



Review article

Defining spinal instability and methods of classification to optimise care for patients with malignant spinal cord compression: A systematic review



C. Sheehan

Guys & St. Thomas' NHS Foundation Trust, St. Thomas' Hospital, Westminster Bridge Rd., London SE1 7EH, UK

ARTICLE INFO

Article history:

Received 2 September 2014

Received in revised form

26 March 2015

Accepted 31 March 2015

Available online 5 May 2015

Keywords:

Spinal instability/stability

Malignant spinal cord compression

Spinal assessment

Systematic review

ABSTRACT

The incidence of Malignant Spinal Cord Compression (MSCC) is thought to be increasing in the UK due to an aging population and improving cancer survivorship. The impact of such a diagnosis requires emergency treatment. In 2008 the National Institute of Clinical Excellence produced guidelines on the management of MSCC which includes a recommendation to assess spinal instability. However, a lack of guidelines to assess spinal instability in oncology patients is widely acknowledged. This can result in variations in the management of care for such patients. A spinal instability assessment can influence optimum patient care (bed rest or encouraged mobilisation) and inform the best definitive treatment modality (surgery or radiotherapy) for an individual patient. The aim of this systematic review is to attempt to identify a consensus definition of spinal instability and methods by which it can be classified.

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Introduction

Malignant Spinal Cord Compression (MSCC) occurs when cancer cells grow in or near to the spine and exert a pressure on the spinal cord. The radiological evidence for cord compression is the indentation of the theca at the level of clinical symptoms.¹ Any cancer can spread to the vertebra of the spine and lead to MSCC. It occurs in approximately 5% of patients living with advanced cancer.^{2–4} Median survival after diagnosis is approximately 3–6 months.^{5,6} Prognosis is dependent on the histology of the primary cancer, patient's ambulatory status at presentation and site and number of other metastases.⁷ In the UK Pease *et al.*⁸ credit a growing incidence of MSCC on an aging population with improving cancer survivorship. Stateside Smith *et al.*⁹ have established a 3.4% annual increase in MSCC incidence and an associated rise in healthcare costs.

The impact of this increased pressure or compression on the spinal cord can be very debilitating, especially for terminal ill cancer patients. Depending on the vertebral level/s at which it occurs, symptoms can range from; unexplained and difficult to relieve back pain, sensory deficits (abnormal skin sensations e.g. tingling, tickling, itching or pins and needles), motor deficits (e.g.

muscle weakness, loss of coordination or paralysis) and/or autonomic dysfunction (e.g. urinary and/or faecal incontinence).¹⁰ Within a short period of time MSCC can lead to permanent paralysis and for this reason must be managed as an oncological emergency.¹⁰ If diagnosed and treated promptly, the symptoms of MSCC can be prevented, minimised or possibly reversed. In 2008 The National Institute of Clinical Excellence (NICE) produced guidelines on the management of MSCC.¹¹ They include a recommendation to assess spinal instability but do not provide guidance on how to carry out such an assessment.

Spinal instability has been extensively explored by biomechanical specialists and in terms of trauma care^{12–16} but much less literature exists for patients with malignant disease. This can result in variations in the management of care for such patients. Upon diagnosis of MSCC some patients are confined to bed rest. When warranted, as in the case of an unstable spine, this can prevent further damage to the spinal cord caused by unnecessary movement.^{8,17} However, if the patient's spine is stable and they are unnecessarily confined to bed rest, Pease *et al.*⁸ suggest the patient can suffer associated complications such as: chest infections; thrombotic events; confusion; urinary tract infections and delayed discharge. Jacobs¹⁸ believes that a speedy treatment and discharge to the patient's choice of destination should be prioritised. Patients on bed rest can experience delays to treatment due to the logistics of booking an ambulance at short notice to transfer them to an oncology centre.

E-mail address: colette.sheehan@gstt.nhs.uk.

This not only delays access to treatment but also subsequent rehabilitation and discharge. Patients with spinal instability have a better neurological outcome with tumour resection and surgical stabilisation prior to radiotherapy.¹⁹

Objectives

The result of a spinal instability assessment can influence the best definitive treatment modality for an individual patient. The purpose of this systematic review is to address the lack of guidance on assessing spinal instability in oncology patients. The aim of which is twofold; to increase awareness of the importance of such an assessment and to investigate how patient care can be optimised by knowing when to permit patients to mobilise and when to restrict them to bed rest. The focus group of patients are those with MSCC who require emergency treatment to minimise the impact of this debilitating condition. The objectives are:

1. To define “spinal instability”
2. To identify methods to assess “spinal instability”
3. To ascertain if it is possible to produce guidance on how to assess spinal instability in patients with MSCC?

Methodology

Search strategy

This literature review was prepared using a systematic approach, to minimise potential bias and random error. Comprehensive searches were conducted on five key databases: MEDLINE; CINAHL; HSNAE; EMBASE and the Cochrane Library. Websites of relevant governing, professional bodies and organisations were searched including NICE, the Royal College of Radiologists (RCR), the Centre for Reviews and Dissemination (CRD) and the Database of Abstracts of Reviews of Effect (DARE) available through CRD. Table 1 records the summary of these results.

Reference lists from relevant articles, clinical practice guidelines and key journals were individually searched as a source for additional literature. Some authors were found to be prolific publishers on specialist subjects. These leading experts in fields of neurosurgery, biomechanics and oncology were contacted via email for their opinions.

Selection criteria

Decisions regarding inclusion and exclusion criterion involves subjectivity. It was important therefore to ensure the definition of eligibility criteria was accurate and the assessment of its methodology unbiased. The PICOS (population, intervention, comparison, outcomes and study design)²⁰ framework was used to define

selection criterion (see Table 2). In addition, articles whereby only the abstract was available were excluded. As the reviewer is only fluent in English, searches were filtered for this language only. A date range was not assigned.

When an article abstract suggested relevance, the full article was retrieved and reviewed. If it met the inclusion criteria it was subjected to the Oxman and Guyatt²¹ Overview Quality Assessment Questionnaire (OQAQ) to measure the scientific quality of the literature. A data extraction form was developed and completed for potentially significant articles. Information compiled from the relevant literature was summarised and recorded in evidentiary tables for ease of reference (Appendix 1).

Results

1 What defines spinal instability?

A literature search for primary studies to define spinal instability, resulted in 16 relevant and referenced sources. Farfan and Gracovetsky²² describe the spine as a mechanical structure and therefore do not consider it intuitive to define clinical instability because it is “too vague” a concept. Leone *et al.*²³ have requested “the term “instability” be abolished, as it is an unproven label”. The term is frequently used “despite the lack of an agreed definition”.²⁴ Attempts have been made, mostly within the biomechanical discipline. The American Academy of Orthopaedic Surgeons²⁵ define spinal instability as “an abnormal response to loads, characterised by movements in the motion segment beyond normal constraints.” White and Panjabi¹² describe it as the “loss of the spines ability to maintain its patterns of displacement under physiologic loads”. Pitkanen and Manninen²⁶ agree and consider lumbar segments specifically, to be unstable when segments exhibit movements which are either “qualitatively or quantitatively abnormal”. Centeno²⁷ echo this definition as “abnormal excess motion in a spinal segment”. Panjabi²⁸ ventures further by describing it as “loss of normal pattern of spinal motion (which) causes pain and/or neurological dysfunction”.

Specialists in Biomechanics^{12–14,16,29} periodically publish ranges of ‘normal’ spinal thresholds beyond which they propose segmental instability can be concluded. Fourney *et al.*³⁰ confirms there is a paucity of data on the topic of spinal instability in oncology patients. This is thought to reflect a controversy which, exists surrounding instability due to neoplastic destruction. Fisher *et al.*³¹ and Weber *et al.*³² provide criterion to describe spinal instability specifically in oncology patients. Fisher *et al.*³¹ point out that spinal instability as a result of a neoplastic process can be significantly different to that resultant from trauma. Others^{30,33,34} agree that the pattern of bone disruption in bone metastases as well as the impact of these and neoplasms, on discs and ligament can be notably different to disruptions to the spine as a result of

Table 1
Summary of the search results.

Search terms:	MEDLINE	CINAHL	HSNAE	EMBASE	Cochrane
1 Spine OR spinal OR vertebrae OR vertebral	369,811	56,123	17,540	425,371	15,722
2 Instability OR unstable OR stable	441,713	30,160	29,295	521,480	22,901
3 Malignant OR metastatic OR cord compression OR bone metastases OR bone metastasis	403,338	23,935	25,366	55,891	12,361
4 S1 AND S2 AND S3	1064	110	14	365	117
5 Investigate OR method OR assess OR measure OR evaluate OR appraise OR judge	2,927,868	308,145	408,387	3,519,078	429,014
6 S4 AND S5	223	33	4	81	115
7 S1 AND S2 AND defin*	925	112	36	1199	402
8 S4 AND defin*	70	5	1	38	105
9 S7 AND biomechanics	97	15	3	112	8
10 S7 NOT biomechanics AND S3	66	4	1	36	100

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