Paraparesis or incomplete paraplegia? How should we call it?

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Abstract

Introduction
The neurological examination terminologies and definitions of the status of spinal cord injured (SCI) patients are of great importance to establish scales and provide standard nomenclatures. There is a disagreement between the classical neurological terminology and the definitions of complete and incomplete paraplegia that have been proposed in traumatic spinal cord injured patients.

Objective
To discuss the adequacy and the impact of the terms incomplete paraplegia and paraparesis in current literature.

Materials and methods
A review of the origin of the terms, definitions and nomenclatures applied by the most widespread assessment scales in traumatic SCI published in peer review papers was performed, searching the scales cited on the references of the latest American Spinal Injury Association classification (2002; available in http://www.asia-spinalinjury.org/) up to the first classification, described by Frankel et al. [14].

Results
The term “incomplete paraplegia” has been used to define clinical situations classically described as “paraparesis”.

Conclusion
The terms “complete” and “incomplete” are adequately used to characterize the completeness of spinal cord lesion but inadequately used when associated to the term “plegia” as a qualifier. Therefore, patients with any preservation of motor strength below the injury level should be described as paraparetic and not as incomplete paraplegic.

Keywords
Paraparesis · Incomplete paraplegia · Spinal cord injury · Terminology · Classification · Scales

Introduction
The standardisation of neurological examination scales in patients with spinal cord injury (SCI) is of great importance in the initial assessment and follow-up of these patients and helps to group them according to the extent of neurological damage. There are several assessment methods such as the Frankel scale, Lucas and Ducker Neurotrauma motor index, Yale scale, “National Acute Spinal Cord Injury Study” (NASCIS) scale and the Standards of the Neurological examination of the “American Spinal Injury Association” (ASIA) [5–7, 12, 14, 15, 21].

Fundamental issues have to be considered in the assessment of a neurological scale. First, in relation to neurological examination, the terms have to be in accordance to classical nomenclature. Second, the corresponding severity groups should correlate to outcome.

The terms incomplete paraplegia and incomplete tetraplegia have been used in clinical situations in which there is some preservation of motor and/or sensory function below the neurological level in SCI patients [28, 29].

Neurosurgeons have to deal with spinal cord injury on a day to day basis. The use of a standard nomenclature is of fundamental importance in the follow-up documentation of neurosurgical procedures and communication among the scientific community.

The latest review of The International Standards for Neurological Classification of Spinal Cord Injury published in 2002 kept the definition of paraplegia as the impairment or loss of motor and/or sensory function in the thoracic,
lumbar or sacral segments of the spinal cord secondary to damage of neural elements within the spinal canal. This definition is in contrast to the classical terminology used in neurological literature [10, 11, 13]. The rationale for our study was to perform a critical review of the literature pertinent to neurological examination nomenclature in SCI patients to discuss the adequacy and the impact of the terms incomplete paraplegia and paraparesis.

Materials and methods

A review of the origin of the terms, definitions and nomenclatures applied by the most widespread assessment scales in traumatic SCI published in peer review papers was performed, searching the scales cited on the references of the latest American Spinal Injury Association classification (2002) up to the first classification, described by Frankel in 1969 [14].

A second search was made on the meaning of the terms paraplegia and paraparesis according to classical neurological examination textbooks.

Finally, a comparison was made, searching the frequency of appearance of papers in the literature using the descriptors “incomplete paraplegia” and “paraparesis”, from the years 1994 to 2008 and limited by “Tag Terms”: Title (PubMed).

As the discussion below is directed to the suffix “plegia” and “paresis” and does not refer to different spinal cord segments, the terms paraplegia or paraparesis may also refer to tetraplegia or tetraparesis, respectively.

Results

Standardised neurological examination scales in traumatic SCI

In 1969, Frankel et al. presented a classification to closed injury of the spine. This was the first neurological examination scale to assess SCI patients. Complete lesions were defined as total loss of motor and sensory functions below the most caudal preserved spinal cord segment [14].

Stauffer reported that “if the patient has no perianal sensation and no voluntary control over his sacral innervated muscles, toe flexors, or rectal sphincter, it is then classified as being a complete lesion. If present, sacral sparing means that the lesion is incomplete”. The period of spinal shock is transient and is heralded by the return of the bulbocavernosus reflex or anal wink. Stauffer suggested that an apparently complete injury with no sacral sparing should not therefore be considered as firmly complete until the bulbocavernosus reflex returns” [26].

In 1978, Bracken et al. described the SCI severity scale developed at the Yale University [7]. The Motor Severity Scale differentiated quadriplegic, paraplegic, quadriparetic and paraparetic patients. The author criticised the classification schemes that describe the extent of neurological deficit with vague criteria such as significant, greater or lesser, satisfactory or unsatisfactory and also the terms discussed in the present article such as “complete” and “incomplete”. Later, Bracken et al. presented a motor and sensory examination scale in The National Acute Spinal Cord Injury Study (NASCIS) I and II [5, 6]. The authors presented a definition of complete and incomplete lesion. At admission, complete lesions were defined as the level below which there are no motor and sensory functions. Incomplete lesions were characterised by residual motor and/or sensory functions. Patients were also categorised according to the degree of the paralysis.

In 1982, the American Spinal Cord Injury Association (ASIA) presented in Chicago the “Standards for the Neurological Classification of Spinal Injury Patients”, which was published in 1984 [1]. The Frankel scale was incorporated as the “ASIA impairment scale” to be the functional abilities assessment tool. The ASIA assessment tool underwent periodic reviews (1982, 1987, 1990, 1992, 1996, 2000, and 2002). SCI was divided into incomplete and complete lesions which were further categorised into five groups.

The international standards booklet for neurological and functional classification of SCI defined that paraplegia refers to the impairment or loss of motor and/or sensory function in the thoracic, lumbar or sacral segments of the spinal cord secondary to damage of neural elements within the spinal canal. The use of the terms quadriparetic and paraparesis was discouraged by Ditunno et al. as these words described incomplete lesions imprecisely. Instead, they suggested that the ASIA impairment scale provided a more precise approach [12].

The origin of the confusion between the terms

Since ASIA defined paraplegia as loss or impairment of motor and/or sensory function, it assumes that paraplegic patients can have a complete or incomplete SCI. Incomplete lesions are categorised as ASIA impairment scale B, C or D. In fact, ASIA C and D, include paraparetic patients, defined by ASIA as paraplegic patients that present an incomplete lesion. The definition of paraplegia proposed by ASIA unites two different neurological situations: paraparesis and paraplegia. This simplification of the traditional nomenclature supported the antagonist nomenclature of incomplete paraplegia that had been used as a category of SCI [28].

In 1985, the Rancho Spinal Cord Injury Data Base was established to enable a prospective collection of neurolog-
cical information on motor and sensory recovery and functional outcome following SCI. Waters et al. published a series of four reports relating to neurological recovery in traumatic SCI patients classified as complete paraplegia, complete tetraplegia, incomplete tetraplegia and incomplete paraplegia [27–30]. In 1994, they replaced the term paraparesis by incomplete paraplegia and included those with ASIA B, C and D as their incomplete paraplegic patients. [28]. Later, in 1998, the term incomplete paraplegia was used by Cohen et al. in an article entitled Test of the International Standards for Neurological and Functional Classification of Spinal Cord Injury [9].

It is important to point out that the first paper using the term “incomplete paraplegia” was published in the British Journal of Urology in March of 1956, before the paper of Waters in 1994 [28], and was entitled, “Lesions of the bladder in incomplete paraplegia” [4]. Furthermore, the first use of the term “paraparesis” located using the electronic search tool was in 1951 in an article entitled, “Cases of spastic paraparesis treated by resection of the sympathetic nerve; results after 16 years” published in the Acta Chirurgica Patavina [8]. Nevertheless, Waters et al. were the first to establish a correlation between incomplete paraplegia and the ASIA scale.

The classical terminologies in neurologic examination

According to DeJong “paraplegia is the paralysis of the legs or the lower parts of the body; tetraplegia is the paralysis of all four extremities”. “Paralysis is the absence of strength while paresis is the impairment of strength or weakness” [11]. Peter Duss reports that “when the weakness is incomplete it is called paresis rather than plegia. Thus, a bilateral lesion in the upper cervical spinal cord can cause quadripareisis or quadriplegia” [13]. DeJong states that the complete transection of the spinal cord causes isolation of the segments below the level of the lesion. In these cases the paralysis and sensory loss are symmetric and total. In incomplete transection the resulting signs and symptoms will depend upon the pathways and cellular structures involved [10]. Michaelis and Braakman defined “complete lesion” similarly to DeJong’s “complete transection” and also reported that it is essential to examine the S3, S4, S5 dermatomes, both around the anus and on the glans penis, to exclude or confirm sacral sparing [22].

The frequency of usage of the terms “incomplete paraplegia” versus “paraparesis”

On the 27th of April, 2008, a PubMed search, with the descriptor “incomplete paraplegia” (using the limit “Default Tag Title”) yielded eleven references. The same search using the descriptor “paraparesis” yielded 905 papers. Among the eleven papers using the former, two were not in the English language, one being French [2] and the other in Chinese [32]. Among the nine English papers, three were published in rehabilitation journals [17–19], one in physiotherapist journal [25] and another in a urological periodical [4]. The other four papers were published in the following journals:- “Spinal Cord” [16], “Spinal Cord Med.”[3], “J Neurotrauma” [31] and “Spine” [20].

Discussion

Early in 1969 Michaelis et al. published “the International inquiry on neurological terminology and prognosis in paraplegia and tetraplegia” to establish an international agreement on neurological terminology. He stated that the term incomplete lesion was vague and meant anything between only sacral sparing, complete motor-paralyis but substantial sensory sparing and incomplete motor and sensory paralysis. However, the authors did not apply the terms paraplegia and paraparesis. Instead, they used “complete motor paralysis” and “incomplete motor paralysis” [23].

Classical neurological examination nomenclature defines that paraplegia is the paralysis of the legs or the lower parts of the body. Paralysis is the absence of strength while paresis is the impairment of strength or weakness [11, 13].

The American Spinal Injury Association SCI assessment tool is widely used in multi-centre studies. It is considered as a level 2 recommendation and is the accepted “gold-standard” assessment tool for clinicians involved in the care of SCI patients [24]. However, in relation to neurological examination, the system has to be in accordance to classical nomenclature.

The classical terms paraplegia and paraparesis were joined in the ASIA definition of paraplegia. The term incomplete paraplegia reinforced the concept that a paraplegic patient can have an incomplete lesion. Another equivocal was to include sensory function in the definition of paraplegia which is in fact a descriptor of motor strength [12].

Paraplegia is a well-established definition that occurs in complete (ASIA A) or incomplete (ASIA B) spinal cord lesions. These terms, complete and incomplete, are adequately used to characterise the completeness of spinal cord lesions but inadequately used as a qualifier. The unique incomplete SCI with paraplegia describes the patient with ASIA B category.

The electronic search with “incomplete paraplegia” revealed that the term is not frequently used. Although Ditunno et al. have discouraged the use of “paraparesis” describing it as imprecise, current literature has shown it is in frequent use [12].
The neurosurgeons and other clinicians involved in the care of SCI patients should realise that the terms paraparesis and incomplete paraplegia cannot be used interchangeably. In fact, the latter should not be used at all because it carries a contradiction. Neurological examination scales do not substitute or redefine the classical nomenclature.

Conclusion

The term *incomplete paraplegia* is in disagreement with the classical terms used to describe sensory and motor function in SCI patients. The term paraplegia should only be applied to describe complete loss of motor strength and not to the impairment of motor function.

References