.



Chapman's Operative Orthopaedics, 3rd Edition, 2001.

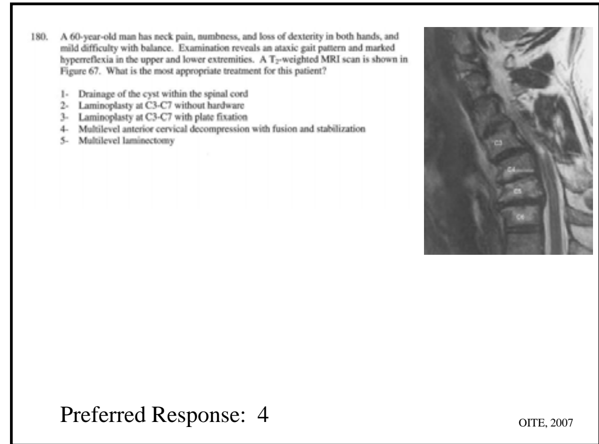




45. A 65-year-old man has low back pain and leg pain with standing. Walking endurance is limited to two blocks due to leg cramping. He has a wide-based, unsteady gait and hyperreflexia. Lumbar radiographs reveal a degenerative spondylolisthesis at L4-5, and an MRI scan shows moderate spinal stenosis at this level. The next step in his care should include

1- lumbar epidural steroid injections.
2- lumbar decompression with fusion.
3- a lumbar epidurogram.
4- interspinous distraction.
5- cervical MRI.

OITE, 2007



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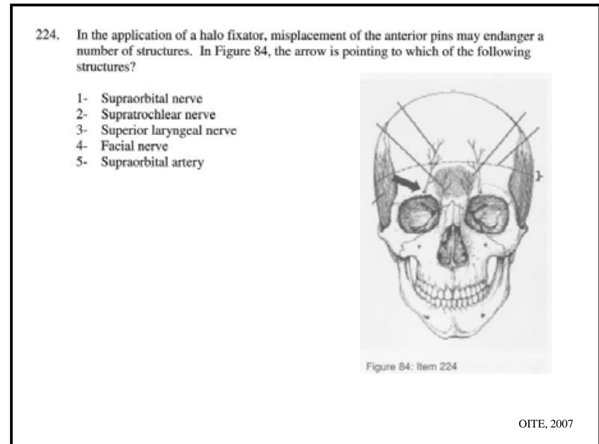
Preferred Response: 5

OITE, 2007



224. In the application of a halo fixator, misplacement of the anterior pins may endanger a number of structures. In Figure 84, the arrow is pointing to which of the following structures?

1- Supraorbital nerve
2- Supratrochlear nerve
3- Superior laryngeal nerve
4- Facial nerve
5- Supraorbital artery

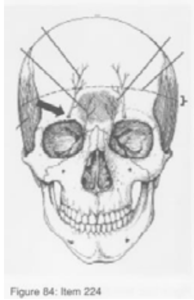


Figure 84: Item 224

Preferred Response: 1

OITE, 2007

16. Respiratory compromise following anterior cervical spine procedures is most closely associated with

1- multilevel approaches above C4.
2- a surgical time of less than 3 hours.
3- obesity.
4- smoking.
5- diabetes mellitus.

OITE, 2003

146. A 58-year-old woman with rheumatoid arthritis reports progressive neck pain and difficulty with fine motor movements, including playing cards and handling coins. Examination revealed hyperreflexia without objective weakness. What is the most important radiographic factor that may predict neural recovery after decompressive surgery?

1- Basilar invagination of less than 1 cm
2- Atlanto-dens interval of less than 5 mm
3- Posterior atlanto-dens interval of greater than 13 mm
4- Subaxial subluxation of less than 3.5 mm
5- Rotatory subluxation of less than 10°

OITE, 2007

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Preferred Response: 1

OITE, 2003

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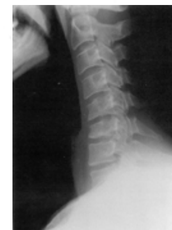
Preferred Response: 3

OITE, 2007

169. A 37-year-old man has neck pain and stiffness following a motor vehicle accident 1 week ago. Examination reveals decreased active range of motion in all planes of the cervical spine, weakness of grip strength, and a bilateral Hoffmann's sign. A lateral radiograph is shown in Figure 58. Further evaluation should include

1- electromyography and nerve conduction velocity studies of the upper extremity.
2- MRI of the lumbar spine.
3- MRI of the cervical spine.
4- flexion-extension radiographs.
5- a bone scan.



OITE, 2003

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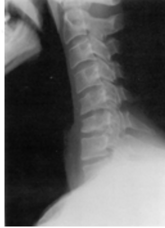

Preferred Response: 3

OITE, 2003

A patient reports changes in vocal quality after undergoing a right-sided anterior cervical approach to C6. Which of the following nerves has most likely been injured?

1- **Vagus**
2- **Phrenic**
3- **Hypoglossal**
4- **Recurrent laryngeal**
5- **Inferior thyroid**

272. Following a left-sided approach for surgery on the anterior cervical spine, the patient reports a drooping left upper eyelid and dryness on the left side of the face. Which of the following structures has most likely been injured?

1- Recurrent laryngeal nerve
2- Superior laryngeal nerve
3- Hypoglossal nerve
4- Phrenic nerve
5- Sympathetic chain

OITE, 2001

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3- **Hypoglossal**
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Preferred Response: 4

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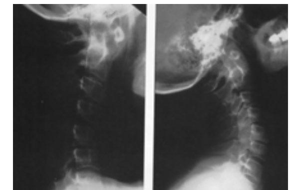
2- Superior laryngeal nerve
3- Hypoglossal nerve
4- Phrenic nerve
5- Sympathetic chain

Preferred Response: 5

OITE, 2001

Which of the following conditions associated with rheumatoid arthritis of the cervical spine is shown in the flexion-extension views?

1- **Cranial settling**
2- **Cranial subluxation**
3- **Odontoid fracture**
4- **Lysis of the arch of the atlas**
5- **Atlantoaxial subluxation**



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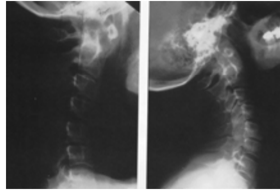

Preferred Response: 5

Examination of a patient with long-standing juvenile rheumatoid arthritis will most likely reveal what abnormality of the cervical spine?

1- **Os odontoideum**
2- **Subaxial subluxation**
3- **Spontaneous ankylosis**
4- **Scoliosis**
5- **Torticollis**

What is the most common cause of injury to the vertebral artery during anterior cervical decompression surgery?

1- **Excessive retraction of the vertebral artery**
2- **Over distraction of the cervical spine**
3- **Lateral bone removal with an air drill**
4- **Kyphotic kinking of the vertebral artery**
5- **Malalignment of the anterior strut graft**

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Preferred Response: 2

What is the most common cause of injury to the vertebral artery during anterior cervical decompression surgery?

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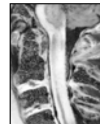
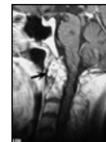
Preferred Response: 3





Thank You