

REVIEW ARTICLE

CURRENT CONCEPTS REGARDING TIMING OF SURGERY AND ROLE OF DECOMPRESSION IN SPINAL FIXATION OF SPINAL CORD INJURY PATIENTS: A REVIEW OF LITERATURE

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ABSTRACT:

The treatment of vertebral fractures was traditionally conservative. With the availability of implant and safe surgery, spinal fixation and decompression of the injured cord is being accepted. Literature is divided on the issue of how early surgery is to be done.

Key words: Spinal fixation, spinal cord injury, vertebral injury.

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INTRODUCTION

Archeological records from over 45,000 years ago are noted to describe Spinal Cord Injury (SCI) as “a disease one cannot treat” and that paralysis is incurable. Even after many remarkable developments in the field of spinal surgery and the management of SCI, the paralysis still remains incurable.¹

There is No official record of actual incidence of acute SCI, but estimated range from 10-83 cases per million population annually. In India we are adding 25,000 new cases of SCI.²

Treatment of SCI is broadly divided into a) Care for Injured Cord b) Care for Injured Vertebrae c) Basic Care of the paralysed body. Spinal Cord behaves like Central Nervous System. It resists any healing process or repair. Till date other than in experimental animal no surgery in human being has shown any evidence of regeneration or repair of the cord.³ The treatment of vertebral fractures was traditionally conservative implying recumbency for 10 to 12 weeks followed by orthosis and gradual physiotherapy. Though literature is itself divided on the issue of conversion of conservative management to surgical management e.g. of fixation and stabilization but due to the availability of better implants and safe anaesthesia there is an increasing trend for early stabilization of unstable spine. In this changing scenario a structured review of the available literature becomes

imperative to outline the evidence based protocol for the treatment of SCI patients.

Material and methods- For the evidence based evaluation of the role of timing of decompressive surgery of spinal cord after trauma, systemic review in different journals were done to find out the feasibility, safety or efficacy of early surgical intervention to align, stabilize the spine and decompress the cord.

Review-Earliest evidence of surgery in spinal cord injury was to do some form of decompression, preferably Laminectomy. But without doing any fixation, laminectomy was a dangerous proposition. This surgery never gained any acceptance. Opponents of surgery had an opinion that if surgical treatment is indicated for other reason, it should be addressed to that, but not addressed to clearing the canal or simple decompression.⁴

Decompression does not increase the chances of recovery. Surgery does not lower the rate of complications. Surgery has its own complication.⁵ Gradually with the development of safe anaesthesia and better implants surgery on the spine gained acceptance. The contemporary literature showed a positive tilt towards surgery. Provided that spine can be stabilized without further damage there should be little doubt about the benefits of early mobilization and ambulation of the patient. It improves psychological and social rehabilitation. There is less chronic pain.⁶

Chronic abnormal mechanical stress to spinal cord may induce localized arachnoiditis and cyst formation leading to deterioration of neurological status. Prevention of secondary neurological deterioration should be added to the list of indication for canal clearance and stabilization.⁷

Neurological deterioration because of instability has been reported in two conservatively treated series.^{8,9}

Vertebral injury can be graded into four groups. Group- I Compression Fracture without neurological lesion but there is risk of deformity - kyphosis. This can be treated with Bed rest and good Orthosis till bone heals. Fixation to prevent possible deformity is Surgeons' personal choice. Grade II-unstable Injury to Vertebral column with risk of neurological deterioration. Stabilization is indicated. Grade III- Mechanical and neurological failure leading to incomplete lesion. Stabilization and decompression is indicated. Grade IV- Mechanical and neurological failure leading to complete lesion or transaction. Reduction and stabilization is indicated.¹⁰ Much emphasis is always put on neurological recovery to justify or contradict interventions in SCI, but even without neurological recovery, spinal fixation provides some positive non neurological advantages e.g. lesser complications, short length of stay, early mobilization and reduction in total cost of hospitalization.

Timing of surgery- The critical analysis of the current pre-clinical evidences in Animal studies strongly indicates that time of spinal cord decompression is a key determinant of recovery after SCI and, hence, there is a biological rationale to support early spinal cord decompression for improved outcomes. But clinical literature in patients of SCI does not hold it true. Delphi convention (2002) gave following recommended that surgical decompression of the injured spinal cord be performed within 24 hours when medically feasible.¹¹ In SCI patients of grade of A through D, with MRI confirmed compression a comparison was done between early surgery (o 24h after SCI) and delayed surgery (X 24h after SCI).¹²

The results add weight to the growing body of literature, which supports the principle of early intervention. In a prospective Canadian cohort study the early decompression group. The mean improvement in (ASIA motor score) at rehabilitation was 20 points, in the late decompression group The mean improvement in (ASIA motor score) at rehabilitation was 15 points. Several studies, failed to find a difference

between early and late surgery after 72-h.¹³ After evaluating the relevant body of literature, it seems that the 24-h cut off represented the most promising time window during which surgical decompression may have the potential to confer a neuro-protective effect. A retrospective case series comparing outcomes of Early (24h and 24–72h) Versus Late (>72 hours) surgical spine interventions versus those treated non-surgically after acute SCI was done. Spinal Fixation was associated with shorter length of Stay and reduced pulmonary complications, however, no differences in neurologic or functional improvements were noted between early or late surgical groups.¹⁴

A multicentric study concluded that early surgery on the cervical spine when cord injury is present appears hazardous, since each of the three patients with a cervical cord injury who deteriorated was operated on within the first 5 days. No such deterioration was observed following surgery performed from the 6th day on.¹⁵

A study of 100 surgically treated patients concluded that the duration of hospitalization could not be reduced in the group of tetraplegic patients. Immediate reduction of the injury is more important for the further neurologic outcome than improved surgical techniques. The cut off time in this study is not available.¹⁶ With a cut off time of 7 days, studies have concluded that no neurological improvement was noted in any patient with a complete lesion who underwent early surgical decompression. In those with incomplete sensorimotor paralysis, it was difficult to document any effect of surgical decompression on neurological recovery. Patients with some degree of sensory preservation had a similar incidence of motor recovery in both surgical and nonsurgical groups.¹⁷ Time of treatment had no significant effect upon admission status and percent recovery. No significant difference in the percent of recovery was noted, whether decompression was early (up to 8 hours) or late (9 to 48 hours) after injury. Surgery did not significantly alter the percent of recovery.¹⁸ Safety has been a concern. Studies have shown that the timing of surgery for patients sustaining traumatic lower cervical spine injury with neurological involvement did not affect neurological recovery. Early surgical intervention was associated with a higher incidence of mortality and neurological deterioration compared with late surgical intervention, indicating that surgery after the first 72 hours might be relatively safe.¹⁹ Decompression prior to 24 hours after SCI can be performed safely and is associated with improved neurologic

outcome, defined as at least a 2 grade AIS improvement at 6 months follow-up.²⁰

Systemic reviews published have shown that there are currently no standards regarding the role and timing of decompression in acute SCI and have recommended urgent decompression of bilateral locked facets in a patient with incomplete tetraplegia or in a patient with SCI with neurologic deterioration. Urgent decompression in acute cervical SCI remains a reasonable practice option and can be performed safely. There is emerging evidence that surgery within 24 hours may reduce length of intensive care unit stay and reduce post-injury medical complications.²¹ Surgical intervention for cervical injuries is safe, as no postoperative neurological deterioration was recorded. Timing of surgery does not affect neurological outcome.²²

Regarding multiply injury patient's evidence states that early spine fracture fixation is safely performed. Early fixation is preferred in patients with thoracic spine fractures because it allows earlier mobilization and reduces the incidence of pneumonia. Although delaying fixation in the less severely injured may be convenient for scheduling, it increases hospital resource utilization and patient complications.²³ In a study, after controlling for potential confounding differences through PSM matching and multivariate analyses, late surgery independently associated with increased in-hospital complications, length of stay, and hospital resource utilization. These data suggest surgery within 72 hours may decrease resource utilization without a corresponding increase in postoperative morbidity.²⁴

In another review study 11 articles directly comparing two cohorts that had early or late surgery were identified. All of the studies consistently demonstrated shorter hospital and intensive care unit length of stays, fewer days on mechanical ventilation and lower pulmonary complications in patients who are treated with early surgical spine decompression and stabilization. These advantages are more marked in patients with polytrauma. Consequently, costs associated with late surgery were higher compared with early surgery.²⁵ Definitive conclusions should not be drawn regarding the prognosis for outcome and recovery after thoracic SCI. From a physiological standpoint, additional methodologically rigorous studies that take into consideration various levels of injury in more anatomically and physiologically relevant form are needed. Use of validated, comprehensive outcomes tools are important to improve our

understanding of the impact of thoracic SCI and aid in examining factors in recovery from thoracic SCI.²⁶

The majority of spine surgeons prefer to decompress the acutely injured spinal cord within 24 hours. The majority of spine surgeons prefer to decompress the cervical spine for patients with complete or incomplete cervical SCI within 24 hours. Early decompression (within 24 hours) should be considered as part of the therapeutic management of any patient with SCI, particularly those with cervical SCI. Very early decompression (within 12 hours) should be considered for a patient with an incomplete cervical SCI (with the possible exception of central cord syndrome).²⁷

The concept of Damage control-In patients with major thoracolumbar trauma it is advisable to proceed with early surgical stabilization within 48 hours unless extenuating medical conditions would prevent it. Similar to the application of external fixators in long-bone fractures, the theory of "damage control" stabilization in the patient with multiple traumas may be applied to the spine. These procedures can be simple posterior stabilizations or open reductions with internal fixation, and they can be combined with staged anterior procedures as necessary.²⁸ The most common definitions of early and late surgical intervention included 24 or 72 h after SCI. Some studies suggested that early surgical intervention is safe and feasible and that it can improve clinical and neurological outcomes and reduce health care costs. Equal number of studies observed that patients who undergo delayed surgical decompression have similar outcomes to patients who received early decompressive operation. No stabilization can prevent the complications of bad management of these neurotraumatized patients. Surgery does not replace any of the components of good conservative care. Operative treatment i.e. stabilization and decompression is by no means an alternative to active conservative care.

CONCLUSION- Stabilisation of the spine is a part of the comprehensive program of rehabilitation. Despite the lack of definite substantiation for one particular timeline, the current clinical evidence along with that from preclinical studies suggests that outcomes after traumatic SCI would be potentially optimised if surgical decompression and stabilization were carried out between 8-24 hrs. Early spinal surgery can help SCI patients to learn their activities of daily living and can mobilize themselves aided or unaided.

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