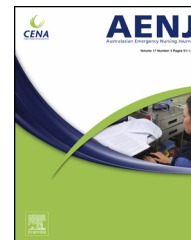




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## SYSTEMATIC REVIEW

# Spinal immobilisation in pre-hospital and emergency care: A systematic review of the literature



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### KEYWORDS

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### Summary

**Background:** Spinal immobilisation has been a mainstay of trauma care for decades and is based on the premise that immobilisation will prevent further neurological compromise in patients with a spinal column injury. The aim of this systematic review was to examine the evidence related to spinal immobilisation in pre-hospital and emergency care settings.

**Methods:** In February 2015, we performed a systematic literature review of English language publications from 1966 to January 2015 indexed in MEDLINE and Cochrane library using the following search terms: 'spinal injuries' OR 'spinal cord injuries' AND 'emergency treatment' OR 'emergency care' OR 'first aid' AND immobilisation. EMBASE was searched for keywords 'spinal injury OR 'spinal cord injury' OR 'spine fracture AND 'emergency care' OR 'prehospital care'.

**Results:** There were 47 studies meeting inclusion criteria for further review. Ten studies were case series (level of evidence IV) and there were 37 studies from which data were extrapolated from healthy volunteers, cadavers or multiple trauma patients. There were 15 studies that were supportive, 13 studies that were neutral, and 19 studies opposing spinal immobilisation.

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**Conclusion:** There are no published high-level studies that assess the efficacy of spinal immobilisation in pre-hospital and emergency care settings. Almost all of the current evidence is related to spinal immobilisation is extrapolated data, mostly from healthy volunteers.

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## What is known

- Spinal immobilisation is a mainstay of trauma management in pre-hospital and emergency care environments.
- Spinal immobilisation is frequently used in pre-hospital and emergency care environments.

## What this paper adds?

- There is no high level evidence to assess the efficacy of spinal immobilisation in the pre-hospital or emergency settings.
- There is evidence that for some patients spinal immobilisation causes harm.
- Decisions to use spinal immobilisation should be based on careful assessment of risk vs benefit in individual patients.

## Introduction

Spinal immobilisation has been a key recommendation in the management of trauma patients for decades.<sup>1,2</sup> Current spinal immobilisation practices are based on the premise that immobilisation will prevent further neurological compromise in patients with a spinal column injury.<sup>1</sup> In Australia, the latest reported statistics on spinal injuries are from 2007 to 2008; during that year there were 362 new cases of spinal cord injury reported by spinal units, 285 of which were related to trauma.<sup>3</sup> The average age of Australians who sustained a traumatic spinal injury was 42 years (SD=20) and 84% were male.<sup>3</sup> The most common causes of traumatic spinal cord injury were transport incidents (46%), falls (28%), water related injuries (swimming, diving, surfing or falling into water) (9%) and being struck or colliding with an object or person (9%).<sup>3</sup> Cervical spine injuries were the most common injury (53%) followed by thoracic spine injuries (32%). The majority of cervical spine injuries (61%) involved C4–C5 and 11% of cases had neurological impairment at the level of the thoraco-lumbar junction (T12/L1).<sup>3</sup>

The two most dominant decision support rules used in determining the need for cervical spine immobilisation are the NEXUS criteria from the National Emergency X-Radiography Utilisation Study and Canadian C-Spine rules.<sup>4,5</sup> It should be noted however, that both of these decision support tools aim to guide decisions regarding cervical spine imaging, and their results have been extrapolated to guide decisions regarding cervical spine immobilisation. The National Emergency X-Radiography Utilisation Study (NEXUS) found that patients meeting the following five criteria have a low probability of cervical spine injury and therefore do not require routine imaging studies; no midline cervical tenderness, no focal neurological deficit, normal state of alertness, no intoxication and no painful distracting

injury.<sup>4</sup> The NEXUS criteria has a sensitivity (true positive rate) of 99% and specificity (true negative rate) of 12.9% for both all patients and patients with clinically significant injuries. The false negative rate (failure to detect a cervical spine injury) was 0.9%.<sup>4</sup> The Canadian C-Spine Rule comprises three main criteria to determine the need for cervical spine radiography.<sup>5</sup> Imaging is recommended in patients<sup>5</sup>:

- (i) with high-risk factors that mandate radiography (age  $\geq 65$  years, dangerous mechanism of injury or extremity paraesthesia);
- (ii) with the absence of low-risk factors that allow safe assessment of range of motion (simple rear-end motor vehicle collision, sitting position in emergency department (ED), ambulation post the injury, delayed onset of neck pain, or the absence of midline cervical spine tenderness); and
- (iii) in patients unable to actively rotate neck 45° to the left and right.<sup>5</sup>

The Canadian C-Spine Rule has 100% sensitivity and 42.5% specificity.<sup>5</sup> There are no validated decision support tools for imaging or spinal immobilisation for patients at risk of thoracic, lumbar or sacral spinal injury.<sup>6</sup> In the main, references to spinal immobilisation for these patients tend to be in the context of general recommendations for the management of trauma patients.<sup>2,6,7</sup>

In recent years, there have been a number of studies that have called the efficacy and effectiveness of spinal immobilisation into question. A Cochrane review in 2001 of 4453 potentially relevant articles found no randomised controlled trials to support the use of spinal immobilisation in either blunt or penetrating trauma.<sup>8</sup> A systematic review of randomised trials, published in 2005, examined the effects of pre-hospital spinal immobilisation on healthy subjects and found that although cervical collars, spine boards, vacuum splints, and abdominal/torso strapping provided significant reduction in spinal movement, spinal immobilisation also resulted in a number of adverse effects such as increased respiratory effort, skin ischaemia, pain and discomfort.<sup>9</sup> Further, it is not known whether spinal immobilisation during pre-hospital and emergency care is effective in preventing secondary spinal cord injuries.<sup>10</sup>

## Aim

The aim of this systematic review was to examine the evidence related to spinal immobilisation in pre-hospital and emergency care settings. Specifically, we sought to answer the question: *'In victims with suspected spinal injury, does the use of spinal immobilisation during pre-hospital or emergency care (in-line manual immobilisation,*

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