

Editorial :**Treatment evolution and the importance of embracing Evidence Based Practices in managing Thoraco-Lumbar Spine injuries**

The erect posture of a man makes him a unique species on earth, which can stand & walk with pride. But within this proud spinal column lay hidden the Achilles heel: the delicate spinal cord. An injury to the spinal cord can lead to instant paralysis & devastating manifestation probably not comparable to any other injury.



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Though physicians were familiar with the diagnosis of spinal cord injury (SCI) for over thousands of years, till as 'recent' as the time of the First World War, about 80% of the spinal cord injury patient died within the first two weeks. Historically, the clinical outcomes following spinal cord injury have been dismal. 'Feet they have, walk they not' was the state of affair, with huge unremitting bedsores, infection, renal failure and death was the rule.¹ So much so that only a few paraplegics out of the thousand SCI war victims of First World War could survive the war within forcing standard textbooks of that time to agree with the conclusion of the unknown author of the *Edwin Smith Papyrus* as described over 4,000 years ago, as "an ailment not to be treated".

In Canada, Pickett et al² reviewed retrospectively records of all SCI patients (n = 151) with traumatic SCI between January 1997 and June 2001 at a tertiary care center. The Annual age-adjusted incidence rates were 42.4 per million for

adults aged 15-64 years and 51.4 per million for those > 65 years. Motor vehicle accidents accounted for 35%, Falls for 63% of SCIs among patients over 65 years. Cervical SCI was the most common, particularly in the elderly; but only 56% had an identifiable fracture. Thoracic and lumbar SCIs were associated with spinal fractures in 100% and 85% of cases respectively. In Asia (Japan) the incidence is 40.2/million/year.² In India the statistics is undoubtedly more. But in this context, there are potential limitations with regard to validation studies of registries and databases in India.³

During the Second World War, with a high number of casualties amongst both military and civilians, nihilistic attitude started to change slowly. German Jewish emigrant neurologist Dr. Ludwig Guttman opened the first comprehensive Spinal Injury Unit at Stoke Mandeville Hospital in Aylesbury, England, in February 1944. He introduced a new concept that included a multidisciplinary approach as much as social and professional rehabilitation throughout all phases of care of paraplegics and tetraplegics after the injury, under the primary responsibility of an experienced physician. The new therapeutic concept embraced sports as a fundamental catalyst for motivation. The pragmatic idea of comprehensive spinal injury unit was thus converted to reality by Guttman. In 1948, Dr. Guttman organized the first National Stoke Mandeville Games for the paralysed. Sprouting from a humble beginning moving beyond the borders of the United Kingdom; by 1960s it grew

into a credible international sporting movement that paralleled the elite Olympics in the 1970s, and finally getting recognized as the Paralympics in the 1980s.⁴

Before 1940s, SCI patients were basically placed on bed rest; during 60's surgical trend started emerging. As we are all aware today, the spinal stability is a critical issue and it is best described by Denis's '3 column concept' arising out of his meticulous CT based analysis of thoraco-lumbar fractures. Instability is said to exist when at least 2 vertebral columns are disrupted leading to a real or potential neurological deficit. The crucial of the entire column-the middle column is anatomically just in front of the delicate spinal cord and any disturbance of this column per se is a sign of instability. Most new classifications of thoracolumbar spine injuries are based on this seminal concept of Denis. In all surgeries it is important to restore the middle column to ensure 'breathing space' for the spinal cord besides creating a long term environment of bony stability to avoid further compression to the cord. Many opine that unstable fracture patterns (e.g., Denis type D) warrant consideration for surgery to provide stability, assist with early pain relief and subsequent rehabilitation^{5,6}

The modern era of spine surgery actually began in 1958 when Harrington first used his dual distraction rods in spinal trauma that he invented for treating scoliosis following poliomyelitis. The technique gained wide acceptance in spinal trauma because of its ease of application and biomechanical principle of 'three point fixation'.¹ Subsequently, several systems came to compensate the inherent limitations of Harrington system. During 80's the practice of early spinal stabilization became widely popular since it was assumed to improve neural recovery and reduce complications in all types of injuries. This initial enthusiastic of blanket early aggressive decompression and stabilization though benefited some patients; the overall results were not uniform.

Controversy started to crop up regarding type of adequate treatment, validity of laminectomy, indirect versus direct neural decompression, anterior versus posterior decompression, early versus delayed decompression, even challenging the true existence of relationship if any, between decompression and neurological recovery to quote a few. By 90's it was realized that decompression-instrumentation greatly eases nursing care, reduces pain and promotes early rehabilitation but sadly enough, it only modestly affect the potential for neurological benefits since maximum neural damage happens at the very time of impact. Experts like Gertzbein (1988), Esses (1990), Chapman and Anderson (1994) questioned any significant advantages of anterior procedures over the posterior procedure.¹ Over the past 20 years, the survival rate and long-term outcome of patients with spinal cord injury have improved with advances in both medical and surgical treatment. However, the efficacy and timing of these treatments remain controversial. The Current areas of investigation include early acute management, maintenance of cord perfusion from the beginning, including early surgical intervention, as well as new pharmacotherapy and cellular transplantation strategies. It is unlikely that a single approach can uniformly address all of the issues associated with spinal cord injury. Thus, a multidisciplinary approach is needed⁷

Evidence based medicine (EBM) is the explicit, judicious and conscientious use of current best evidence in making decisions about the care of individual patients, that requires the translation of population data into relevant patient-centered care decisions'.⁸ The benefits offered by the EBM approach include selective reading of the literature which saves time, direct patient relevance, and confidence in practical decision-making.⁹ In effect EBM provides 'bottom line' recommendations for clinical practice since it is the outcome of voluminous scientific information generated, pooled, analyzed and reported in many reviews in

journals.⁹ Yet, there are gray areas in spine practice where convincing evidence is not forthcoming and as yet, we have to act on empirical basis; sometimes on half truths. General recommendations bottom lines in the literature is possibly best summed up by John S. Kirkpatrick¹⁰ that "The anterior surgical approach is appropriate for some thoraco-lumbar burst fractures in patients with neurologic deficit and without posterior ligamentous injury. Surgery is most often indicated for patients with incomplete deficit, especially those with a large retro-pulsed fragment, marked canal compromise, severe anterior comminution, or kyphosis $>30^\circ$. This approach provides excellent visualization of the anterior aspect of the dura mater for decompression. Reconstruction of the anterior body defect can be done with autograft, allograft, or a cage. Supplementation of the graft with anterior internal fixation helps prevent kyphosis. Clinical results demonstrate improved neurologic function in most patients, minimum loss of kyphosis correction as well as low pseudarthrosis rates. In patients with incomplete deficit, improvement in neurologic function usually can be expected with few complications".

In a recent study¹¹ based on epidemiological data from two populations of acute spinal cord injury patients managed from 1947-73 before the establishment of the Spinal Unit compared to those managed in spinal unit from 1974-81 showed that the patients treated in the spinal units had a significant reduction in the mortality rate ($P = 0.022$), a significant reduction in the Length of stay ($P < 0.001$), and a significant increase in neurological recovery ($P < 0.001$). Thus, these results support the view that management of Acute SCI patients in a regional, multidisciplinary unit improves outcome as predicted by Guttman.

Anterior decompression seems more logical in unstable burst fractures when compressive structures are lying anteriorly, which is quite often

the situation. But this is technically demanding, has the potential for increased blood loss, morbidity and even mortality; may need a multispeciality surgical team and Intensive Care Unit backup for ensuring safety of relatively more extensive anterior operative procedure. On the other hand posterior approach is a simple & more familiar procedure for most orthopaedic surgeons with lower risk of morbidity and mortality.

Posterior decompression with conservative laminectomy with preservation of facet joints and subsequent stabilization by instrumented fusion may still be a valid procedure in the management of a spectrum of thoracolumbar spinal injuries. Dural tears, lamina fractures, epidural haematoma are better seen through posterior approach. Posterior compression rods may be appropriate or enough for seat belt injuries, other distraction injuries and certain stable burst fractures when risk of poor follow up and dangerous overloading exist.¹²

Clearly cord decompression is incomplete with posterior decompression alone and anterior compressive elements should desirably be dealt with more directly through anterior approach to relieve the neural structures. Therefore whenever facilities and expertise are available and patient can afford, anterior decompression should be attempted in unstable fractures to give a better chance for long term kyphosis correction, neurological recovery especially recovery from the neurogenic bladder and reducing long term morbidity of bed rest, back pain and progressive kyphosis. Again Root recovery may be more predictable than spinal cord and bladder recovery in traumatic conus medullaris injury.¹³ In a very recent and interesting systematic review¹⁴ designed to answer primary research questions it was found that: There is no specific surgical approach in the case of a TL burst fracture with incomplete neurologic deficit that has any advantage with regard to neurologic recovery. Complete disruption of the posterior ligamentous

complex as determined collectively by morphologic criteria using plain radiographs and computed tomography is an indication for surgical intervention in TL burst fractures

The recent treatment protocol goals at early aggressive treatment to prevent secondary injury mechanisms by adequate resuscitation, proper handling/transportation and cord perfusion, relatively early decompression and correction of kyphosis with instrumentation followed by early mobilization after adequate stabilization expecting a timely fusion. The NASCIS study in North America showed early intravenous methylprednisolone within 3-8 hours of spinal injury may significantly improve neurological recovery by preventing the secondary injuries due to inflammation (by epoxides, free radicals etc) within the cord. Several discoveries at the preclinical level are now transitioning into the clinical arena after the NASCIS Study. These include the Surgical Treatment for Acute Spinal Cord Injury Study (STASCIS) Trial to evaluate the role and timing of surgical decompression for acute SCI, neuroprotection with minocycline; aiding axonal conduction with the potassium channel blockers, neuroregenerative / neuroprotective approaches with the Rho antagonist Cethrin; the use of anti-NOGO monoclonal antibodies to augment plasticity and regeneration, as well as cell-mediated repair with stem cells, bone marrow stromal cells, and olfactory ensheathing cells. Cethrin inhibits Rho, a signaling master switch that, when activated, triggers cell death and increases damage after SCI. According to a study by American and Canadian researchers Cethrin is promising in SCI¹⁵. Cethrin potentially inhibits cell death and promotes neural regeneration in SCI. Study with Cethrin dose escalating regime administered extradurally to 37 spinal cord injured patients improved by one or more ASIA grades (28 percent) at six months¹⁶

Fortunately, improved diagnostic imaging modalities, advanced surgical techniques, safe & sophisticated anaesthesia and resuscitative techniques, availability of wide range of safe & effective antibiotics all have given an impetus for extensive and difficult spine surgery to be performed with greater precision and safety. But despite this advancement and better understanding of pathoanatomy, pathophysiology and biomechanical intricacies, it is painfully true even to the most enthusiastic spine surgeons that the chance of neurological recovery so often depends on the degree of damage caused to the spinal cord at the very time of impact. However again, neurological recovery has been reported in patients, in whom cord decompression was done many months after the injury; implying that there may be ray of hope even in darkness.

The last two decades have seen great improvement in the treatment of spinal injuries. These advances are born on evolving understanding of spinal biomechanics & injury mechanisms, improved instrumentation; better imaging modalities and better rehabilitative care. Although technique may change treatment should be guided by well documented principles and detailed structural and neurological assessment and best evidence practices. While utility of these therapeutic options provides some benefits, there is a critical need to identify novel approaches to treat or repair the injured spinal cord in hope to neurological improvement for regaining patient's quality of life. With the words of William Osler "Medicine is a science of uncertainty and an art of probability"³.

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