Head & Spinal Injury

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Spinal Immobilisation
Aims:

- History of prehospital spinal immobilisation
- Procedures & Equipment
- Practicalities & Problems
- Evidence base
- Current recommendations
First Recommendations 1970’s

Principle Behind Immobilisation

Unstable axial skeletal injury with out cord injury

Medical interventions  “Inappropriate” handling

Unstable axial skeletal injury with cord injury
The problem

- 40-50 SCI per million population
- 3 – 25% occur after injury
- 5 million immobilisations per year (US) \(^1\)

50% - Road Traffic Accidents
Epidemiology of spinal injury

- Cervical Spine: 55% (65% if spinal injury alone)
- Thoracic Spine: 30%
- Lumbar Spine: 15%
- Two regions: 4.7%
- > 2 regions: 0.5%

NEXUS:
Distribution of fractures

Occ* Level
C7 C6 C5 C4 C3 C2 C1

Percentage of fractures

N = 1195
Cervical spine injuries and GCS

- Traffic injuries and falls admitted to LA trauma center
- 292/14,755 (2.0%) with c-spine injuries

Demetriades D. J Trauma 2000;48:724-7
What can be done to minimise further injury?
Manual in-line stabilisation
Handling Measures – Log Roll
Splintage devices - collars
Splintage Devices – eg KED
Lifting & Carrying Tools
Rigid Cervical Collars (RCC)

Clinical assessment
Goniometry
Photography
Radiography
Cinematography
CT / MRI

80 – 90% reduction in c spine movement
Rigid Cervical Collars + other

90 - 95% reduction in c spine movement

Other = KED, RED, Short spinal board
Side Effects RCC – Raised ICP
Side Effects – Raised ICP


Hunt, K et al. The effects of rigid collar placement on intracranial and cerebral perfusion pressures. Anaesthesia. 56(6):511-513, June 2001


No effect

4 mmHg rise

4 mmHg rise
Side Effects

- Pressure necrosis
- Airway obstruction
Side effects KED

Impaired:
- FVC
- FEV1
- FEV/FVC
- FMEF

Bauer D, Kowalski R. *Effect of spinal immobilization devices on pulmonary function in the healthy, non-smoking man.* Ann Emerg Med. 1988 Sep;17(9):915-8
Spinal Board

- Extrication tool
- Carrying tool if prone
- Scoop if supine
- Not for transfer work
- No more than 45 mins
Joint Royal Colleges
Ambulance Liaison Committee (JRCALC)
&
Faculty of Prehospital Care

Recommendations for Spinal Immobilisation:
For unconscious trauma patients

- Spinal board
- Rigid cervical collar
- Blocks
- Remove spinal board ASAP
- (Scoop if already on ground)

No comments re short spinal boards / KED’s etc
“Loosen / remove the collar in severely head injured patients when they are strapped with blocks”
Axial Skeleton - Principles of Handling

- Minimise number of movements
- Coordinate all movements along length of spine (log roll)
- Avoid rotation / flexion / extension
- Use axial movement where possible
Clearing spine on scene:

- Altered Mental State
- Neurological Deficit
- Spine pain / tenderness
- Evidence of Intoxication
- Distracting Painful Injury

Results:

- 8,975 patients
- 295 with spinal injuries
- 280 identified with above criteria
- 15 misses
  - 13 minor pedicle fractures
  - 2 unstable had evidence of alcohol in ED
Domeier et al: Conclusion

Altered Mental State
Neurological Deficit
Spine pain / tenderness
Evidence of Intoxication
Distracting Painful Injury

If yes……then immobilise
Recommended by

- National Association EMS Physicians (US)
- Faculty of Prehospital Care (UK)
- Joint Royal Colleges Ambulance Liaison Committee (UK)
Displacement of cervical spine is maximal at time of impact

Hauswald M. Curr Opin Crit Care 2002; 8: 566-570
Is it all a waste of time?

- Hauswald et al 1998
- Retrospective review
- 2 “similar” hospitals (Malaya, Mexico)
- 1 receiving patients with no precautions
- No difference in spinal injury rates or disability
Waste of time?

- Change over time
- 1970’s 55% complete lesions
- 1980’s 61% incomplete lesions

Gunby P. JAMA 1981. 245:1201-1206
Spinal cord injury and direct laryngoscopy – the legend lives on

- Dog study indicates need compression of > 50% of cord diameter for > 1 hr for permanent injury
- Spinal cord perfusion pressure
- Patient positioning

McLeod ADM, Calder I. BJA 2000; 84: 705-9

We did not find any randomised controlled trials that met the inclusion criteria. The effect of spinal immobilisation on mortality, neurological injury, spinal stability and adverse effects in trauma patients remains uncertain. Because airway obstruction is a major cause of preventable death in trauma patients, and spinal immobilisation, particularly of the cervical spine, can contribute to airway compromise, the possibility that immobilisation may increase mortality and morbidity cannot be excluded.
Airway & C Spine
Neurologic deterioration associated with airway management in a cervical spine-injured patient

- Man walking after road crash
- Left arm weakness - X-rays “normal”
- Developed stridor – airway obstruction
- Bag-valve-mask – laryngoscopy – cricothyroidotomy
- Quadriplegia – unstable C6/7 injury

Hastings RH. Anesthesiology 1993;78:580-3
Spinal cord injury after intubation in patients with undiagnosed cervical spine fractures

- 2 cases: initially neurologically intact; quadriplegic post-operatively; no stabilisation during intubation
  - Case 1 - missed C2/3 injury after motor vehicle crash
  - Case 2 - GSW to neck - burst # C6

Muckart DJJ. Anesthesiology 1997; 87: 418-20
Cervical motion during laryngoscopy

Crosby E. Can J Anaesth 2002;49:733-44
Cervical spine motion during laryngoscopy

- Cinefluoroscopy in 10 normal patients
- No head lift & minimal exposure

Sawin PD. Anesthesiology 1996; 85: 26-36
Cervical spine motion during laryngoscopy

- Laryngoscopy mean max extension:
  - Occ/C1 extension = 6.8° (norm max 20°)
  - C1/C2 extension = 4.7° (norm max 10°)
  - C2-C5 minimal displacement (extn) only

- Extrapolation to injured spine??

Sawin PD. Anesthesiology 1996; 85: 26-36
Anatomy of occipito-atlanto-axial articulation

Normal space available for cord (SAC) = 20 mm
The effect of airway manoeuvres on the unstable C1-C2 segment

- 6 cadavers
- Video fluoroscopy
- Transoral osteotomy of odontoid base
- Basic airway and intubation
- Angulation (A), SAC, Distraction (D)

Donaldson WF. Spine 1997;22:1215-8
The effect of airway manoeuvres on the unstable C1-C2 segment

<table>
<thead>
<tr>
<th>Technique</th>
<th>A (°)</th>
<th>↓ SAC (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable flexion/extn</td>
<td>5.3</td>
<td>1.5</td>
</tr>
<tr>
<td>Unstable flexion/extn</td>
<td>12.4</td>
<td>6.1</td>
</tr>
<tr>
<td>Chin lift</td>
<td>4.3</td>
<td>1.1</td>
</tr>
<tr>
<td>Jaw thrust</td>
<td>5.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Oral</td>
<td>4.7</td>
<td>1.6</td>
</tr>
<tr>
<td>Nasal</td>
<td>2.6</td>
<td>1.6</td>
</tr>
</tbody>
</table>

Donaldson WF. Spine 1997;22:1215-8
Cervical collars impair airway management
Grade of view at laryngoscopy:

- Grade 1: 82%
- Grade 2: 48%
- Grade 3: 30%
- Grade 4: 17%
- Grade 5: 1%
- Grade 6: 22%

Nolan JP. Anaesthesia 1993; 48: 630-633
Gum elastic bougie

- Accept a view of arytenoids only and use GEB
  - Nolan JP. Anaesthesia 1993;48:630-3

- Bougie better than stylet
  - Gataure P. Anaesthesia 1996;52:935
  - Noguchi T. CJA 2003;50: 712-7
Methyl prednisolone

- Not currently used