Characterizing Spinal Injury at the Craniocervical Junction: Who, What, Where?

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Craniocervical Junction Anatomy
- CC Junction functions as one joint

Alar ligaments
- Primarily restrain rotation

Bilateral alar ligament avulsions

Transverse atlantal ligament
- Restrict dens from impaling cord in flexion
- Maintain atlanto-axial distance at <3mm (adults) and <5mm (kids)
- 80% of odontoid fractures are caused by flexion
- Lat displacement of C1 lateral masses compared to C2 lateral masses raises concern for TAL disruption
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Craniocervical Junction Trauma

- Atlanto-occipital dissociation
  - Usually fatal
  - Unstable—all stabilizing structures disrupted in distraction injuries—neurologic deterioration with delayed treatment
  - Check for associated injury

Atlanto-occipital Dissociation

Basion-dens interval < 12 mm
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Atlanto-occipital Dissociation

Left Carotid injection

Atlanto-occipital Dissociation

Craniocervical Junction Trauma

- Atlanto-occipital dissociation
- Occipital condyle

- Comminuted?
Craniocervical Junction Trauma

- Atlanto-occipital dissociation
- Occipital condyle
  - Comminuted?
  - Associated occipital skull fx?
  - Usually stable (type II)

- Atlanto-occipital dissociation
- Occipital condyle
  - Comminuted?
  - Associated occipital skull fx?
  - Non-Displaced?
  - Displaced
  - Potentially unstable (type III)

Craniocervical Junction Trauma

- Atlanto-occipital dissociation
- Occipital condyle
  - Comminuted?
  - Associated occipital skull fx?
  - Non-Displaced?
  - Displaced?
  - Associated injury?

Occipital condylar synchondrosis

- Atlanto-occipital dissociation
- Occipital condyle
- C1 fractures
  - Atlas = most fragile vertebrae
  - >3 parts = burst fracture
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C1 fracture: malaligned lateral masses

Usually heal with conservative treatment

Craniocervical Junction Trauma

- Atlando-occipital dissociation
- Occipital condyle
- C1: lateral mass
- Dens fractures
  - Most common c-spine fracture in elderly

Craniocervical Junction Trauma

- Atlando-occipital dissociation
- Occipital condyle
- C1: lateral mass
- Dens fractures
  - Type I
    - Odontoid tip avulsed by alar ligament

Craniocervical Junction Trauma

- Atlando-occipital dissociation
- Occipital condyle
- C1: lateral mass
- Dens fractures
  - Type II
    - Fractures at odontoid waist

Type II dens fracture

5 months post fall down stairs, initially treated with ASPEN collar

post-op pin

3 months post-op
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Anterior oblique fracture lines do not allow interfragmentary compression

NO anterior pin fixation

Craniocervical Junction Trauma

- Atlanto-occipital dissociation
- Occipital condyle
- C1: lateral mass
- Dens fractures
  - Type III
    - Extend into cancellous body (better vascularized)
    - Usually heal with conservative management
    - If >5mm vertical distraction—treat surgically

Type III dens fracture

Treated conservatively

Spinal cord injury

- Stabilizing structures of spine have failed, surgical treatment should be considered
- 17% of patients with cord injury die during initial hospitalization
- High-level tetraplegia = 10% of spinal cord injuries but 80% of direct medial cost of spinal cord injury

REFERENCES


Noble ER, Smoker WR. The forgotten condyle: The appearance, morphology and classification of occipital condyle fractures. AJNR. 1996;7(12):1805-1809

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