Adult Spinal Cord Injury Update: 2025 REACH Conference

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Disclosures

- No Disclosures

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What are we here to accomplish?

1. Recognize Trends in spinal cord injury epidemiology.
2. Understand indications for imaging, bracing, and transfer.
3. Recognize and manage spinal shock, address hemodynamic concerns in SCI patients.
4. Case-based spinal cord injury presentations and surgical management.

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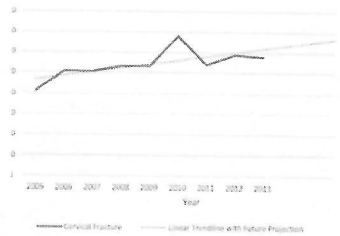
Epidemiology of Cervical Spine injuries

- 17,500 new spinal cord injuries each year
  - $14B per year in direct medical costs
  - $5B in lost productivity
  - **~20% mortality before arriving to hospital**
- Mechanisms
  - Traumatic
  - Non-traumatic
- Aging adult population



Passias et al. 2018. World Neurosurg.

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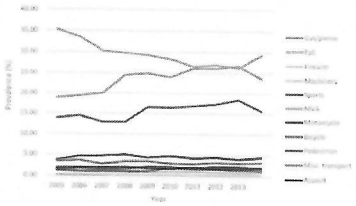
Cervical Spine Injury: Mechanisms (Adult)



- Significantly less SCI from MVA's since 2005
- Increasing prevalence of SCI from Falls
- **Prevalence of all SCI's is decreasing with the exception of upper cervical central cord syndrome.**

Passias et al. 2018. World Neurosurg.

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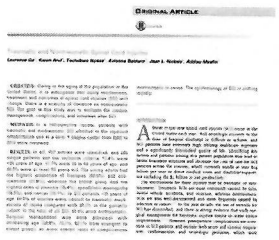
Cervical Spine Injury: Aging Population

- Age Distribution
  - 17% < 35 years
  - 51.7% 35-64 years
  - 30.9% > 65 years
- Young-adults highest proportion of fractures (60.5%) and subluxations (21.8%)
- Geriatric group highest rates of stenosis (35.5%, spondylotic myelopathy (16.5%) and cancer (15.1%).
- Trauma more common MOI in young patients 66.6% vs 30.2% in geriatric population


ORIGINAL ARTICLE

Ge et al. 2018. World Neurosurg.

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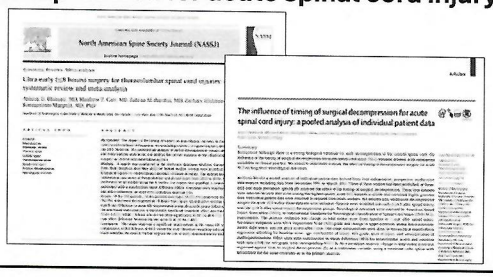
The influence of timing of surgical decompression for acute spinal cord injury


North American Spine Society Journal (NASSJ)

The influence of timing of surgical decompression for acute spinal cord injury: a pooled analysis of individual patient data

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Prevention of 2° Injury: Surgical management

"Time is spine"
(Growing consensus)

The influence of timing of surgical decompression for acute spinal cord injury: a pooled analysis of individual patient data

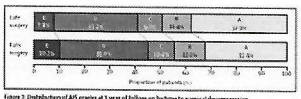
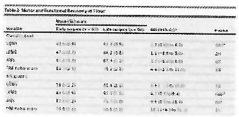


Figure 3 Distribution of AIS grades at 1 year of follow-up by time to surgical decompression

JAMA Surgery | Original Investigation

Early vs Late Surgical Decompression for Central Cord Syndrome



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Pre-hospital Considerations

- Manual Cervical Stabilization – Performed during scene size-up.
  - Initiate manual stabilization immediately if spinal cord injury is suspected.
  - Neutral in-line head and neck position.
  - Assess pulses, motor, and sensory function (PMS)
- Cervical Collar Application – A treatment step during secondary assessment
- Indications for SMR
  - Altered consciousness (e.g. GCS < 15, intoxication)
  - Midline neck/back pain or tenderness
  - Focal deficit
  - Distracting Injury
  - Anatomic deformity

Fischer et al. 2018, doi:10.1080/10903127.2018.1461476

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Sizing and Applying the Cervical Collar

- Measure from chin to shoulder (~4 fingers width).
- Collar maintains a neutral in-line position.
- Reassess PMS

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Safe Patient Movement and Transport

- Conscious: Pivot and sit method to gurney.
- Unconscious: Log roll with spine board; head position leader coordinates.
- Prevent lateral spine movement.
- **Secure patient for transport**
  - Center patient on board.
  - Use proper lift techniques to cot.
  - Remove board before transport and secure with 4 gurney straps.
  - Reassess PMS before transport.

Patient with SCI should be transferred to closest facility that can

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Hemodynamic Considerations

- **Neurogenic Shock**
  - Low Blood Pressure **and** Bradycardia
  - Loss of sympathetic tone (injuries above T5)
  - Skin often warm and flush below level of injury due to vasodilation and poor venous return
- **Hypovolemic Shock**
  - Low Blood Pressure **and** Tachycardia
  - Caused by blood loss
  - Skin is cool and clammy due to peripheral vasoconstriction
- Goal: Maintain **perfusion**, minimize **secondary injury**
- Assess for **combined shock states** (neurogenic + hypovolemic)
- Tailor intervention to suspected **dominant mechanism**

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Managing Neurogenic Shock

- **Fluid Resuscitation:**
  - Indicated in polytrauma or concurrent hypovolemia
  - **Avoid over-resuscitation** – risk of pulmonary edema, especially in isolated neurogenic shock
- Vasopressors and Inotropes
  - **Norepinephrine:** α & β activity – preferred for vasoconstriction and mild inotropy
  - **Epinephrine:** Strong α stimulation – may cause reflex **bradycardia**
  - Consider **Atropine** for symptomatic bradycardia
  - Titrate to maintain **MAP > 85 mmHg**
  - Avoid **SBP < 90 mmHg**

Caution: In isolated neurogenic shock, aggressive fluid boluses may worsen outcomes

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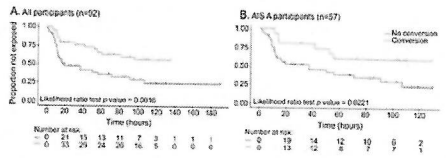
Maintaining Spinal Cord Perfusion Pressure

- Patients who don't convert AIS grades have higher rates of exposure to SCPP < 50 within the first 24 hours.
- While SCPP is measured invasively, our best correlate is hypotension.



Squair et al. 2017. Neurology

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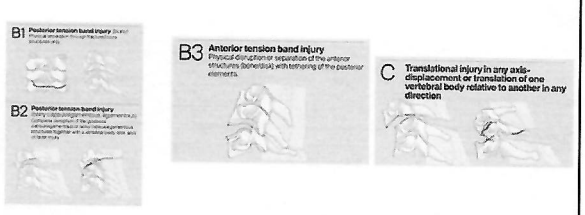
Common Operative Cervical Injuries



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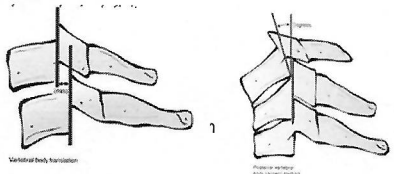
Definition of Cervical Instability

- Inability to maintain, under physiologic loads, a pattern of displacement so that there is no...
  - initial or ad
  - major defor
  - incapacitat
- 3.5 mm horiz
- 11 degrees o



White and Punjabi 1975

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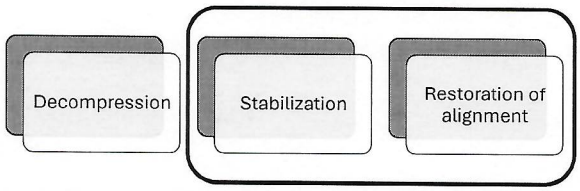
Surgical Management



- "Fusion" surgeries try accomplish both goals simultaneously
- Fusion ≠ fixation

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Cervical Spine Surgery

Anterior Surgeries

- Anterior cervical discectomy and fusion (ACDF)
- Cervical corpectomy

Posterior Surgeries

- Laminectomy and posterior fusion

The location of the pathology dictates the choice of approach

Pathology treated

- sites of ongoing compression
- sites of instability
- sites of malalignment

The desired correction of alignment also affects choice of approach

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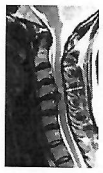
Cervical Spine Surgery

Anterior pathology



Posterior pathology

The location of the pathology dictates the choice of approach

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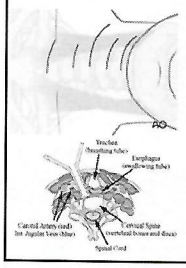
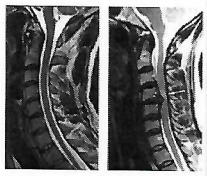
Anterior Cervical Surgery (ACDF)





Anterior Cervical Surgery

- Horizontal incision in front of neck
- Retraction of trachea, esophagus
  - Dysphagia
  - Hoarseness
- Less blood loss and muscle dissection

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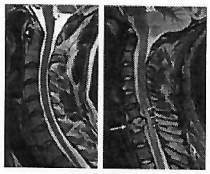
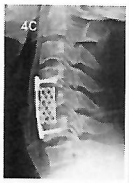
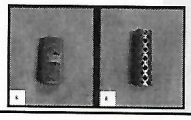
Anterior Cervical Surgery: Corpectomy







Same approach / exposure as discectomy (ACDF)

Anterior Cervical Surgery

- Horizontal incision in front of neck
- Retraction of trachea, esophagus
  - Dysphagia
  - Hoarseness
- Less blood loss and muscle disection

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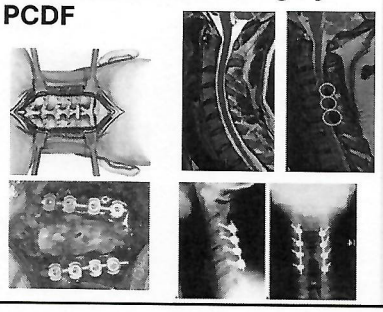
Posterior Cervical Surgery: PCDF



Posterior Cervical Surgery

- Midline posterior neck incision
- More blood loss, muscle dissection
- Can include many levels

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Case 1: Houston, we have a problem!

- 71 yo M Aeronautics Engineer
- PMHx: HTN, HLD, CAD on ASA 81 mg
- Fall > 10 ft from ladder
- Down for 1-2 hours in field
- Bradycardic to 30's, received atropine in field by EMS
- SBP in 80's

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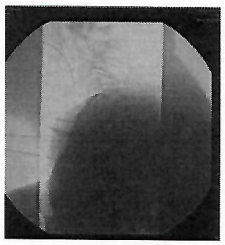
Surgical Management:



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Case 2: Kangaroo Bounce

- 73 yo F
- Fall down hill while holding a kangaroo
- Severe back pain
- Motor intact 5/5 strength in all muscle groups
- Sensory intact
- Unable to walk due to pain
- Recent history of right knee replacement with prolonged recovery

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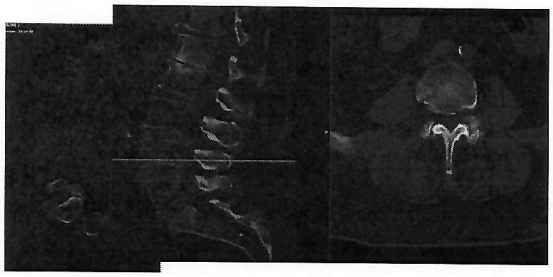
Case 2: Pre-operative Imaging



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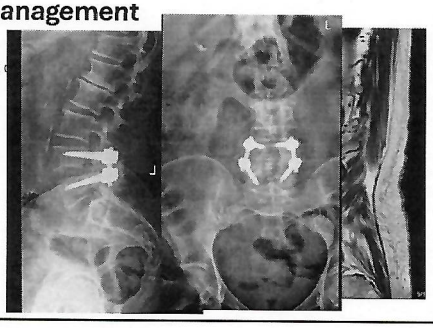
Case 2: Management

Develops delayed
incontinence.



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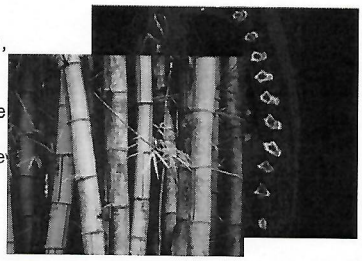
Case 3: Bamboo Spine

- 76 yo Female
- PMHx: Afib with RVR, HTN, HLD, DM2, BMI 37
- Fall from standing
- Unstable T8 DISH Fracture
- Motor and Sensory Intact
- Unable to ambulate 2/2 se pain.



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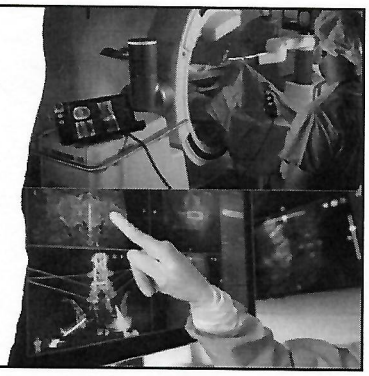
Management/ Surgical Workflow

- Pre-operative planning: High resolution CT imaging
- Screw planning with robotic software: Can optimize screw size/length and trajectory
- Able optimize trajectory for rod placement
- Fluoro or E3D shot and anatomic registration



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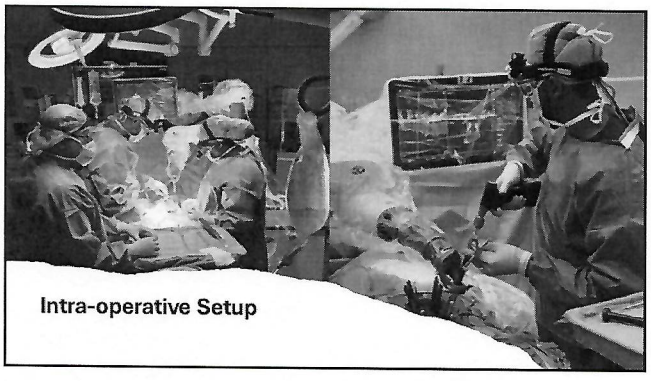

Intra-operative Setup

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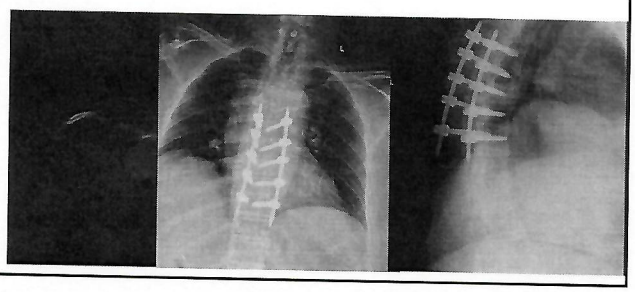
Intra-operative Spine and Post-op films



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Acknowledgements/Questions



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