DOI: https://doi.org/10.3329/bjns.v9i1.42918

Original Article

Internal Fixation, A Reconstructive Spine Surgery: A Remedy of Long-Term Spinal Problems

Islam MA[1], Manik MAH[2], Chowdhury RU[3], Salek MAA[4], Amir Ali[5], Faisal H[6], Karim AKMB[7]

Conflict of interest: There is no conflict of interest relevant to this paper to disclose.

Funding Agency: Was not funded by any institute or any group.

Contribution of Authors: Islam MA was Principal investigator, Manik MAH help for protocol preparation, Chowdhury RU, Salek MAA, Amir Ali, Faisal Hhelp for data collection, Karim AKMBhelp for editorial formatting.

Received: 1 Junuary, 2019

Accepted: 15 January, 2019

Abstract

Background: *Spinal instrumentation provides a stable, rigid column that encourages bones to fuse after spinal fusion surgery.*

Methods: *The study was carried out in the Neurosurgery Center, CMH, Dhaka, from 01 January 2013 to July 31 2018. A total of 95 patients were included with unrestricted age and gender, underwent spinal surgery with fixation.*

Result: *Better outcome was observed in spinal surgery with stabilization.*

Conclusion: *Whereas early (within hours) or immediate (within 48 h) stabilization and indirect or direct decompression has excellent outcome, even delayed stabilization of the unstable spine has benefits.*

Keywords: *Internal fixation, spinal injury, reconstructive spine surgery.*

Bang. J Neurosurgery 2019; 9(1):11-15

Introduction:

The debate over the management of spinal injuries continues, with controversy remaining as to whether treatment should be non-operative or operative[1,3,12] and in the case of the later, whether a posterior or anterior approach is indicated to achieve the desired result[3,10,13,14].

Advocates of surgical treatment claiming improvement in spinal alignment, decreased deformity, early mobilization and rehabilitation of the patient and a decrease in complications arising from prolonged bed rest and back pain[4,5,9].Advocates of the non-operative option, such as Bedbrook[1] and others[19],have reported equivalent results, claiming satisfactory alignment of the spinal column and the maintenance of its stability by non-operative means. Biomechanical and clinical studies, however, have shown that when there is loss of more than 50% of the vertebral body height or angulation of the thoracolumbar junction of more than 20^{0} [20],acute spinal instability results, and the spinal segment will eventually fail with weight bearing. Biomechanical studies have also shown that spinal instability results when there is failure of at least two of Denis' three columns[11].

The aim of this study was to evaluate the outcome of patients with spinal operation who underwent spinal fixation for last five years.

Materials and methods:

The study was carried out in the Neurosurgery center, CMH, Dhaka, from 01 January 2013 to July 31 2018.

1. Col. (Dr.) Md Aminul Islam, Head of Department, Neurosurgery Centre, CMH, Dhaka.
2. Maj. (Dr.) Md. Abdul Hye Manik, Consultant Neurosurgeon, CMH, Dhaka.
3. Col. (Dr.) Rukun Uddin Chowdhury, Consultant Neurosurgeon, CMH, Dhaka.
4. Lt. Col. (Dr) Md Al Amin Salek, Consultant Neurosurgeon, CMH, Dhaka.
5. Lt.Col. (Dr.) Amir Ali, Consultant Neurosurgeon, CMH, Dhaka.
6. Maj. (Dr.) Hasnayen Faisal, Consultant Neurosurgeon, CMH, Dhaka.
7. Dr. A K M Bazlul Karim, Associate Professor of Neurosurgery, Enam Medical College & Hospital, Savar.

Address of Correspondence: Col. (Dr.) Md Aminul Islam, Head of Department, Neurosurgery Centre, CMH, Dhaka.

A total of 95 patients were included with unrestricted age and gender. The final analysis was based on these patients after obtaining informed consent from them.

Patients

95 patients with sign and symptoms related to spines, admitted in Neurosurgery center, CMH Dhaka were treated by spinal fixation between January 2013 to July 2018.

Indication for surgical stabilization

Patients with one of the following were considered to have an indication for surgical stabilization of the spine:

- all neurologically stable patients with instability criteria (GradeII or more listhesis and vertebral body height loss of more than 50%).
- all neurologically stable patients with instability criteria (vertebral body height loss of more than 50%).
- all patients with spinal injury with loss of alignment.

In cervical spines, right anterior approach was carried out. After discectomy, different types of spacers/cages were being used. Plates of proper length were placed in front of the bodies.

In dorso- lumber region, operations were done by posterior approach with one screw above and one below the injured vertebra.

The operative technique involved posterior exposure of the spines up to the tip of the transverse process. The pedicle entry points were located and the area was marked with a pointed awl which was used to penetrate the pedicle at the junction of the transverse process and superior facet and to develop a tract through the pedicle into the vertebral body. The awl was also used to feel for any violation of the pedicle wall. If no defect was found, the hole was tapped and the pedicle screw placed in position. The whole procedure was carried out under C-arm control in the lateral plane. When all of the screws were in position, rods of the proper length were placed bilaterally after contouring to the spinal curvature. Patients were encouraged to sit by the second post-operative day and to use a dorso-lumbar-sacral orthosis (DLSO) for 3 months.

Results:

Table-I

Distribution of age group of the study population (n = 95)

Age group	No of patients	%
16 - 20	03	3.15
21 - 25	03	3.15
26 - 30	05	5.26
31 - 35	09	9.47
36 - 40	10	10.55
41 - 45	12	12.65
46 - 50	11	11.57
51 - 55	16	16.85
56 - 60	11	11.57
61 - 65	10	10.53
66 - 70	03	3.15
71 - 75	02	2.10

Table I shows distribution of age group of the study population. Among the 95 patients, highest 16.85% were between 51 – 55 years.

Table-II

Sex distribution of the patients (n=95)

Sex	Frequency	%
Male	73	76.84
Female	22	23.16
Total	95	100

Table II shows sex distribution of the study population male were 3.3 time more prone than female group.

Table-III

Operative approaches for spinal fixation (n = 95)

Approach	Frequency	%
Anterior	36	37.89
Posterior	59	62.11
Total	95	100

Table III shows the operative approach 62.11% were treated by posterior approach.

Table-IV

Involved spinal segment underwent fixation (n = 95)

Spinal segment	Frequency	%
Cervical	36	37.89
Thoracic	02	2.11
Thoraco-lumber	07	7.37
Lumber	31	32.63
Lumbo-sacral	19	20
Total	95	100

Table IV shows the spinal segments needed surgery. The highest was cervical part followed by lumbar segment.

Table-V
Underlying causes that necessitate spinal fixation (n=95)

Causes	Frequency	%
Degenerative	76	80
RTA	08	8.43
Fall from height	07	7.37
Infection	02	2.10
Others	02	2.10
Total	95	100

Table V shows the cases of the ailment treated by spinal fixation. Degenerative diseases hold the highest position (80%).

Table-VI
Complications following spinal fixation (n=95)

Complications	Frequency	%
Hardware failure	02	2.10
Graft site infection	02	2.10
Superficial wound Infection	01	1.05
Deep wound infection	01	1.05
Urinary tract infection	06	6.31

This table showing the complications following the operation. The commonest complication was urinary tract infection (6.31%).

Discussion:

Fracture and fracture dislocations of the thoracolumbar spine are the most commonly occurring types of osseous spine injury. In developed countries such injuries mainly occur in association with motor vehicle accidents and falls[5,9], while in the developing world they are primarily the result of a fall from height[4,19]. The advantage of an operative procedure for treating these injuries is the immediate stabilization of the injured spine and an indirect or direct decompression of the neural structures. Operative stabilization enables early mobilization without a heavy and uncomfortable cast and clearly shortens the hospital stay[4,5.7.9]. The indication for an operative stabilization in patients with unstable spine injuries and complete paraplegia is the prospect of early rehabilitation and a reduced burden to the care-giver.

The age ranged from 19 to 75 years, and there were 73 males and 22 female patients. Road traffic accident was the most common cause of injury.

The bulk of the patients were of degenerative diseases (80%) followed by injury (15.80%) Following a routine examination and X-ray of the spine, MRI of the involved level and adjacent vertebrae was carried out. Computed tomography (CT) scan was ordered in fractures and suspected ossified posterior longitudinal ligament (OPLL) cases.

In our hospital short segment fixation is practiced. Short segment fixation immobilizes less motion segments, so the mobility of the spinal column is hardly affected. Operative stabilization of the patients reported in this study was based on the radiological criteria of more than 50% loss of vertebral height and listhesis 50% or more, as has been adopted by many surgeons[4,16].

The most common fracture pattern in our study was unstable burst fracture, as revealed in the CT scan by subluxation of one or more facet joints, fracture of one or more neural arches or gross displacement of the neural elements[17]. The second most common pattern was translational injuries, usually involving the thoracolumbar junction. The CT reconstruction characteristically showed the malalignment. There were two vertebral body outlines at one level, referred to as the double margin sign[18]. Flexion distraction injury was another pattern of fracture which showed a characteristic, so-called naked facet sign on the CT scan[23]. Unstable burst fractures and, in particular, translational injuries were associated with severe neurological involvement. Nam-Hyun et al[21]. also reported a high degree of neurological involvement in patients with posterior element involvement – i.e. burst fractures and rotational injuries. Most of our patients with severe neurological involvement had a fall from trees.

The improvements observed in the radiological parameters (vertebral body height, listhesis) measured in the immediate post-operative period and at the final follow-up are, with a few exceptions, comparable with those reported elsewhere[4,5,9].After an initial substantial correction, there was a gradual partial loss of correction, leaving an overall loss of kyphosis at the final follow-up. The loss of initial correction after pedicle screw fixation has been reported by many authors. Although a good correction of kyphosis and

restoration of vertebral body height is achieved by surgery, most is lost during the long-term follow-up period. This loss of correction and the failure of the implant are more common in spine fractures repaired with pedicle screws[2,5] than in those in which anterior grafting and instrumentation are used[7,13,14], reported due to the failure of posterior instrumentation to support the anterior column.

Neurological recovery has been reported with early stabilization of thoracolumbar spinal fractures[9]. The highest recovery rates have been reported for patients operated within 8 hours of the initial trauma, while high remission rates have been reported for patients operated on within 48 hours of the initial trauma. After this time there is no significant difference in the neurological outcome with respect to the timing of operation after the trauma. As with all surgical implants, failure of the instrumentation with subsequent loss of reduction is of utmost concern. We had a significant number of implant failures in the form of loose, bent and broken screws. Almost all of the implant failures in our study occurred at the thoracolumbar junction. Krag[15] has suggested segmental pedicle fixation two levels above the kyphosis to avoid such implant failures. We believe that this technique should be used at the thoracolumbar junction where compression forces act more anteriorly. Another pedicle-related concern, which has been reported to occur in between 10 and 28.8% of cases[15], is screw misplacement. 2.10%of our screws, as evident from post-operative radiographs, were misplaced, and all of these eventually failed.

Conclusion:

Where as early (within hours of the initial trauma) or immediate (within 48 h) stabilization and indirect or direct decompression is a distant dream in our surgical set-up (and, we believe, in most of the developing countries), even delayed stabilization of the unstable spine has benefits. However, the number of complications remains worrisome; this is particularly true with respect to hardware failure.

References:

1. Bedbrook GM (1975) Treatment of thoracolumbar dislocations and fractures in paraplegia. Clin Orthop 112:27–43
2. Benson DR, Burkus JK, Montesano PX et al (1992) Unstable thoracolumbar and lumbar burst fractures treated with the AO Fixateur interne. Spinal Disord 5:335–343
3. Bradford DS, Akbarnia BA, Winter RB, Seljeskoj EL (1977) Surgical stabilisation of fractures and fracture-dislocations of the thoracic spine. Spine 2:185–186
4. Chadha M, Bahadur R (1998) Steffee variable screw placement system in the management of unstable thoracolumbar fracture. A third world experience. Injury 29:737–742
5. Carl AL, Tromanhauser SG, Roger DJ (1992) Pedicle screw instrumentation for thoracolumbar burst fractures and fracture dislocations. Spine 17:5317–5324
6. Denis F, Armstrong GWD, Searl K, Matta L (1984) Acute thoracolumbar burst fractures in the absence of neurological deficit. A comparison between operative and non operative treatment. Clin Orthop 189:143–150
7. Erbil A ,Sukru SA, Mert TM, Teoman BI, Mahmut K (1999) Z-Plate instrumentation in thoraco-lumbar spinal fractures. Bull Hosp Joint Dis 58:92–97
8. Frankel HL, Hancock DO, Hyslop G, Melzak J, Michaelis LS, Ungar GH, Vernon JDS, Walsh JJ (1969) The value of postural reduction in the initial management of closed injuries of the spine with paraplegia and tetraplegia. Part I. Paraplegia 7:179–192
9. Gaebler C, Maier R, Kutscha-Lissberg F, Mrkonjic L, Veesei V (1999) Results of spinal cord decompression and thoracolumbar pedicle stabilisation in relation to the time of operation. Spinal Cord 37:33–39
10. Gurwitz GS, Dawson JM, McNamara MJ et al (1993) Biomechanical analysis of three surgical approaches for lumbar burst fractures using short segment instrumentation. Spine 18:977–982
11. Haher TR, Bergman MO, Brien M et al (1991) The effect of three column of spine on the instantaneous axis of rotation in flexion and extension. Spine 16:S312–S318
12. Jacobs RR, Asher MA, Snider RK (1980) Thoracolumbar spinal injuries. A comparative study of recumbent and operative treatment in 100 patients. Spine 5:463–477
13. Kaneda K, Abumi K, Fujiya M (1984) Burst fractures with neurologic deficits of the thoracolumbar-lumbar spine: results of anterior decompression and stabilisation with anterior instrumentation. Spine 9:788–795
14. Kaneda K, Taneichi H, Abumi K, Hashimoto T, Satob S, Fujiya M (1997) Anterior decompression and stabilisation with the Kaneda device for thoracolumbar burst fractures associated with neurological deficits. J Bone Jt Surg 79A:69–83
15. Krag MH (1991) Biomechanics of thoracolumbar fixation: a review. Spine 16:S84–S99
16. Mikles MR, Stchur RP, Graziano GP (2004) Posterior instrumentation of thoracolumbar fractures. J Am AcadOrthop Surg 12:424–435
17. McAfee PC, Hansen A, Yuan HA et al (1983) The value of computed tomography in thoracolumbar fractures. J Bone Jt Surg 65A:461–473

18. McAfee PC, Yuan HA (1982) Computed tomography in spondylolisthesis. Clin Orthop 166:62–71

19. Mehemet TR, Erden E, Cagaty O, Irfan O, Unal K (2005) Conservative treatment of fractures of the thoracolumbar spine. Int Orthop 29:78–82

20. Nagel DA, Koogle TA, Piziali RL et al (1981) Stability of upper lumbar spine following progressive disruption and the application of individual internal and external devices. J Bone Jt Surg 63A:62–70

21. Nam-Hyun K, Hwan-Mo L, InMo C (1999) Neurological injury and recovery in patients with burst fractures of the thoracolumbar spine. Spine 24:290–294

22. Nash CL, Schartzinger LH, Brown RH et al (1977) The unstable thoracic compression fracture: its problems and the use of spinal cord monitoring in the evaluation of treatment. Spine 2:261–265

23. O'Callaghan JP, Ullenich CG, Yuan HA (1980) ct of facet distraction in flexion injuries of the thoracolumbar spine. The "naked" facet. Am J Neuroradiol 1:97.