

# Cervical Spine Trauma

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# Recommendations

## (Neurosurgery Supplement: March 2012)

- ◆ Standards
  - Class I evidence (RCT)
  - High degree of clinical certainty
- ◆ Guidelines
  - Class II evidence (non-randomized)
  - Moderate degree of clinical certainty
- ◆ Options
  - Class III evidence (observational studies)
  - Unclear clinical certainty

# Management

- ◆ Clinical Assessment
- ◆ Radiographic Assessment
- ◆ Reduction of Fracture Dislocations
- ◆ Blood pressure management
- ◆ Pharmacologic Therapy

# Specific entities

- ◆ Atlanto-occipital Dislocation
- ◆ Occipital Condyle Fractures
- ◆ Atlas Fractures
- ◆ Hangman's Fractures
- ◆ Odontoid Fractures
- ◆ C2 body Fractures
- ◆ Locked and Perched Facets

# Pre-Hospital Immobilization

- ◆ Standards
  - None/Insufficient evidence
- ◆ Guidelines
  - None/Insufficient evidence
- ◆ **Options**
  - **Immobilization at the scene and during transport**
  - **Combination of rigid collar and supportive blocks on backboard recommended**
  - **Sand bags/tape NOT recommended**

# Clinical Assessment

- ◆ Standards
  - None/Insufficient evidence
- ◆ Guidelines
  - None/Insufficient evidence
- ◆ **Options**
  - **ASIA recommended**

# Spinal Cord Injury Clinical Assessment

## ◆ ASIA (Acute Spinal Injury Association) Scale

Scale most commonly used

Graded A to E

- **E: normal motor and sensory**
- **D: half the muscles below the level of injury greater than 3/5 (anti-gravity)**
- **C: half the muscles below the level of injury less than 3/5 (non anti-gravity)**

# Spinal Cord Injury Clinical Assessment

- ◆ ASIA (Acute Spinal Injury Association) Scale
  - Scale most commonly used
  - Graded A to E
  - **B: sensory, but no motor function, below the level of injury down to S4-5**
  - **A: no motor or sensory function below the level of injury down to S4-5**



# Radiographic Assessment

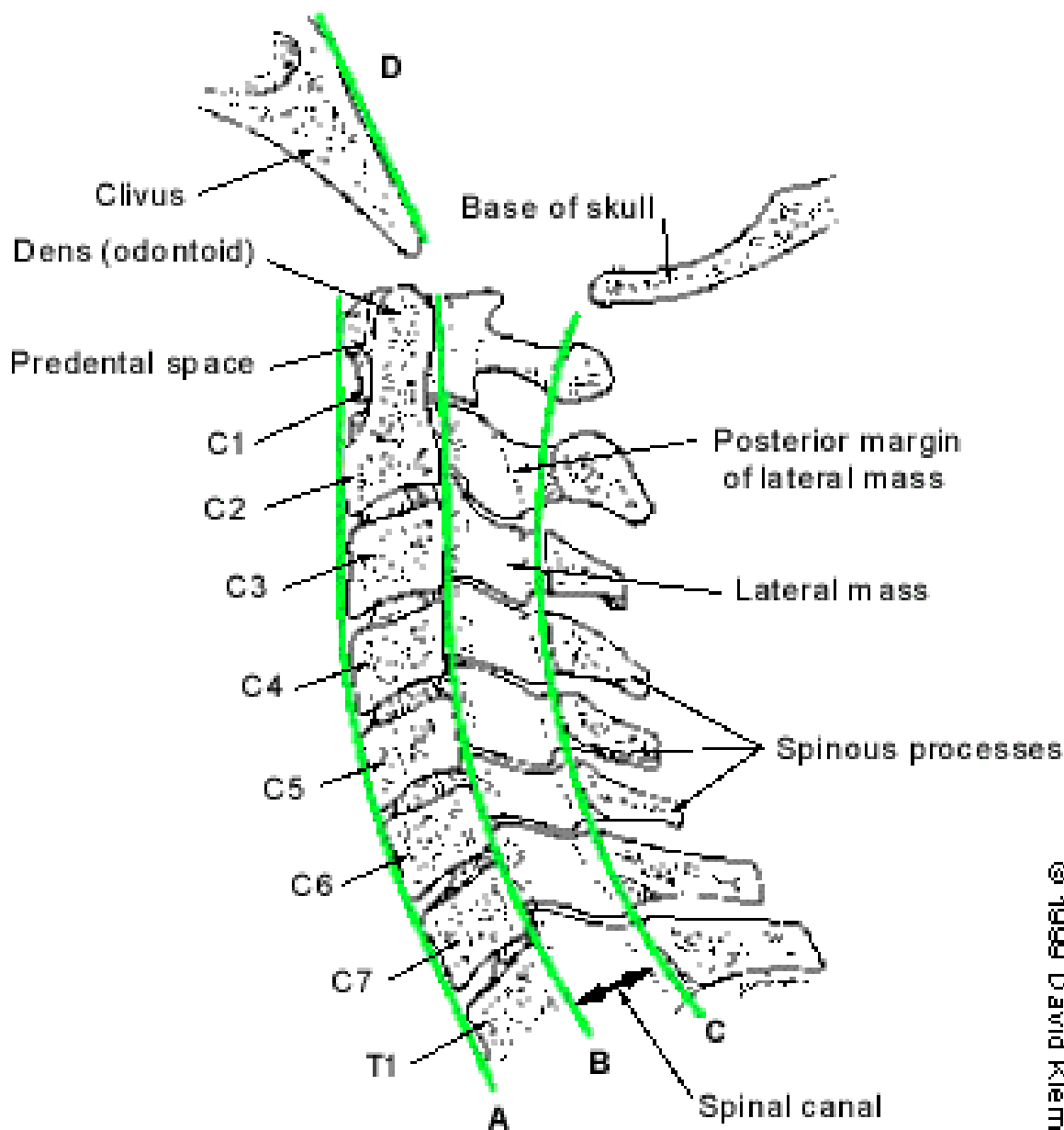
## ◆ STANDARD

- Imaging **NOT** recommended in trauma patients who are **AWAKE, ALERT, and NOT INTOXICATED**, who are **WITHOUT NECK PAIN or TENDERNESS**, and who do not have **SIGNIFICANT ASSOCIATED INJURIES** that detract from their general evaluation.

# Radiographic Assessment in Symptomatic Trauma Patients

## ◆ STANDARDS

- Three view (AP, LAT, odontoid) is recommended for radiographic evaluation of who are symptomatic after traumatic injury.
- CT should be used to define areas that are suspicious or not well-visualized



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- ◆ A=anterior spinal line;
- ◆ B=posterior spinal line;
- ◆ C=spinolaminar line;
- ◆ D=clivus base line

# Radiographic assessment in Symptomatic Trauma Patients

## ◆ OPTIONS

- If an awake patient has neck pain or tenderness and normal C-spine xray (including CT as needed), discontinue C-collar after
  - Normal flex/ex films
  - Normal MRI within 48 hours.

# Radiographic assessment in Obtunded Trauma Patients

- ◆ In OBTUNDED patients with normal C-spine radiographs, d/c immobilization
  - Dynamic flex/ex studies under fluoro
  - Normal MRI within 48 hours
  - Discretion of treating physician.

# Closed reduction of fracture/dislocation injuries.

- ◆ Standards
  - None
- ◆ Guidelines
  - None
- ◆ **Options**
  - **Early closed reduction (cranio-cervical traction) is recommended in awake patients to restore anatomic alignment**
  - **Closed reduction in patients with a second rostral injury is not recommended**

# Closed reduction of fracture/dislocation injuries.

- ◆ **Patients who cannot be examined during closed reduction, or before open posterior reduction, should undergo MRI before reduction.**
  - A disc herniation is a relative indication for ventral decompression before reduction.

# Closed reduction of fracture/dislocation injuries.

- ◆ Patients who fail attempts at closed reduction should have an MRI
- ◆ Pre-reduction MRI in patients with c-spine fracture dislocation will demonstrate disrupted discs in 1/3-1/2 of patients with facet subluxation.
  - They do not seem to significantly influence outcome after closed reduction in awake patients.
  - ?Utility of pre-reduction MRI in awake patients



# ICU/Monitored Management

- ◆ Standards
  - None
- ◆ Guidelines
  - None
- ◆ **Options**
  - **Patients with severe acute cervical injury should be managed in a monitored setting**
  - **Use of cardiac, hemodynamic, and respiratory monitoring devices is recommended**

# Blood pressure management

- ◆ Standards
  - None
- ◆ Guidelines
  - None
- ◆ **Option**
  - **Avoid Systolic pressure < 90 mm Hg**
  - **Maintenance MAP 85-90mm Hg for 7 days after acute SCI to improve spinal cord perfusion is recommended**

# Steroids

## ◆ Mechanism

Stabilize membrane structures, maintain blood-spinal cord barrier potentially reducing vasogenic edema, enhance blood flow, inhibit endorphin release, scavenge free radicals and limit inflammatory response.

# Steroids

- ◆ NASCIS I (National Acute Spinal Cord Injury Study) 1984
- ◆ 1000mg bolus of methylprednisolone then 100mg/day for 10 days showed no difference
- ◆ Animal studies suggested the dose was too low.

# Steroids

- ◆ NASCIS II (1990)
- ◆ 30mg/kg bolus, then 5.4mg/kg infusion for 23 h.
- ◆ If given within 8 hours, there was improvement at 6 month follow-up.
- ◆ 1 year follow up showed significant improvement in motor scores

# Steroids

- ◆ Major Flaws of NASCIS II:
  - Randomization process
  - Medical management
  - Surgical management
  - Statistical analyses.

# Steroids

- ◆ NASCIS III 1997
- ◆ No difference treated within 3h between 3 and 8h.
- ◆ But if steroids started within 3 h, 24h maintenance
- ◆ Steroids started 3 to 8 hr after injury should be maintained on 48 h.

# Steroids

- ◆ NASCIS III
- ◆ 48h or steroids had 2-fold higher incidence of pneumonia, 4-fold of sepsis, 6 fold of death due to respiratory complications compared to 24h



# Steroids

- ◆ Standards/Guidelines

- None

- ◆ Options

- Treatment with methylprednisolone for either 24 hour or 48 hours is an option with the knowledge that evidence suggesting harmful side effects is more consistent than any suggestion of clinical benefit.

# GM1 Gangliosides

- ◆ Two randomized trials in North America have shown no benefit from GM-1 gangliosides.
- ◆ GM-1 gangliosides administered for 56 days after methylprednisolone within 8h has suggested—but not convincingly proven—some benefit

# GM-1 ganglioside

- ◆ Standards
  - None
- ◆ Guidelines
  - None
- ◆ Options
  - GM-1 ganglioside treatment is an option but there is no clinically-demonstrated benefit

# Stem Cells

- induce myelination
- survive in injured cord
- produce trophic factors
- combat inhibitory factors
- improve functional recovery

# Clinical Trials

## ◆ StemCells

- Fetal human brain-derived SC
- Phase I/II
- Safety/efficacy in patients with ASIA A-C thoracic SCI
- No complications/side effects to date

## ◆ Geron

- Embryonic stem cells
- Phase I
- Thoracic SCI
- Study closed?

# Modern SCI Research

## ◆ Accomplishments

- Immediate post-traumatic reactions fairly well understood
  - Ischemic
  - Inflammatory
- Modulation of ischemic/inflammatory response

## ◆ Challenges

- Replacing lost cells & supporting tissues
- Filling physical gap/cavitation after SCI