Rethinking prehospital c-spine immobilization

Terje Sundstrøm MD PhD
K. G. Jebsen Brain Tumor Research Center
Department of Neurosurgery
Haukeland University Hospital
Bergen, Norway
Level II

- Spinal immobilization of all trauma patients with a known or suspected CSI or SCI; however, experienced personnel should evaluate the need for immobilization during transport.

- Fully awake and communicable patients that are not intoxicated, without neck pain/tenderness, neurologically intact, and without distracting injuries should not be immobilized (NEXUS).

Level III

- The preferred method of immobilization is the combination of a rigid collar and supportive blocks on a spine board with straps.

- Sandbags and tape alone should not be used and spinal immobilization in patients with penetrating trauma is not recommended.
How frequent are cervical injuries?

- Severe c-spine injury in Norway 2009-2012
  - Median age 54
  - Incidence 16.5 / 100,000 / year
  - Spinal cord injury 13%
  - 18% operated

- 1-4% of major trauma patients
  - 1/5 have spinal cord injury
  - More common if reduced consciousness

- Up to 100 patients are immobilized for every patient that has a significant c-spine injury

Ref.: Hasler 2011 & 2012; ATLS 9th ed 2012; Demetriades 2000; Chiu 2001; Deasy 2011; Fredø 2014
Just as important as Airway control?

- **ABCs**: Routine application of rigid collars

- Uncertain effect on mortality, neurological injury, spinal stability, and of adverse effects

- Growing body of evidence and opinion against this practice

How good are rigid collars at motion control?

- Never examined in real trauma patients

- Numerous studies in simulated environments (cadavers, healthy volunteers)
  - Any form of stabilization is superior to no stabilization
  - No benefit of adding collars to head blocks

Do collars reduce secondary spinal cord injury?

- Dubious claim: “3-25% of SCIs are secondary and result from inappropriate management”

- 5% of patients experience neurological worsening even with proper immobilization

- New Mexico (collar) vs Malaysia (no collar): More neurological disability with a collar
  - Patients maintain a position of comfort with muscle spasm protecting the spine, and movements during transport are unlikely to generate sufficient energy to result in additional injury

What happens if cervical injuries are overlooked?

- Five studies: Up to 8% of spinal injuries were missed, but there were no neurological deficits

- But, delayed diagnosis can result in permanent deficits
  - Pooled data: 52 injuries missed, 12 permanent deficits

- NB! Application & removal of a trauma collar usually spans a couple of hours, whereas the window between trauma and diagnosis for missed injuries can be from days to weeks

Ref.: Armstrong 2007; Brown 1998; Domeier 2005; Domeier 2002; Stroh 2001; Gerrelts 1991; Davis 1993; Platzer 2006
Considerable force is required to fracture the cervical spine, and subsequent low-energy movements are unlikely to cause secondary spinal cord injury.

Most spinal injuries are biomechanically stable in the acute phase, and unstable injuries that have not caused acute, irrevocable injuries are very rare.

“It is likely that minor degrees of cervical spine movement are without consequence and more significant movement prevented by common sense.”

Ref.: Hauswald 1998; Plumb 2013; Hauswald 2012
Potential harmful effects of collars

- Distraction of injured segment
- Poorly fitted (reduced efficacy, increased risk)
- Ankylosing spondylitis (5% of fx-patients)
- Raised intracranial pressure (ca 4.5 mmHg)
- Delays release and rescue procedures (including resuscitation)
- More difficult trauma examination (missed injuries)
- More difficult airway management (intubation, aspiration, respiratory restriction)
- Pressure ulcers, discomfort and pain (confounding factors)
- Radiology to “clear the neck” is more likely

Potential harmful effects of collars

- Distraction of injured segment
- Poorly fitted (reduced efficacy, increased risk)
- Ankylosing spondylitis (5% of fx-patients)
- Raised intracranial pressure (ca 4.5 mmHg)

Information from a large volume of studies disfavoring the use of collars has not been sufficiently appreciated and has had a marginal influence on the practice of prehospital spinal immobilization.

- More difficult airway management (intubation, aspiration, respiratory restriction)
- Pressure ulcers, discomfort and pain (confounding factors)
- Radiology to “clear the neck” is more likely

Moving our practice forward

- Low quality evidence for and against collars

- Few patients need spinal immobilization, and clearance protocols should be optimized to identify these high-risk patients (NEXUS, CCSR, others)

- Systematic literature review + Expert consensus

- Prospective clinical trial unlikely
  - ATLS: “... unlikely to occur in North America, but could perhaps be done elsewhere”

Ref.: Armstrong 2007; Brown 1998; Domeier 2005; Domeier 2002; Stroh 2001; Gerrelts 1991; Davis 1993; Platzer 2006
Recent developments

Application of a cervical collar is not recommended

Manual in-line stabilization is a suitable alternative to a cervical collar

Adequate stabilization can be achieved with manual in-line stabilization or head blocks (full guideline!)

Selective spinal motion restriction protocols are needed...

Ref.: Connor 2013; ACEP 2015; Zideman 2015; Kornhall 2017
Summary

- Spinal immobilization → Spinal motion restriction
- Uniform protocols → Triage-based guidelines
- Rigid collar → Head blocks / Manual in-line stabilization
- Hard surface stretchers → Soft surface stretchers