

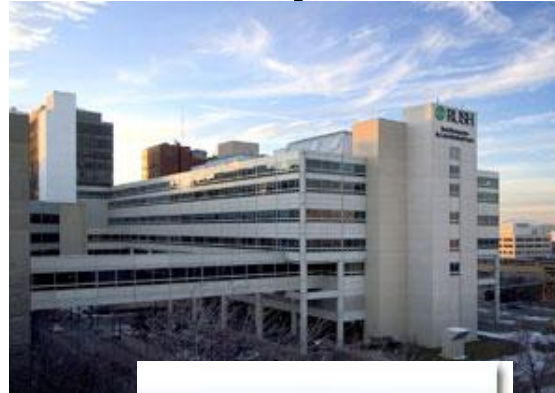
Motion Preservation Procedures for the Cervical Spine

Howard S. An, M.D.

The Morton International
Professor of Orthopaedic
Surgery

Director, Spine Surgery

Rush University Medical
Center Chicago, IL



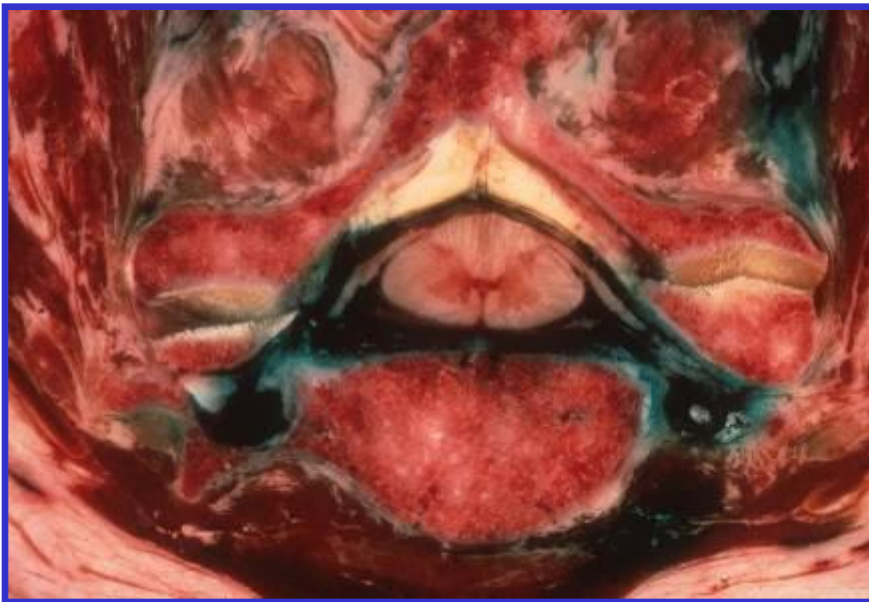
Disclosures: PO1 NIH grant, research/education grant funding# and/or
Consultants* for Zimmer Spine*, Pioneer*, Advanced Biologics*, Globus #,
Medysys*, Synthes#, Life Spine*, Royalty from U&I Inc, SAB of Spinal
Kinetics , BOD of Articular Engineering LLC

Cervical Spinal Disorders (Etiologies)

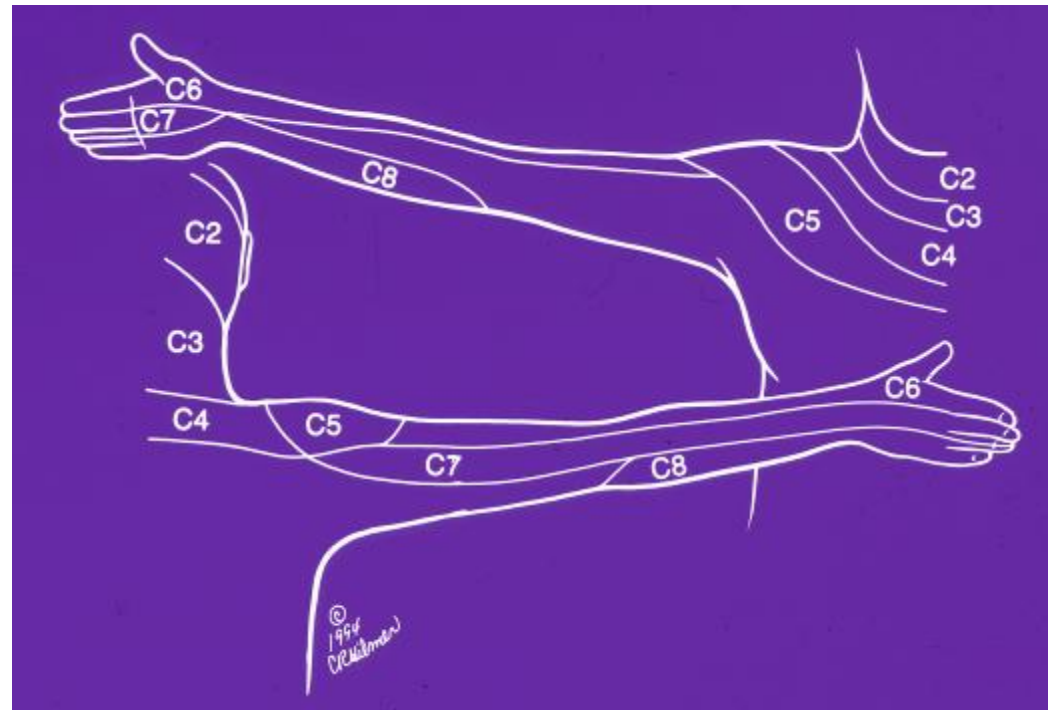
- Fractures/Dislocations
- Tumors or Infections
- Deformities
- Post-surgical, laminectomy, etc.
- Degenerative Disc Disorders

Cervical Disc Disorders

- Axial neck pain
- Radiculopathy
- Myelopathy
- A combination of above

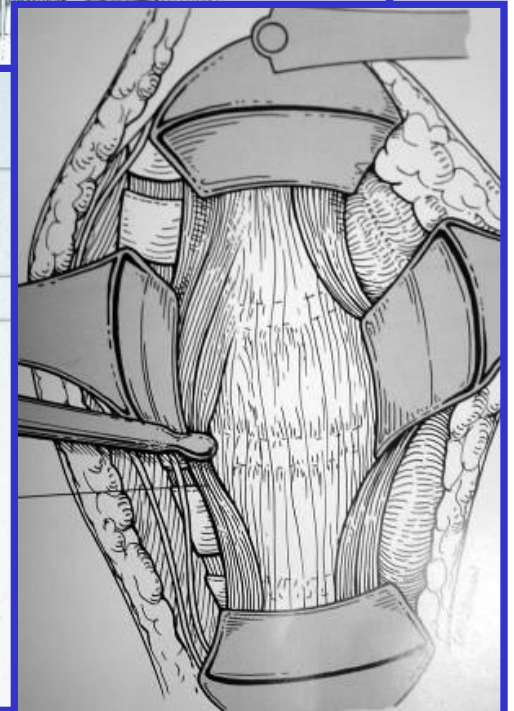
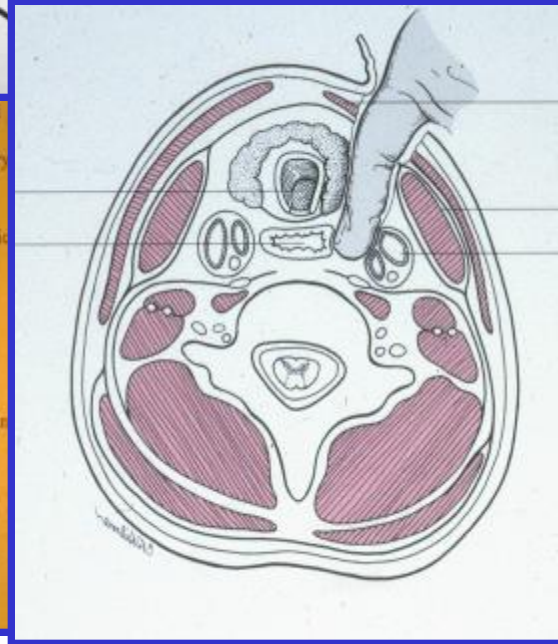
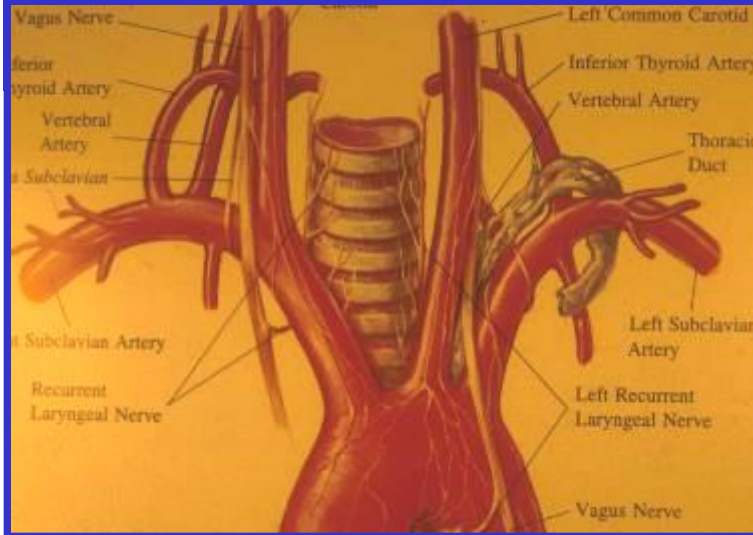
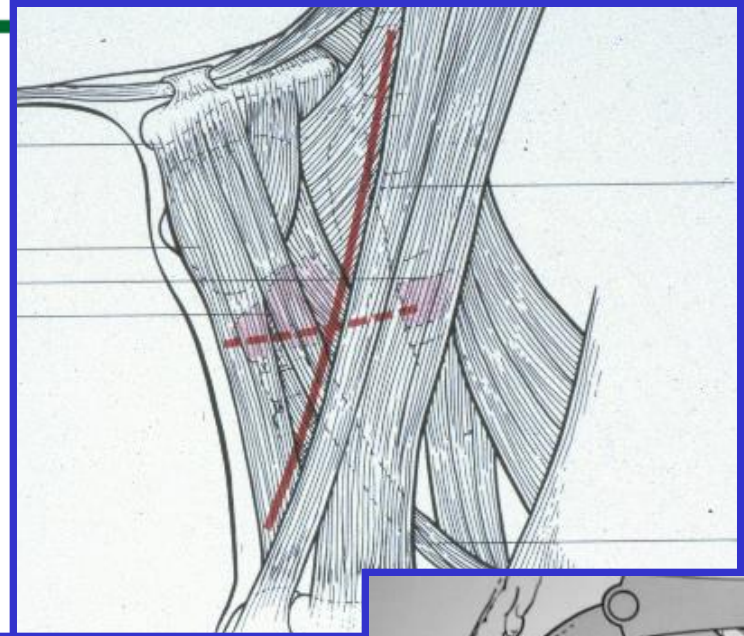


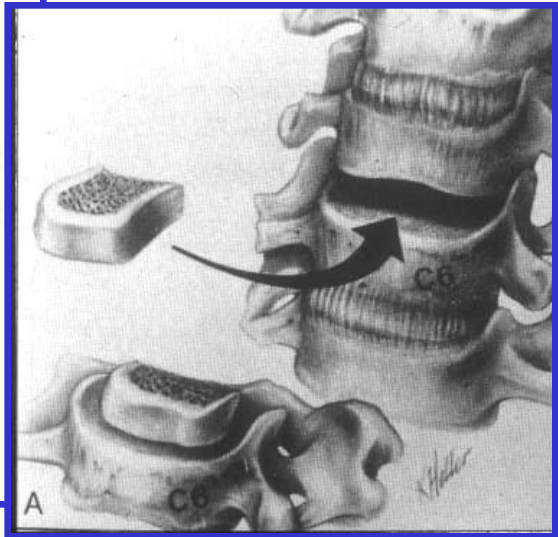
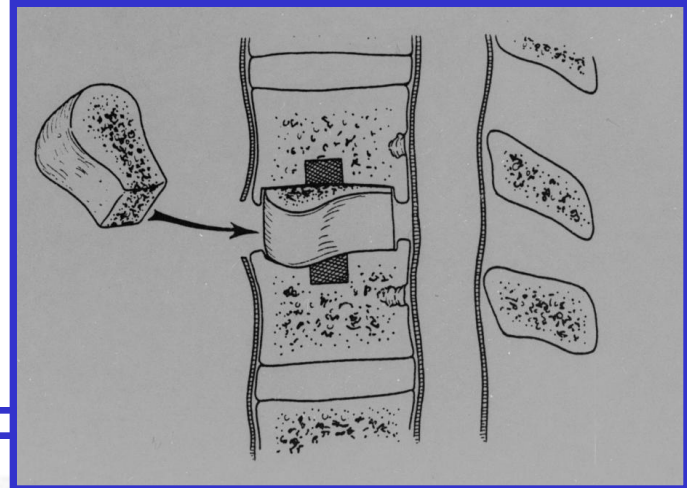
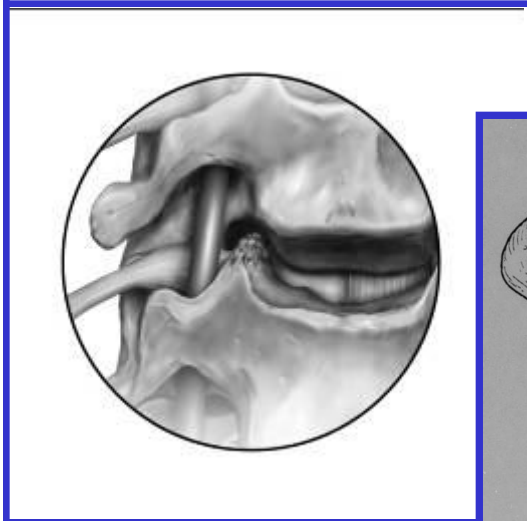
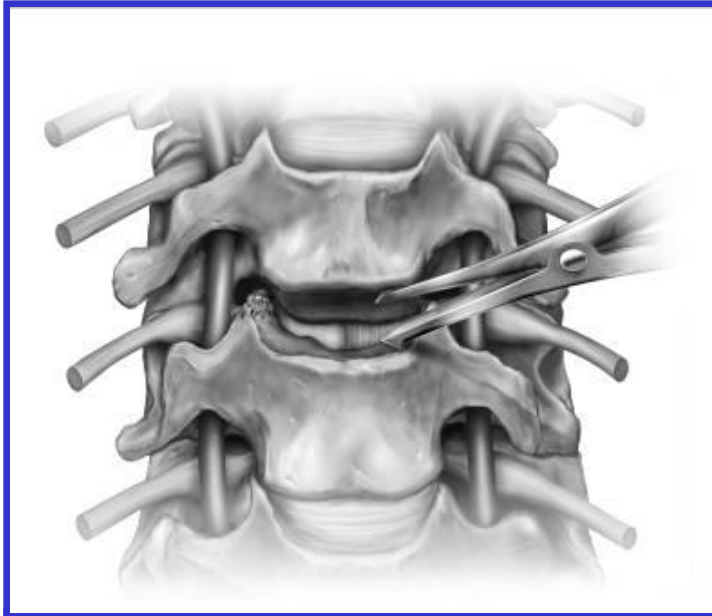
- Pain and/or neurological deficits in a dermatomal distribution
- C3,4 radiculopathy (Jenis, An et al, J Spin D. 2000)
- DDX: Double crush phenomenon, shoulder disorders



- Surgical indications: persistent radicular pain despite conservative treatment (NSAIDs, PT, epidurals) for 2-3 months or presence of significant numbness or weakness
- Anterior discectomy and fusion (ACDF)
- **Posterior lamino-foraminotomy**: predominant arm pain and no kyphosis (esp. previous anterior anterior fusion cases, multi-level unilateral radiculopathy, and C7-T1 level in obese pt.)
- **Artificial disc**

Anterior Discectomy and Fusion





Allograft vs. Autograft



No differences in fusion rates (>96%) between autograft and allograft in rigid plating cases

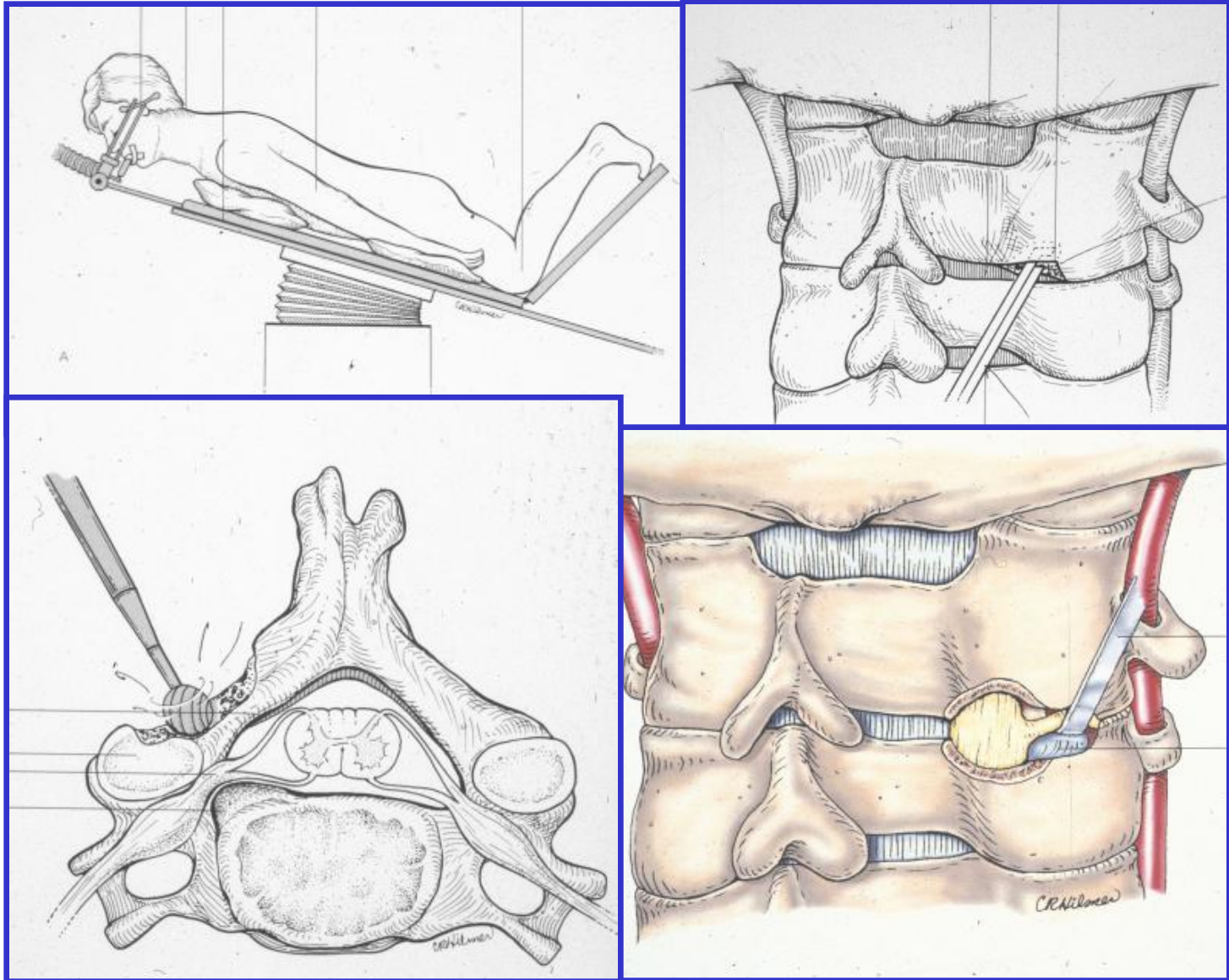
Samartzis, An et al, Spine Journal, 2003

Adjacent Segment Degeneration vs. Natural History

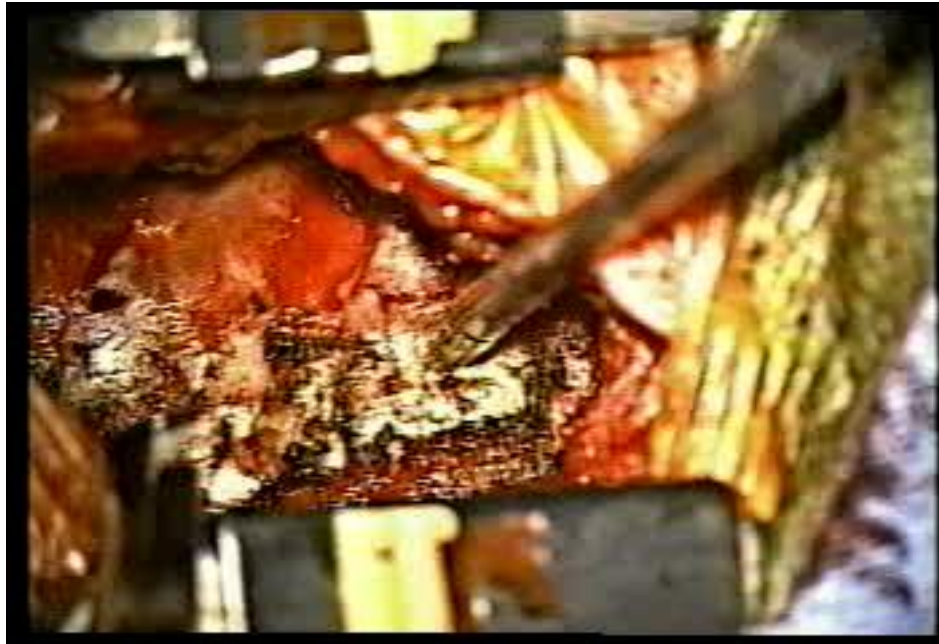
- Gore and Sepic (Spine 1998):
 - New spondylosis in 25% of 121 patients and progression of pre-existing spondylosis in another 25% of patients who had undergone prior ACDFs after 5 years.
- Hilebrand et al. (JBJS, 1999)
 - 409 ACDFs among 374 patients: Symptomatic adjacent segments requiring surgical intervention is 2.9% per year and 25% over 10 years. Lower risk after multilevel procedure ($p < .001$)



Microscopic Laminoforaminotomy



Caudad



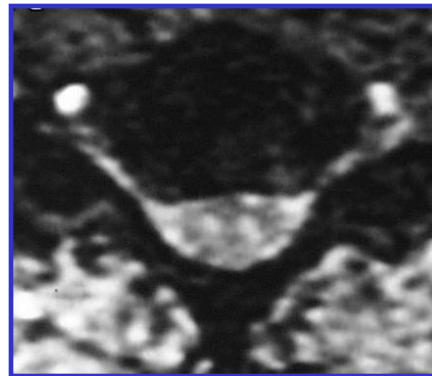
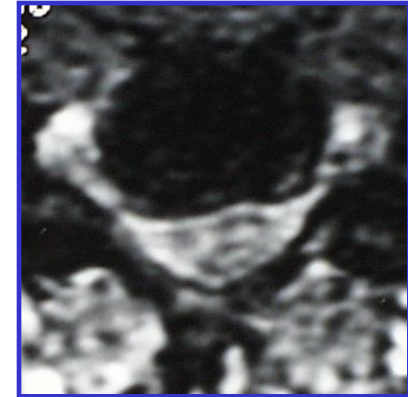
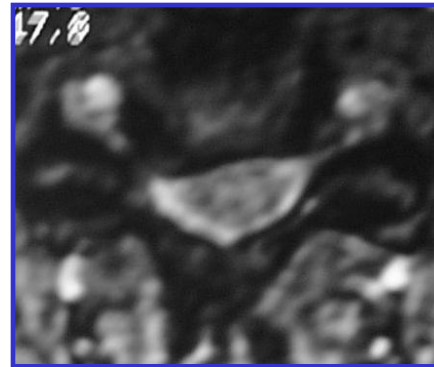
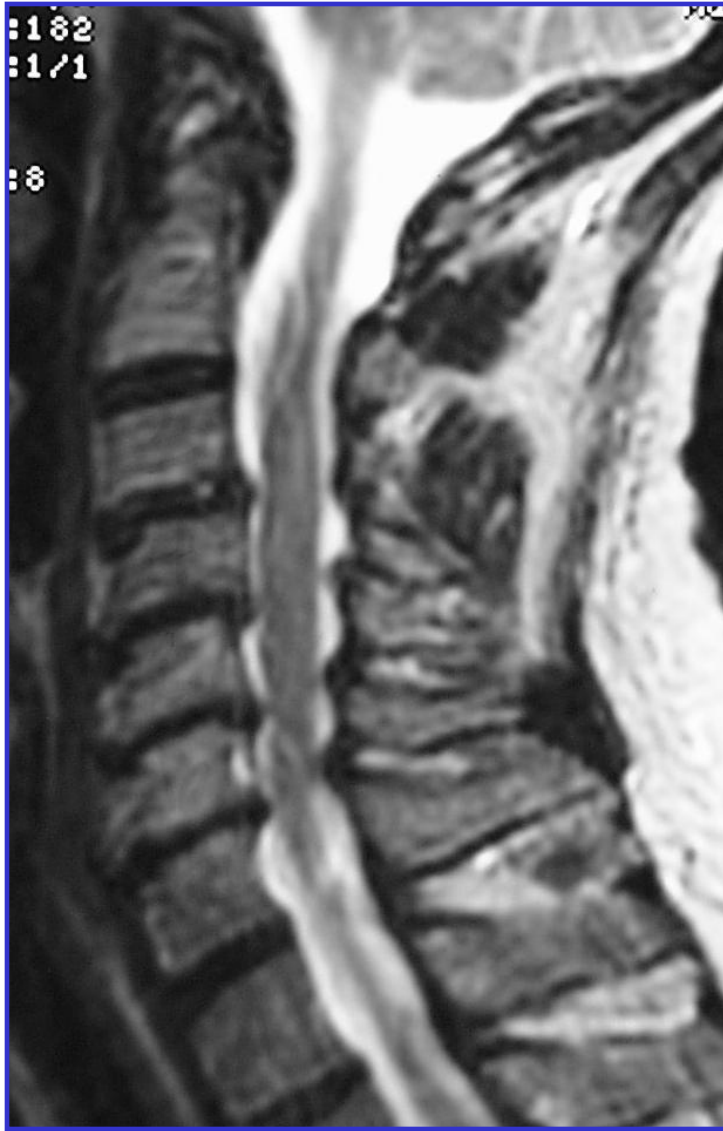
Cephalad

Right C5-6 Foraminotomy

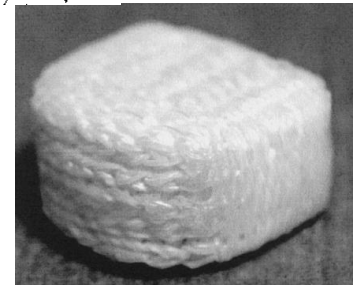
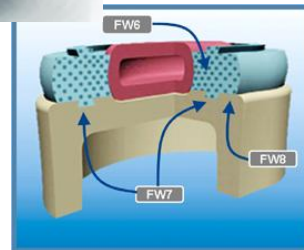
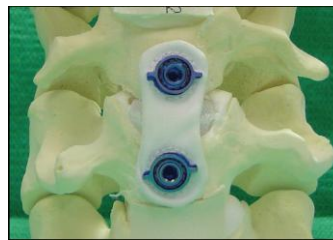
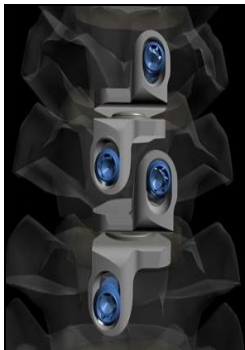
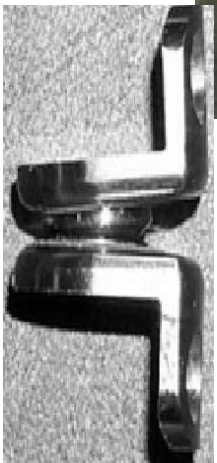
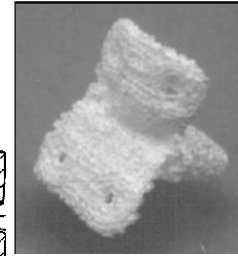
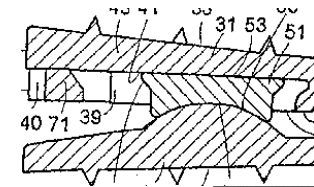
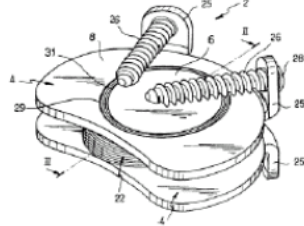
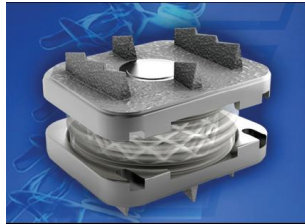
45 year old ♀ with right C6 radicular pain



62 year old ♂ with right C4, C5, and C6 radicular pain

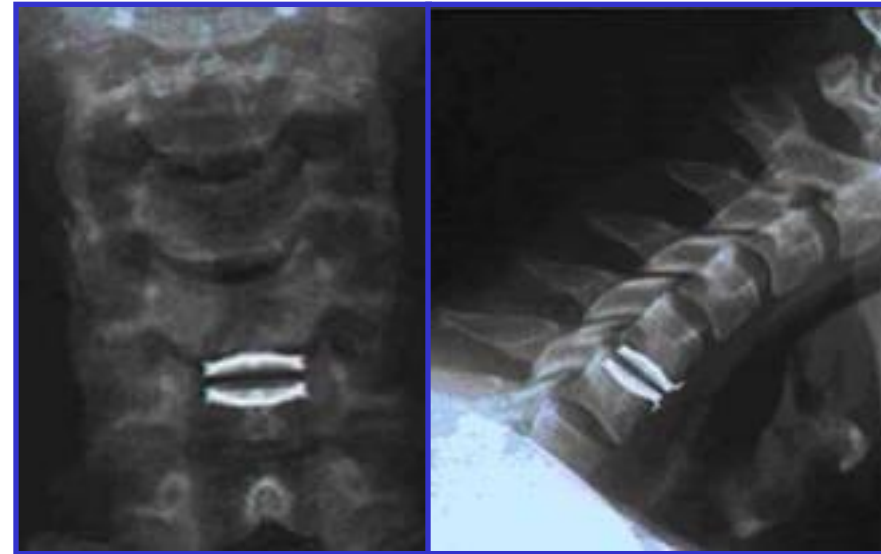


Cervical Disc Arthroplasty



Goals for Cervical Disc Replacement

- Pain relief (axial & radicular)
- Restore and maintain height
- Provide stability
- Maintain foraminal opening
- Decrease adjacent segment disease
- Maintain normal neck mobility
- Eliminate graft site morbidity
- Eliminate possibility for disease transmission (Allograft)
- Decreased recuperation period
- Preclude need for bracing



Indications for Cervical TDR

- Normal alignment with retained motion
- Single-level Radiculopathy
 - Foraminal osteophytes
 - Disc herniation
- Questionable indications:
 - Myelopathy
 - Multi-level cases
 - Facet joint osteoarthritis and significant disc space narrowing
 - Severe Neck pain



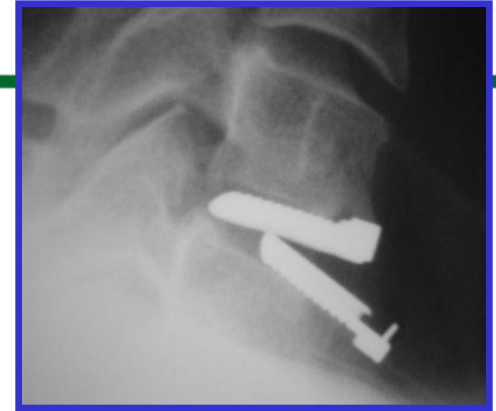
Contraindications Cervical TDR

- Global deformity
- Instability
- Recent infection
- Osteoporosis
 - RA, Renal failure
- Primary axial neck pain without radiculopathy
- Severe spondylosis with collapsed disc space



Concerns

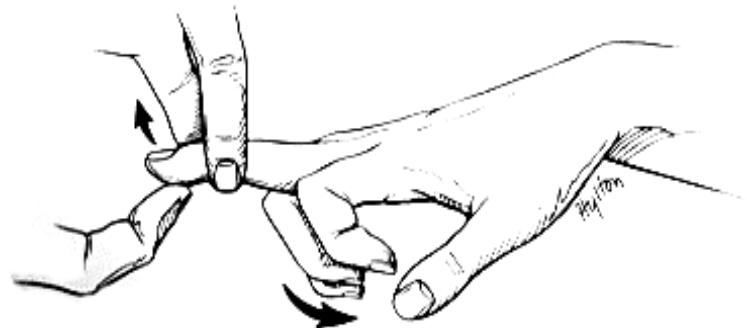
- Prosthesis failure
- Dysphagia
- Subsidence
 - Footprint Design
 - Osteoporosis and endplate preparation
- Spontaneous fusion and heterotopic ossification
- Stress on facets
 - Dependent on design and placement technique
 - Axial pain/radiculopathy
- Kyphosis
- Tribiology
 - Wear debris
 - Metal ion issues
 - Osteolysis



Surgical Treatment of Cervical Radiculopathy

- Lamino-foraminotomy: radicular arm pain without significant neck pain due to HNP or foraminal stenosis
- Disc arthroplasty: radicular pain due to HNP or foraminal stenosis at one level (motion present with flexion-extension, no significant spondylosis and facet joint arthrosis, no significant osteoporosis or kyphosis)
- ACDF: the majority of patients with cervical radiculopathy and neck pain

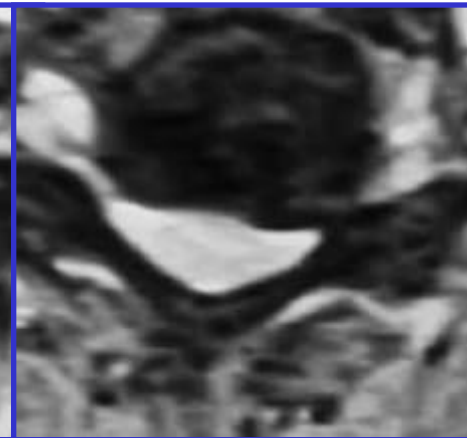
- Difficulty walking/balance, hand numbness and clumsiness
- Exam: myelopathic hand, spasticity, Lhermitte's sign, hyperreflexia, Hoffman sign, Babinski, clonus,



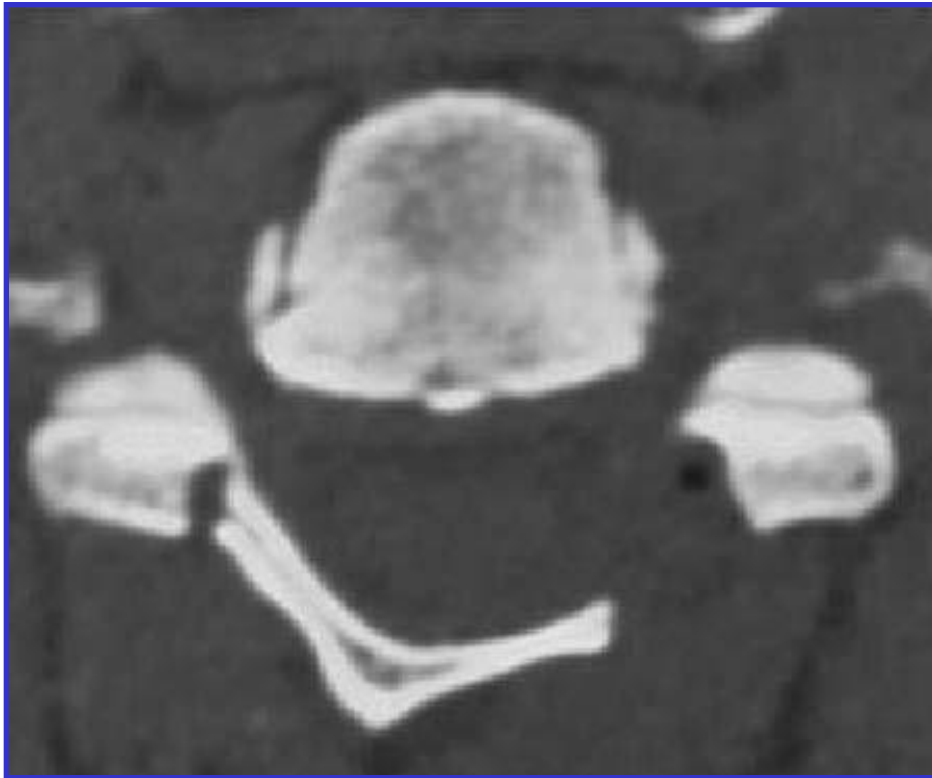
Surgical Treatment of Cervical Myelopathy

- Loss of cervical lordosis or kyphosis: anterior decompression (discectomy and/or corpectomy) and fusion
- Cervical lordosis maintained:
 - Anterior corpectomy and fusion with plating: 1-2 level involvement
 - Posterior laminectomy and fusion: > 3 level involvement and instability with significant neck pain
 - **Posterior laminoplasty**: >3 level involvement, no severe neck pain

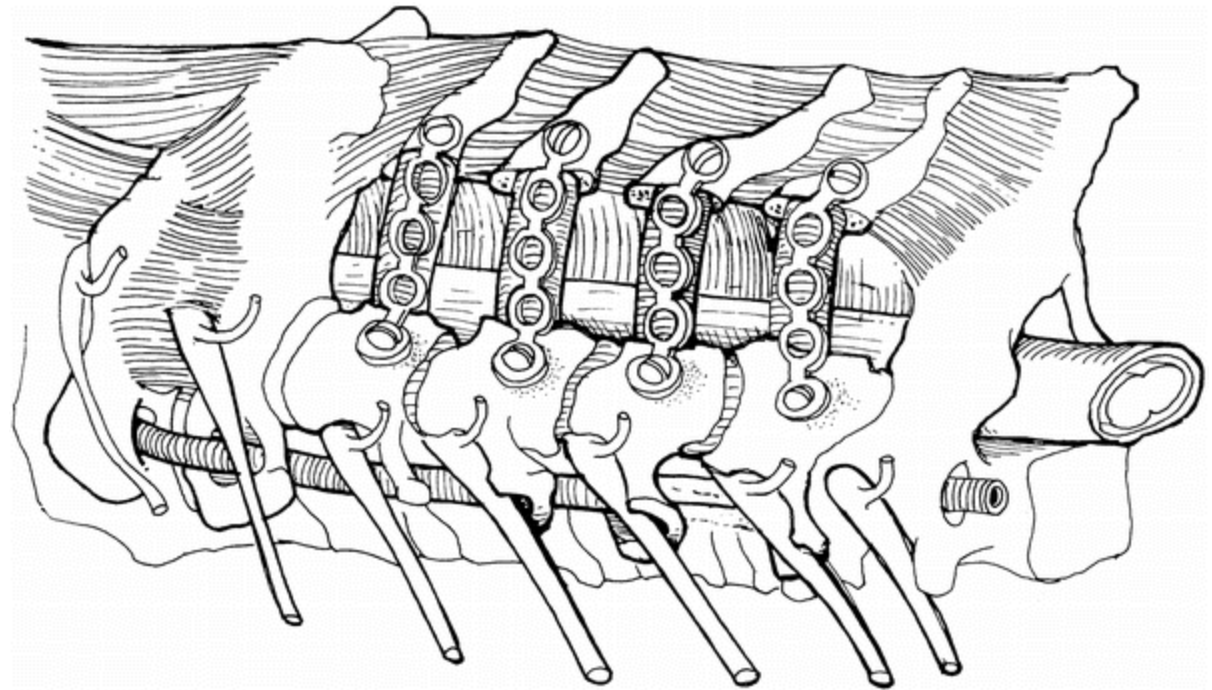
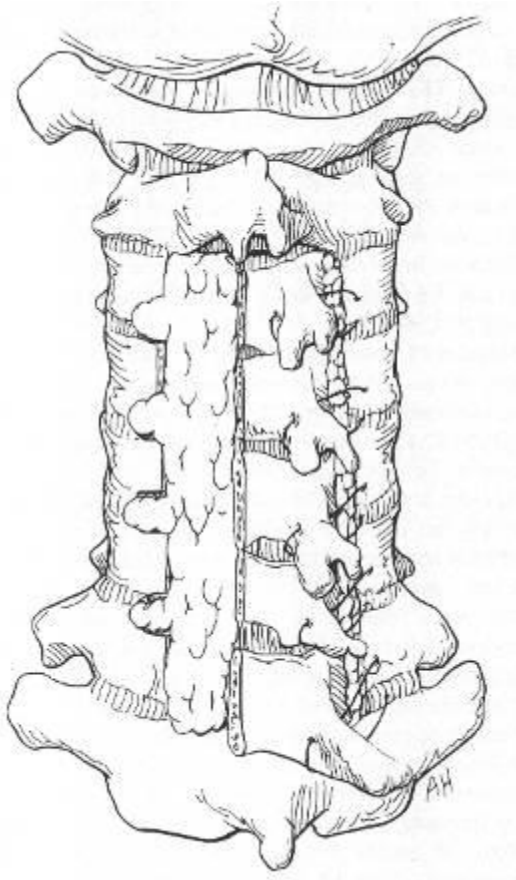




Laminoplasty



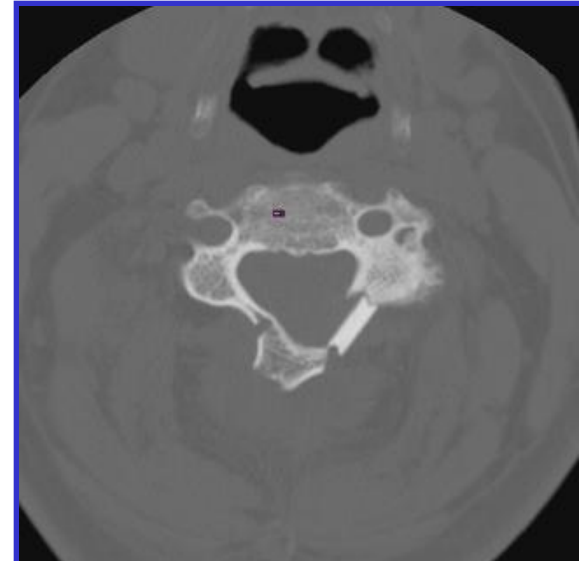
Lamina Opening Stabilization



Shaffrey et al, J Neurosurg, 1999

An et al, Surgery of the Cervical Spine, 1994

Laminoplasty plate



Conclusions

- Motion preservation surgical procedures for cervical spinal disorders include microscopic lamino-foraminotomy, artificial disk and laminoplasty.
- Motion preservation procedures allow faster rehabilitation and maintenance of range of motion
- Key to successful outcome is patient selection with proper surgical indications