

## Subaxial (C3-C7) cervical spine injuries : Comparison of early and late surgical intervention

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**Abstract:** This study was carried out to determine whether the timing of surgery affects neurological outcome in patients with subaxial cervical spine trauma. We studied 41 patients with a fracture and/or fracture-dislocation of C3 to C7 cervical vertebrae who were treated operatively during the period January 2004 to June 2009. Surgery was performed as soon as the patient's medical condition allowed, within 2 weeks of trauma in 20 patients and after 2 weeks of the injury in 21 patients. Outcome was assessed using Frankel grading. In both groups only those patients who had incomplete spinal cord injury showed neurological improvement after surgery. There was no statistically significant difference in final neurological outcomes in patients having early as opposed to delayed surgery. Similarly there was no statistically significant difference in two groups based on level of injury and associated cord injury. Surgical intervention for cervical injuries is safe, as no postoperative neurological deterioration was recorded. Timing of surgery does not affect neurological outcome.

**Keywords:** cervical vertebrae; neurologic manifestations; quadriplegia; spinal cord injuries

### INTRODUCTION

One third of all spinal injuries involve cervical vertebrae<sup>1</sup>, and the impact of injury to the cervical spinal cord is profound, requiring systemic treatment. About 40% of such injuries are complete, another 40% are incomplete; remaining 20% spare the cord and involve only the nerve roots<sup>2</sup>. Some authorities recommend early surgery<sup>3-6</sup>, as the neurological condition may worsen due to haematoma formation, oedema progression, and/or spinal instability. Others argue that delaying surgery decreases physiologic complications and prevents iatrogenic cord injuries<sup>7,8</sup>. Whether early or delayed spinal decompression and stabilisation decreases morbidity remains controversial<sup>7-9</sup>. We aimed to determine whether the timing of surgery affected neurological outcomes in patients with unstable subaxial cervical spine injuries (C3 to C7 vertebrae).

### MATERIALS AND METHODS

Records of 36 men and 5 women aged 13 to 72 (mean, 36.4) years who sustained an acute unstable injury of the subaxial cervical spine (C3-C7) between January 2004 and June 2009 were reviewed. Indications for surgery were spinal instability, deformity, and

neurological compromise due to compression of neural elements. Injuries were classified as burst fractures or facet fracture-dislocations. Surgery was performed as soon as the patient's medical condition allowed; 20 patients underwent surgery within 2 weeks of injury (early group) and 21 patients underwent surgery 2 weeks after trauma (delayed group). Anteroposterior, lateral, and oblique plain radiography, computed tomography (CT), and magnetic resonance imaging was done pre- and post-operatively. Neurological status was assigned according to the Frankel grading. Pre- and post-operative neurological status of the patients with spinal cord injury in the early and delayed surgery groups was compared. Cranial traction was applied pre- and intra-operatively; steroids (Methylprednisolone) were administered preoperatively in patients who came within eight hours of injury. Open reduction, decompression, and spinal stabilisation were performed via a posterior (3 patients), anterior (37 patients), or combined approach (1 patient) based on the location of injury. Autologous bone grafting was performed in all patients. Postoperatively, a Philadelphia cervical collar was applied for 12 weeks, to reduce neck pain associated with neck movement, patients were advised to start isometric neck exercise as soon as possible. Fusion was defined as the presence of a homogenous mass and segmental movement of <2° on flexion-extension lateral radiographs. Statistical analysis was performed using the independent sample Student's t test and Chi squared test. A p value of <0.05 was considered significant.

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## RESULTS

The mean follow-up period in early group was 43.4 (range, 7–67) month and in late group was 28.2 (range, 3–66) month. The causes of injury were road traffic accident (n = 19, 46.3%), fall from a height (n = 14, 34.1%), fall of object (n = 4, 9.8%). Twenty six patients (63.4%) had a fracture as well as dislocation between C3 and C7 vertebrae, while 2 patients (4.9%) sustained fracture without dislocation between C3 and C7 vertebrae. Eight patients (19.5%) had a dislocation without fracture between C3 and C7 vertebrae. Most dislocations were unilateral. Most common injury level was C5-C6 (39.0%) followed by C4-C5 (34.2%). No statistically significant difference was found in the distribution of ages and genders between the early and delayed surgery groups (p = 0.100, and p = 0.592, respectively). Preoperatively 41 (100%) of the patients had a neurological deficit (3 grade A, 16 grade B, 13 grade C, and 9 grade D). Comparison of Frankel Grading at discharge and at follow up between early and late group revealed no statistically significant difference (p = 0.404, and p = 0.801 respectively). Postoperatively, only patients with incomplete spinal cord injury (grades B to D) had neurological improvement. Two patients with grade A and one patients with grade B injury died due to cardiopulmonary insufficiency.

## DISCUSSION

The timing of surgery had no effect on neurological recovery in patients with cervical spinal cord injury<sup>10–12</sup>. However, experimental studies showed that early surgery might be associated with improved results<sup>13,14</sup>. Some authors considered early surgery (<72 hours from injury) the best treatment for cervical spinal cord injury<sup>3,15</sup>. Others reported improved neurological outcome after delayed surgery<sup>16–18</sup>. Surgical treatment (compared to conservative treatment) may be associated with higher complication rates<sup>9</sup>, particularly within 5 to 7 days of injury<sup>7,8,19</sup>. Neurological deterioration was more likely in patients with unstable spinal injuries and less likely to be related to the timing of surgery. Early surgery gave improved results in patients with cervical spinal cord injury<sup>4</sup>. Although surgical treatment may not be necessary because of spontaneous fusion<sup>20</sup>, anatomical reduction appears to be necessary to minimise the risk of dynamic cervical translation and to decrease pain and stiffness or both<sup>21</sup>. Therefore, internal fixation is often required for immediate mechanical stabilisation<sup>22</sup>, to decrease post-traumatic complications resulting from immobilisation<sup>7</sup>,

and to improve the physiological environment and thus maximise neurological improvement<sup>6</sup>. Cranial traction was applied preoperatively in all patients, as immediate reduction (<6 hours after injury) is more important for improving neurological outcome than surgical techniques<sup>16,23,24</sup>. Surgery promotes spinal stabilisation, facilitates patient mobility and prevents spinal deformity. Surgical approaches (anterior vs. posterior vs. combined) did not correlate with postoperative neurological status. Only patients with incomplete spinal cord injury had neurological improvement postoperatively. Early surgery might benefit patients with incomplete injury. Pathologic changes in neural tissue accelerate within 8 hours of injury, and the use of steroids is neuroprotective if administered within that period<sup>25</sup>.

## CONCLUSION

Surgical intervention for cervical injuries is safe, as no postoperative neurological deterioration was recorded between the early and delayed surgery groups. Neurological recovery may be expected in patients with incomplete spinal cord injury. There was no statistically significant difference between the neurological outcomes associated with early versus delayed surgery. Prospective randomised studies are needed to better document the results according to the timing of surgery.

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