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Original Contribution

The definite risks and questionable benefits of liberal pre-hospital spinal immobilisation

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ABSTRACT

Introduction: The routine practice of pre-hospital spinal immobilisation (phSI) for patients with suspected spinal injury has existed for decades. However, the controversy surrounding it resulted in the 2013 publication of a Consensus document by the Faculty of Pre-Hospital Care. The question remains as to whether the quality of evidence in the literature is sufficient to support the Consensus guidelines. This critical review aims to determine the validity of current recommendations by balancing the potential benefits and side effects of phSI.
Method: A review of the literature was carried out by two independent assessors using Medline, PubMed, EMBASE and the Cochrane Library databases. Manual searches of related journals and reference lists were also completed. The selected body of evidence was subsequently appraised using a checklist derived from SIGN and CASP guidelines, as well as Crombie's guide to critical appraisal.
Results: No reliable sources were found proving the benefit for patient immobilisation. In contrast there is strong evidence to show that pre-hospital spinal immobilisation is not benign with recognised complications ranging from discomfort to significant physiological compromise. The published literature supports the Consensus guideline recommendations for safely reducing the impact of these side effects without compromising the patient.
Conclusion: The literature supports the Consensus Guidelines but raises the question as to whether they go far enough as there is strong evidence to suggest phSI is an inherently harmful procedure without having any proven benefit. These results demonstrate an urgent need for further studies to determine its treatment effect.

1. Introduction

Spinal cord injury is associated with significant morbidity and mortality. There is an immediate risk of death but also severe morbidities such as permanent hemiplegia and tetraplegia. Annually the UK and Ireland have approximately 1000 new cases of spinal cord injury however this is a worldwide problem with all Nations at risk [1].

1.1. Pre-hospital spinal immobilisation

To reduce secondary neurological damage most pre-hospital care systems advocate spinal immobilisation for patients considered at risk. The inherent limitations of identifying this patient group, combined with the assumed benefits of immobilisation and its perceived innocuous nature, has led to a high level of over-treatment.

There is, however, growing concern regarding the effectiveness and potential complications of phSI [2].

The rationale of phSI, postulated by experts in the mid-1960s, was that after spinal trauma, an unstable vertebral column carries the risk of mechanically severing the spinal cord, leading to catastrophic neurological sequelae.

As there is limited high quality evidence and research in pre-hospital care, the use of phSI continued on the basis of this theory long after its introduction in the mid-1960s. The procedure saw incorporation into the Advanced Trauma and Life Support course (ATLS), as well as local pre-hospital guidelines [1].

The scrutiny over phSI increased with the shift of focus towards evidence based medicine. This resulted in a number of publications questioning its efficacy. In 1998, Hauswald concluded from biomechanical studies that immobilising the spine is unlikely to prevent further spinal cord damage to the patient [3]. Local oedema and hypoxia were more likely to be contributors to secondary neurological damage. These are time dependent factors, potentially exacerbated by the delays to definitive care involved in immobilising the patient [3].

Since these studies were released, controversy has continued to grow surrounding the procedure, with greater documentation of adverse effects of its use [2]. This has led to clinicians in the U.K. reflecting upon how phSI should be implicated in modern care.

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1.2. Consensus guidelines 2013

Connor et al. examined the evidence base concerning phSI on behalf of the Consensus group for the Faculty of Pre-Hospital Care [3]. Recommendations intended to reduce its side effects whilst maintaining the potential benefits included:

- Manual in line stabilisation (MILS) being a suitable alternative to a rigid collar.
- Support for the development and dissemination of an algorithm allowing for selective spinal immobilisation.
- Discouraging the use of immobilisation for penetrating trauma.
- Avoiding the immobilisation of ambulatory patients.
- Encouraging minimal patient handling.
- Discouraging the use of a spinal board for any role other than extrication.
- Advocating the use of a vacuum mattress or scoop stretcher for prolonged transport.

1.3. Rationale and aims

The 2013 Consensus Statement served to highlight that phSI may not be a benign process, with the potential for side effects of varying severity that all patients undergoing the procedure are exposed to. However, the traditionalised process behind phSI may be saving many patients from death or significant disability. Therefore there is a necessity to examine the evidence base detailing the side effects as well as the potential benefits of phSI.

This critical literature review is designed to appraise the available evidence regarding the potential benefits and side effects of phSI. This is done in order to determine whether the risks of traditional spinal immobilisation outweigh its proposed therapeutic value. In doing so, it also aims to:

- Determine whether the available literature on phSI agrees or disagrees with the 2013 Consensus statement.
- Critically appraise the available literature on phSI to determine whether the evidence base is strong enough to warrant further changes to the traditional protocol.
- Identify any areas where high quality research is still required.

By achieving these aims, recommendations may be made for the improvement of the management of pre-hospital patients with suspected spinal injury.

2. Methodology

This critical review aims to determine whether the side effects of pre-hospital spinal immobilisation outweigh the potential benefits. This is intended to determine the validity of the 2013 Consensus statement by scrutinising currently existing evidence.

2.1. Search strategy

Online searches were conducted on a number of databases including Ovid Medline, PubMed, Cochrane library, EMBASE, NHS knowledge Network and Google Scholar. Several related journal searches were also conducted of European Journal of trauma, JAMA, Lancet, New England Journal of Medicine, Clinical biomechanics and Spine. The databases and journals were selected based on their propensity for publishing articles related to this study.

MeSH (Medical subject heading) terms were used as search terms for all databases and journals where suitable, and combined with Boolean terminology. Search terms used included “Spinal Immobilisation”, “Immobilisation”, “Spinal injuries”, “Spinal cord injuries”, “Spine”, “Emergency Medical Services” and “Emergency treatment”.

As well as searches using the search functions of the journal websites, the contents lists of all the journal publications used in the online search were also hand searched for relevant titles. However, due to time constraints, journals were only hand searched for three years from the time of this review.

Steps were taken to minimise the risk of publication bias. Unpublished records were sought out for potential inclusion. Reference sections of all selected articles were also scanned for other relevant titles. Professionals in the field of emergency care and spinal immobilisation were also contacted, so that related unpublished literature could be identified (see Acknowledgements). Other potential grey literature sources were searched, including the websites of the London ambulance services, the Scottish and English ambulance services and the BASICS (British Association of immediate care service) website.

2.2. Study selection

As part of the screening process all articles which could not be definitely excluded by title were examined by abstract. If necessary, the full text was then examined.

The inclusion and exclusion criteria for the review are included (see Table 1):

- For pragmatic reasons of time and cost, only English articles were considered.
- The significant anatomical differences between humans and animals meant that the latter were not used in this study.
- The difference between pre-hospital and secondary care have a significant effect on decision making, hence the focus on pre-hospital care [3].
- Only spinal injury through trauma was considered. Spinal injury can occur through medical causes and congenital deformities but their management differs to that of trauma victims.
- Studies on healthy volunteers were included because they can provide useful information on both the biomechanics and ergonomics involved in phSI.
- Study design filters were not used due to the general lack of high quality research in the pre-hospital field.
- It was decided that articles would not be excluded based solely on age, as there is a paucity of evidence in the literature regarding phSI.

2.3. Quality assessment

In order to make the critical appraisal process as objective and systematic as possible, a checklist was created based on the SIGN levels of evidence [4], and a ten-part questionnaire that combined questions from the CASP checklists [5], and Crombie's “Guide to Critical Appraisal” [6]. An example of a completed version is available (Appendix 4). The contents of the checklist were agreed upon by all three authors of the study (TAP, PAD, BC). To ensure the best quality of articles was used, only articles assigned a score of 13 or greater were then assessed for individual strengths and weaknesses. These results are presented in table format with the full body of data available as online supplementary material (Appendix 5).

Table 1
Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
Studies in English	Non English
Human studies	Animal studies
Pre-hospital care	In hospital care
Emergency services	Long term treatment/rehabilitation
Traumatic spinal injury	Non traumatic spinal injury
Appraisal checklist score 13[a] or above	Appraisal checklist score below 13[a]

[a] This minimum score was selected using the average scores of the first thirty articles appraised in order to ensure the higher quality articles were included in the study.