Pre-hospital Spinal Immobilisation: An Initial Consensus Statement

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Abstract

This paper reviews the current evidence available on the practice of spinal immobilisation in the pre-hospital environment. Following this, initial conclusions from a consensus meeting held by the Faculty of Pre-hospital Care, Royal College of Surgeons of Edinburgh in March 2012 are presented.

Introduction

Spinal injuries are thankfully relatively uncommon but have the potential to cause very significant morbidity and mortality. It is reported that between 0.5 and 3% of patients presenting with blunt trauma suffer spinal cord injury (SCI). (1,2) The incidence varies globally and time has yielded increased numbers of injuries annually. American figures estimate an incidence in the region of 40 cases per million per year. (3) In the UK, the majority of traumatic SCI are attributable to land transport (50%), followed by falls (43%) then sport (7%). (4) Of those fractures causing SCI, half involve fractures of the cervical spine, with 37% due to thoracic spine injury and 11% lumbar spine. Of the C-spine, 50% occur at the C6/7 junction and a third at C2. (5) Data shows a crossover rate in the region of 10-15% of patients with a confirmed cervical fracture also having a thoracolumbar fracture (6). It is well recognized that immobilization is not without harm but the 'number needed to treat' in order to include one actual injury is high.

SCI occurs when unstable spinal fractures (only diagnosed by imaging in hospital) cause direct mechanical damage as a result of traction and compression, following which ischaemia and cord swelling ensues. Unstable fractures are those where there is disruption of two or three vertebral columns. The anterior column Is formed by the anterior longitudinal ligament and the anterior half of the vertebral body, disc and annulus, the middle column by the posterior half of the vertebral body, disc and annulus and the posterior longitudinal ligament and the posterior column by the facet joints, ligamentum flavum, the posterior elements and the interconnecting ligaments. Immobilisation is based on the logical premise that preventing movement should decrease the incidence of SCI or further deterioration of existing damage. This is undertaken by, in effect, adding external supports to the body, preventing secondary injury during extrication, resuscitation, transport and evaluation.

Immobilisation is a routinely performed procedure in the pre-hospital environment. Its potentially serious adverse sequelae and the litigious nature of modern medicine have seen the development of an extraordinarily conservative approach to immobilisation where it is applied in many cases in which neither the mechanism of injury nor the clinical findings would support its use.

Methods vary and research has drawn together consensus opinion on immobilisation techniques. Common practice involves the use of a rigid cervical collar, head blocks with straps or tapes and a long board with straps. A number of organisations use the

orthopaedic scoop stretcher or Kendrick Extrication Device (KED). The scoop stretcher is of value in reducing the amount of handling to which victims of trauma are subjected and the Faculty of Pre-Hospital Care is shortly to issue consensus guidance regarding *minimal handling protocols* in trauma. The vacuum mattress is indicated in prolonged transportation to minimize the risks explained below. A pelvic sling should therefore be placed in the correct position in the vacuum mattress and the patient transferred in the scoop onto the mattress and the pelvic binder fastened appropriately. Once on a vacuum mattress, the scoop can be removed.

Search Strategy

Prior to the Faculty meeting in March 2012, a review of the published literature was undertaken utilising PubMed to search the Medline database. Secondary searches were made using UK PubMed Central and Google Scholar. The search terms included pre-hospital, out-of-hospital, spinal immobilisation, cervical collar, c-spine clearance. A tertiary search analysed the references of retrieved articles to identify further sources.

The Debate

Immobilisation is a key concept in most trauma guidelines. The ATLS course recommends that all trauma patients considered to be at potential risk of spinal injury have immediate neck immobilisation. (7) This guidance is founded upon expert opinion rather than definitive evidence and current protocols have a strong historical rather than scientific precedent. In the practice's favour, Reid in 1987 reported that secondary neurological injury occurred in 1.4% of patients with spinal injury diagnosed in the ED whereas the secondary neurological injury rate was 10.5% in those where a diagnosis of spinal injury was missed. (8)

However, a full review undertaken by Kwan and colleagues concluded that there is no high-level evidence quantifying the effect of immobilisation versus no immobilisation on adverse effects. (9) They commented that the low prevalence of SCI would mean 50-100 patients would need to be immobilised for every patient at risk of SCI. Opinions are increasingly being expressed that the practice is overused and needs review since the procedure itself is not benign. Rather it is uncomfortable, takes time so delaying initiation of specialist treatment in time critical patients, raises intracranial pressure, increases aspiration risk and the risk of decubitus ulceration and also potentially reduces airway opening and respiratory efficacy. (9) Indeed, the latter two risks refute an axiom of pre-hospital care where airway maintenance takes precedence over other considerations. Kwan concludes her review by stating that, "...*the possibility that immobilisation may increase mortality and morbidity cannot be excluded."*

Hauswald's biomechanics have been published several times. (10,11) His group surmises that injury is done at the time of impact by forces of greater magnitude than those encountered in subsequent movement which is generally not sufficient to cause further damage. They comment that the alert patient will develop a position of comfort with muscle spasm protecting a damaged spine.

A 2009 review also concluded that the alert, cooperative patient does not require immobilisation even if a clinical decision rule is positive, unless their conscious level deteriorates. (12) They state that muscle spasm is a superior method to an artificial procedure. The College of Emergency Medicine guidance emphasizes the need for large-scale studies (13) whilst acknowledging the ethical conundrum that, "*the current*

practice...is so widely adopted and the consequences of causing or exacerbating a spinal injury so catastrophic that such trials may not be supported."

Selective Immobilisation

Practice is shifting from blanket immobilisation to a selective approach. The question posed is whether guidelines can safely identify those with a spinal fracture or SCI. Whether selective immobilisation differs from pre-hospital clearance is undecided. At times the terms appear synonymous. However, an algorithm-based decision rule must only have the sensitivity to identify all occult fractures. Clearance requires a high degree of specificity that is not required when ruling-in immobilisation.

Emergency Department management of spinal patients has changed over the past ten years with the incorporation of level one evidence into x-ray procedures. There are two validated decision rules with near 100% sensitivity for significant SCI. The NEXUS rules (14) identified five low risk criteria which, if met, could exclude injury:

- no midline tenderness
- no focal neurological deficit
- normal alertness
- no intoxication
- no painful distracting injury

The Canadian C-Spine Rule (CCSR) utilises low and high risk factors (15):

- Firstly, is any high risk factor present (age greater than 65, paraesthesia, significant mechanism?)
- Secondly, is there any low risk factor that allows safe assessment of range of motion? (Simple rear-end collision, sitting position in the ED, ambulatory at any time, delayed onset of pain, absence of spinal tenderness).
- Lastly, can the patient actively rotate their neck through 45 degrees?

NICE guidance favoured the CCSR but chose to combine the two rules adding midline tenderness to increase sensitivity (16). However, whilst this may appear logical it invalidates the evidence base developed for each system and a paper comparing the two came out firmly in favour of CCSR (17).

Validation of the CCSR in the pre-hospital setting has been undertaken and its reliability proven. Qualitative studies have shown that paramedics are comfortable using it. (18)

Other rules exist. American EMS physicians algorithm indications include patients with a mechanism suggestive of clinical risk and at least one of: an altered mental status, evidence of intoxication, distracting painful injury, neurological deficit or spinal tenderness. (19)

Mechanism of injury is commonly used as being a predictor of injury and is component of the CCSR, despite being excluded from the NEXUS guidance. The American College of Neurological Surgeons emphasises it as the main factor mandating immobilisation over examination in the pre-hospital setting. (20) Refuting this, other series show no link between mechanism and outcome. (21)

JRCALC guidance suggests that all patients should be initially immobilised if the mechanism of injury is suggestive of SCI (22). The guidance give a list of criteria which, if absent, allow removal of immobilisation. The recent 2011 update stresses that suspicion of thoracic and lumbar injury despite a 'cleared' C-spine warrants full immobilisation. The current lack of a clear consensus potentiates the risk of litigation, as no matter which guideline is used, expert witnesses will be found who will argue against it.

Consensus Outcomes

The consensus meeting held by the Faculty of Pre-hospital Care aimed to clarify the practice of immobilisation. Preliminary discussions highlighted salient points that required discussion. The conclusions of the consensus group are given below.

1. The long spinal board is an extrication device solely. Manual-in-line stabilisation is a suitable alternative to a cervical collar.

With respect to methods of immobilisation, a firm distinction was made between extrication and transport / evacuation. The Faculty recommend the use of a long board solely as an extrication device and not for the transport of patients to hospital. For this purpose, a scoop stretch or vacuum mattress should be used. Not only does this abate pressure effects but limits the exposure of patients to unnecessary and detrimental log rolling. It was also felt that manual-in-line stabilisation is an appropriate substitute for a cervical collar and may well be better in certain patients such as those with a compromised airway, possible raised intracranial pressure, combative patients and children. However, if a cervical collar is used this should be correctly sized and fitted. Incorrect use may give a false sense of security and the patient should still be fully immobilised. Once fully immobilised the collar may be loosened to reduce discomfort, reduce intra-cranial pressure and potentially facilitate airway management.

2. An immobilisation algorithm may be adopted although the content of this remains undefined.

Selective immobilisation algorithms are viable in the UK pre-hospital setting. Using algorithms such as these in the pre-hospital environment ,would allow clinicians to immobilise only those who meet pre-defined criteria. The precise details of these pre-hospital criteria are yet to be decided but may well resemble the NEXUS rules. With any algorithm, a sensitivity level must be accepted that strikes a balance between prevention of SCI and use of the finite resources available. Furthermore, the practice of 'clearing the C-spine' should be aimed at including all serious injuries and treating accordingly.

The suggestion that some of the criteria in the above mentioned guidelines might be 'weighted' was discussed although no firm conclusions were drawn, in particular, it was felt that the subjective elements (e.g. mechanism of injury) could be viewed as a source of over-triage whereas objective elements such as age might be given more priority.

3. There may be potential to vary the immobilisation algorithm based on the conscious level of the patient.

It was felt that emphasis should remain on prioritising ABC in polytrauma patients. It was agreed that differentiation between the conscious and unconscious patient and the appropriate treatment for each should be considered in future guidelines. It may be that

in the cooperative patient immobilisation can be deferred until after the primary survey by advising the casualty to refrain from movement. This is obviously not possible in the unconscious patient, but in their case, the need for a primary survey evaluation is paramount and independent movement is less likely. These suggestions are provisional.

4. Penetrating trauma with no neurological signs does not require immobilisation.

In line with other evidence, the meeting agreed that penetrating trauma to the spine does not require immobilisation in the absence of overt neurological signs.

5. 'Standing take down' practice should be avoided.

It was also agreed that the practice of a 'standing take down' where a person who is wandering around with an element of neck ache gets placed against an upright spinal board and placed horizontal and then immobilised is seldom if ever warranted.

Conclusions

The consensus group was absolutely clear that a change is needed from a policy of immobilizing necks as much for the protection of the clinician as for that of the patient, to a system of selective immobilization designed to reduce the risks to the trauma victim.

It is important to remember, however, that voluntary aid organisations will be looking for guidance in this challenging area. For these practitioners, guidance for the 'non-professional' managing trauma should err towards the side of over triage. They could with benefit, however, be made aware that cervical collars are not the panacea that they are often made out to be and that manual inline stabilisation (MILS) is often a more beneficial and acceptable modality compared with triple immobilisation. They should also be encouraged to consider moving away from spinal boards towards non-metallic scoops and the concept of minimal handling.

8. Further research and into effective, practical and safe immobilisation practice, and dissemination of this, is required.

The consensus group emphasized the differences between the pre-hospital environment and secondary care and the unique challenges pre-hospital practice presents. As a result, in hospital guidelines can not be assumed to be directly transferable. Research in this area is needed and research supported practices will, the group believes, lead to advances in care which should be widely disseminated via reproducible education and training. Subsequent audit of the new practice will allow refinements and changes to be instigated.

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