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Editorial

Measurement in spinal cord injury

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Wars have often provided a stimulus for medical research to develop improved care for the injured. Modern wound care was established by Truetta during the Spanish Civil War and observations on the inadequacies of medical treatment during the 1914–1918 conflict led to the well-known establishment of regional spinal injuries centres in the United Kingdom during the Second World War and to a revolutionary system of care spearheaded by Guttmann.

Before the interest in spinal cord injury, there was a recognition of the poor results of treatment of peripheral nerve injury and an awareness in both the United Kingdom and in the United States of America of the impending numbers and the demand for effective treatment. At a conference on peripheral nerve injury convened by the National Research Council on 10 December 1941 chaired by Dr Loyal Davis, it was noted that the problems revolving around nerve suture and transplants, and muscle function were the most pressing when rated to urgency in national defence.[1] One of the immediate issues then was the need to standardise methods of pre- and postoperative diagnosis. The scheme prepared by Professor James Learmonth from the special centre for nerve injuries at Gogarburn Hospital, near Edinburgh, Scotland was considered to be well adapted for use in such a special hospital *where there is sufficient time and adequate facilities for a thorough examination of the cases*. The examination required a record of the individual muscles and both the ability to contract voluntarily and the response to faradic and galvanic stimulation. Pain, touch and temperature sensation was recorded together with the area over which sweating was absent. It should be remembered that the test for sweating (autonomic function) had been worked out by Guttmann at Oxford and published in 1940.[2] Perhaps the greatest and most valuable product of this joint enterprise was the publication of a manual[3] that remains the seminal study for the examination of the peripheral nervous system and the basis of the ASIA protocol. This manual was the product of detailed anatomical studies, careful clinical examination and of surgical observation.

Now a new stimulus has arisen. Basic scientific research into spinal cord trauma provides optimism that repair or reduction in the injury may be possible in the near future. This possibility demands an improvement in the ability to define the extent of the injury (loss) in a manner that is entirely reliable and reproducible. The methylprednisolone trials emphasised that requirement.[4] Pollock[5] again referring to regeneration following peripheral nerve injury stated 'of all the signs of regeneration of a nerve, I consider the disappearance of the reaction of degeneration, the return of objective sensibility in the isolated supply of a peripheral nerve, and the return of motion as the only certain ones'. That statement remains true till today.

The need for an accurate clinical assessment of the level of injury is clear, especially, if claims are to be made for benefits arising from a planned intervention when it is accepted that there is enormous individual variation in the force of blunt trauma to the spinal cord and of the response to that injury.

There are three main periods for intervention. The early postinjury period (the first 8 hours) when an attempt may be made to reduce the secondary effects of the injury. This concept is supported by the histological studies of Kakulas,[6] who showed in postmortem material in the hyperacute situation that many of the so-called clinically complete cases were, in fact, significantly incomplete. The second period may be within the first few days of injury and often will be associated with procedures to provide surgical stabilisation of the spine. The third opportunity for intervention will be much later when the lesion has stabilised.

Unfortunately, there has been no agreement on the timing of neurological testing in relation to the prediction of outcome, but Ditunno[7] demonstrated that the evolution of reflexes over several days following injury was more relevant to prognosis than either the presence or absence of reflexes on the day of injury. Waters[8] began observations at 30 days postinjury in clinically complete tetraplegic patients.

Ideally, the same clinical system should be equally deployable in those three situations but the acute situation will create some limitations, not only of time, but also of the ability of the patient to cooperate fully with the examiner. In addition, it is essential that the appropriate neurophysiological studies can be readily applied at the bedside and not only in the laboratory.

There are also three possible outcomes from an intervention, namely, an identifiable and otherwise unexpected improvement in function(s), no discernible change, or some deterioration in one or more functions. These outcomes may be single or be in some combination.

Although assessment in the acute phase may be limited, the above possibilities make it mandatory to record not only motor and sensory function but also to consider carefully those matters that result in so much of the morbidity following spinal cord injury. It will be necessary therefore to assess autonomic function, sacral nerve function (representing bladder and bowel function) and, importantly, to record the individuals perception of pain.

The Scientific Committee of the International Spinal Research Trust have recommended that initial interventions transferring from animal models to the human subject should be limited to the midthoracic region, where loss of a segment would not be significant. This also is an area where a gain of at least two segments would be necessary to be greater than the usual change seen in clinical practice. It is also a region that does not score in the motor component of the ASIA Scale.

The reported collaboration of five European Spinal Cord Injury Centres[9] now provides a significant development in the assessment of injury (deficits) and of likely functional outcome. The group have employed neurography, somato-sensory-evoked potentials (SSEP), motor-evoked potentials (MEP) and sympathetic skin response, which are not influenced by the cooperation of the subject and recognise that transcranial magnetic brain stimulation may be used to reliably assess the impulse conductivity of cortico-spinal tract fibres after SCI. The most important feature of this exercise is the harmonisation of the technical procedures to secure the same standard of neurophysiological examinations in each centre.

The European Group have chosen to begin their studies at 5–10 days postinjury to allow a distinction between resolving injury mechanisms and later repair processes, but this may require review in the light of experience and of the opportunity for direct therapeutic intervention.

In 1941, there was international cooperation that produced a lasting legacy in the form of an accurate clinical assessment of injury although primarily directed at peripheral nerve injury. It was recognised then that such an examination required both time and resources. In the light of the experience of the European Group based in Zurich and of the progress of basic science, it is essential that a consensus for the accurate evaluation of spinal cord injury employing modern and practical neurophysiological techniques should be established as a matter of urgency. The need to standardise methods of pre- and postoperative assessment (diagnosis) is as vital now as it was in 1941.

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