



Comparative Study of Interspinous Wiring and Lateral Mass Fixation in Conjunction with Anterior Fusion in the Treatment of Sub Axial Cervical Spine Trauma

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ABSTRACT

Cervical spine injuries is an important cause of morbidity worldwide, the common causes being fall from height and road traffic accidents. Different techniques are described for the management of severe sub axial spine trauma. For stabilization of two and three column injuries, traditionally surgical fixation is done. While anterior cervical fusion with plating and screwing/corpectomy and CAGE is done anteriorly to stabilize the ventral column, many methods for stabilizing posterior column has been described. In our institution we have regularly followed two methods: either a simple posterior interspinous wiring or lateral mass screw and rod fixation .

58 cases who underwent surgery during three year period were analyzed, 47 cases available for follow up. 23 cases had interspinous wiring and 19 cases lateral mass fixation as posterior procedure along with anterior fusion. Only anterior fixation was done in 16 cases. Comparison of the two procedures in terms of stability and fusion on serial x-rays, complications, surgical time, neurological recovery and cost factor was done.

While used in conjunction with anterior fusion, the role of both interspinous wiring and lateral mass fixation are same ie. to maintain the posterior construct and provide the stability till the anterior fusion is complete. Interspinous wiring is a relatively safe, simple technique even in inexperienced hands. The duration of surgery, blood loss and radiation exposure are less compared to lateral mass fixation

Keywords: *Interspinous wiring, Lateral mass fixation, circumferential fusion.*

Introduction

The incidence of traumatic spinal cord injury varies from 13.1 per million in developed countries to 12.7 to 29.7 per million in developing countries.^[2] The average age of victims in developed countries varies from 30.7 to 48.5 years whereas in developing countries the average age is below 30 years ^[2,3,4]. Male to female ratio in

developed countries varies from 3:1 to 4.3:1. The main cause of traumatic spine injury in developed countries is road traffic accidents followed by falls while in developing countries, falls are the primary cause. In trauma patients, vertebral column injuries occur in about 6% of cases. ^[1]. Patient characteristics like age more than 50, high energy trauma as the mechanism of injury and

presence of head injury adversely affect the survival of patients with traumatic spine injury.^[1,6] Prolonged use of external stabilization with collars can result in skin complications. So it is preferable to operate on sub axial cervical spine fractures to stabilize the fracture and improve healing^[1]. In subaxial cervical spine fractures involving two or three column injuries, the most stable technique is circumferential fixation^[7] The anterior column is stabilized by anterior cervical discectomy or corpectomy with fusion. But for the posterior stabilization, many methods like lateral mass fixation, inter spinous wiring, facet wiring, lateral fixation with plates etc. We try to analyze the effectiveness of the two procedures- Interspinous wiring or Lateral Mass Fixation-when used in conjunction with ventral fusion—in terms of fusion, stability, complications, Surgery time and cost factor

Materials and Methods

All patients who underwent circumferential fusion during the three year period from 2013 to 2016 were evaluated.

Inclusion Criteria

1. Sub axial cervical spine injury
2. H/o trauma
3. two or three column injury
4. Facet dislocation with unilateral or bilateral locking
5. Single motion segment
6. Posterior elements intact in patients undergoing interspinous wiring.

Exclusion Criteria: Patients without subluxation, multiple motion segments involved and those cases requiring multiple level constructs, pathological fractures

All patients were evaluated with initial X-ray cervical spine followed by CT scan cervical spine and head, MRI cervical spine.

Traction was applied in a good number of cases. Those cases not reduced under skull traction had to undergo posterior approach, reduction and fixation by either lateral mass fixation or interspinous wiring. Some patients with

significant anterior compression with disc material had to undergo initial anterior procedure. Some cases with reduction under traction underwent anterior cervical discectomy with fusion and fixation with anterior cervical plates and screws, followed by Philadelphia collar for 3 months. All other cases underwent circumferential fixation. anterior cervical discectomy or corpectomy, fusion with iliac crest graft or titanium cage filled with bone graft and fixation with titanium plates and screws. Posterior stabilization was done with either lateral mass screw rod fixation or interspinous wiring with titanium wires. For lateral mass fixation, we used 3.5 mm screws by Magerl's technique.

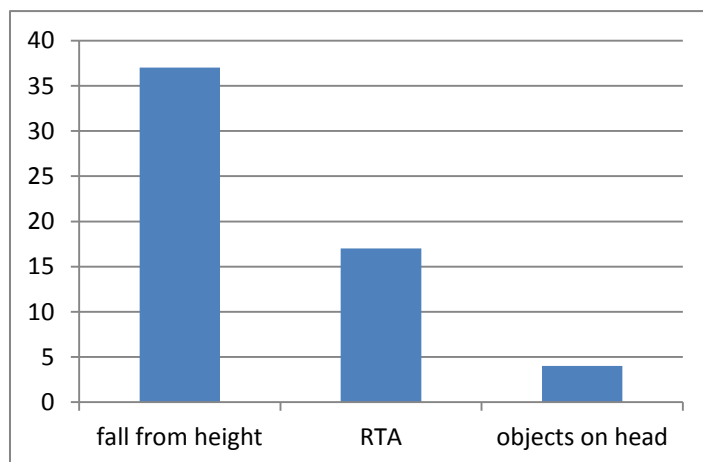
Post operatively the patients were put on hard cervical collar for two weeks and started mobilization depending on the patient's neurological status and post-operative X-ray. Patients were followed up two weeks after discharge and again at 3 months and 6 months. X-rays were repeated during each visit to look for any malalignment, graft displacement, wire breakage, screw pull out, recurrent subluxation or loss of sagittal alignment. Assessment of neurological status was done using the American Spinal Injury Association(ASIA) Scale pre- and postoperatively and during follow up⁽⁸⁾. Stability and fusion was assessed in X-rays by^[1] absence of translation between the vertebra on flexion extension images^[2] absence of hardware loosening^[3] absence of motion between contiguous spinous process on flexion –extension X-rays.^[9]

Information regarding the following were collected and tabulated: Age/sex, Mechanism of injury, Level of subluxation Cord injury, Neurological deficits in case of cord injury and neurological improvement was recorded in ASIA chart, Reduction to traction, Type of posterior procedure, Operative time, Complications, Improvement on follow up, Achievement of fusion, The role of traction in achieving reduction was analyzed. A comparison was drawn between interspinous wiring and lateral mass fixation based on information collected.

Results

Total of 58 patients ranging from 20 years to 75 years with a mean age of 42.7 years, 56 males and 2 females underwent surgery for severe sub axial cervical spine trauma during the study period. 11 patients expired of which 9 expired during the first two weeks and 2 after 3 months. Fall from height was the major cause of injury in 37 cases (63.7%), road traffic accidents in 17cases (29.3%) and heavy objects falling on head in 4 cases (6.9%). (chart 1).C3-4 in 4 cases C4-5 in 8 cases, C5-6 in 22 cases, C6-7 in 21 cases and C7-D1 in 3 cases were involved(chart 2). 16 cases underwent anterior fusion alone following reduction by skull traction of which 4 patients expired. 42 cases underwent circumferential fusion with interspinous wiring as the posterior procedure in 23 cases (3 expired) and lateral mass fixation in 19 cases (4 expired). 47 cases were available for follow up. The average duration of surgery in circumferential fusion when lateral mass fixation is used is 5 to 5 ½ hours whereas it is 4 to 4 ½ hours in interspinous wiring. Blood loss is significantly less in interspinous wiring. 16 cases in interspinous group showed neurological improvement in ASIA score, the rest remain same. In lateral mass fixation group, 12 cases showed improvement while others static. No significant operative complication was observed in interspinous wiring but one case of root injury and one case of lateral mass fracture in the lateral mass fixation group . In those cases where only anterior fusion was done, recurrent subluxation occurred in one patient and had to undergo a revision surgery and circumferential fixation. Follow up dynamic x-rays showed stability and fusion in all cases of circumferential fusion in both the procedures.

Chart 1. Causes of Trauma: Total 58 patients



RTA: Road Traffic Accidents

Chart 2. Levels of Trauma: Total 58 patients

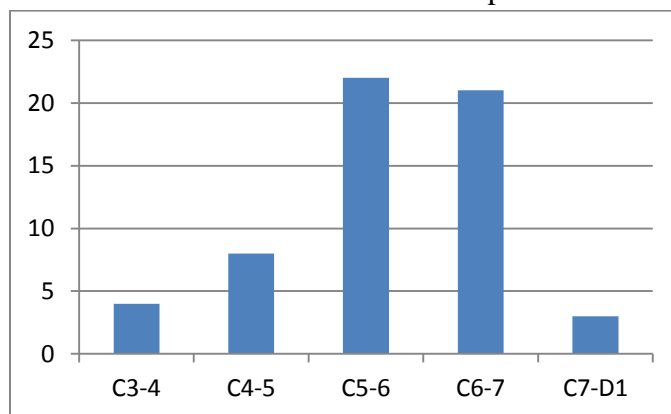
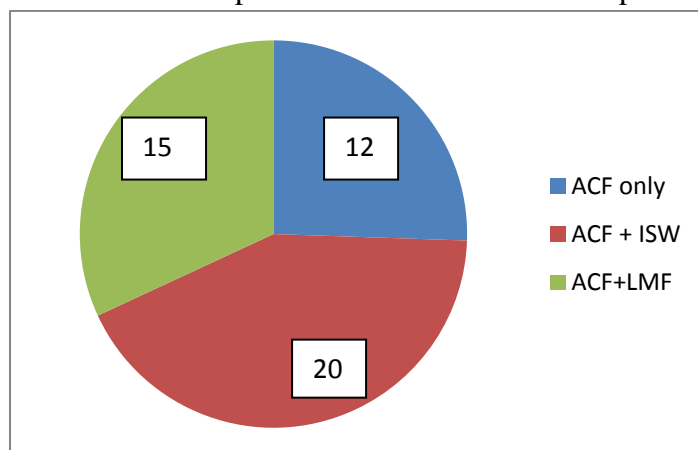


Chart 3 Total 47 patients available for follow up



ACF: Anterior Cervical Fusion ISW: Interspinous wiring
LMF: lateral Mass Fixation

The major causes of death in patients were respiratory tract infection, ventilator associated pneumonia and sepsis. Two patients developed refractory hypotension and cardiac arrest.

In those cases where anterior fusion alone was performed, the patients had to be kept on collar immobilization for 2 months and hence collar related skin excoriations and skin infections were seen in majority of patients.

The cost of titanium wire for interspinous wiring is 1000 rupees whereas that for lateral mass fixation is around 20,000 rupees in addition to the cost of anterior fixation.

Fig 1.C4-5 traumatic subluxation with locking CT and MRI



Fig 2.Posterior wiring + Anterior fusion follow up

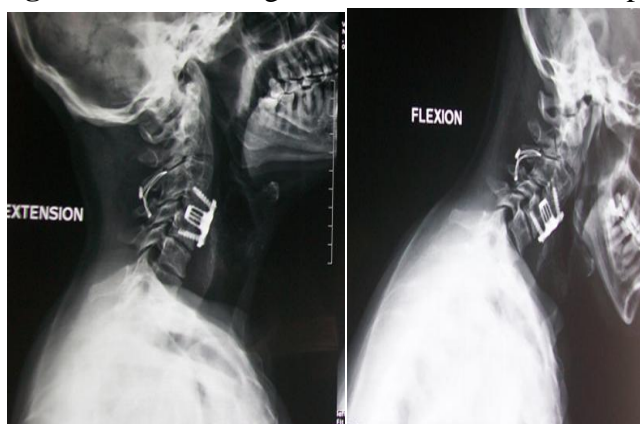
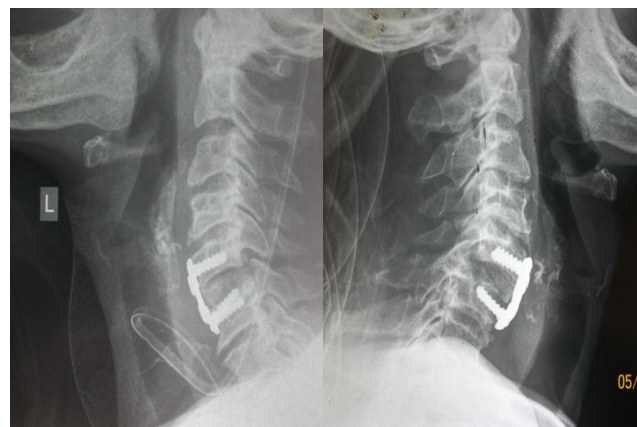


Fig 3.Lateral Mass Fixation + Anterior fusion-Follow up



Fig 4.Anterior Fixation alone and recurrent subluxation



Discussion

For the management of severe cervical spine injury involving anterior and posterior columns, in those with unilateral or bilateral facet dislocations, circumferential fixation is the most stable technique. [7] But it requires prolonged surgical time and is associated with significant morbidity and blood loss. Some cases of facet dislocation which are reduced by traction, there is a tendency to fix anteriorly alone. Many authors have described this closed traction, rapid realignment followed by surgical stabilization with a view that early reduction gives high chance of neurological recovery. [7,10]. But in cases with traumatic disc protrusion, this can be hazardous. Hence Eismont et al proposed that before any such attempt, MRI should be done to rule out traumatic disc protrusion [11].

Whether posterior stabilization which allows the disrupted posterior tension band to be reestablished alone is sufficient is again a matter of debate. Elgaffy et al described the development of segmental kyphosis in some cases treated by posterior fixation alone like wiring.

Cervical spine injuries with bilateral facet dislocation indicate severe and unstable injury and it requires dorsal supplemental instrumentation even if reduction and stabilization is achieved through anterior approach. Some authors have described that in bilateral facet dislocations treated by anterior approach alone, the redislocation rate is unacceptable [12]. So bilateral

facet dislocation needs posterior unlocking, stabilization of posterior column by any acceptable technique followed by anterior fixation by graft at the level of disc space.

The management of unilateral facet dislocation in a neurologically intact patient is an area of debate. Many people practice halo vest or collar immobilization without open or closed reduction. But the incidence of recurrent instability and chronic pain in more than 50% of patients suggests reconsideration of this approach [13]. Some group suggests skeletal traction and anterior approach alone. In a series by Henriques the reoperation rate in such patients was 5.9% [14]. Shapiro et al described posterior wiring and facet wiring with iliac crest graft and in 22 cases of unilateral facet dislocation treated by his procedure, one had resubluxation which required anterior cervical fusion with plates [16]. This again suggests that anterior fusion with posterior augmentation by any procedure is the most stable one in comparison with anterior alone or posterior alone procedures.

Benzel in 1989 published an article where posterior interspinous wiring and fusion was used in 50 cases where graft from iliac crest was placed on medial lamina to achieve fusion posteriorly. He described it as a simple and straightforward procedure [17].

We use anterior cervical fusion with iliac crest graft or cage filled with graft and fixation with plates and screws in all the cases of sub axial cervical spine injuries with subluxation. About one third of the cases reduced by closed reduction with traction underwent anterior procedure alone. The remaining two third of the patients underwent posterior procedure either interspinous wiring or lateral mass fixation along with anterior fusion.

Posterior interspinous wiring, first described by Hadra in 1891 for the treatment of Potts spine has played a major role in cervical spine stabilization [18]. Rogers in 1942 gave a detailed description of the procedure [19] which was modified time to time by Abdu and Bohlman (triple-wiring), White hill, et al., Benzel and Kesterson, and Murphy and

Southwick. Inter spinous wiring restores the posterior tension band reconstruct but does not prevent lateral bending and rotation [15]. Posterior cervical wiring requires that the posterior bony ring is preserved i.e., lamina, facet, and spine. The technique we follow involves; after reduction of the facet, a burr hole drilled transversely at the base of the upper spinous process and the lower spinous process. A braided titanium wire or cable is passed through the burr holes and tightened to keep the facet and lamina in anatomical position. The procedure is relatively safe and does not cause any injury to nerve roots, dura or vessels. It is cost effective too.

However posterior cervical interspinous wiring today has a very limited role in fixation of the subaxial spine, after the introduction of plates and screws, usually as an adjunct to other fixation constructs [8].

Lateral mass fixation with screws, first described by Roy-Camellie in 1964 has recently been the mainstay of posterior fixation of subaxial spine [18]. It was later modified by Magerl, Louis and Anderson.

We commonly use the Magerl's technique where the entry point is 1mm medial and 1 mm cephalad to the Centre of the lateral mass directed 25 degrees laterally and parallel to the overlying facet joint cranially. 18mm long bicorticate screw is preferred while in Roy –camellie 14 mm screw is used [15]. Misplacement of the screws can cause injury to vertebral artery and the nerve root. Screw loosening and pull out are also described [15,20]. Moreover it is a technically demanding procedure using c-arm intensifier with about 92.5fsec [1].

Conclusion

While used in conjunction with anterior fusion, the role of both interspinous wiring and lateral mass fixation are same ie to maintain the posterior construct and provide the stability till the anterior fusion is complete. Interspinous wiring is a relatively safe, simple technique even in inexperienced hands. The duration of surgery, blood loss and radiation exposure are less

compared to lateral mass fixation. The cost of implant is about 1000 rupees in wiring compared to 30,000 rupees in lateral mass fixation. The chance of complications like injury to vertebral artery and nerve roots is less with wiring and hence better safety profile. The chance of implant failure like screw pullout is less in wiring.

But unlike lateral mass fixation, it does not provide stability in lateral flexion and rotation and has a limited role in cases where the spinous process and lamina are fractured.

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