Original Research Article

A study on short segment fixation for thoraco-lumbar fractures

Abstract

Background – Spine injury is being one of the commonest injuries which pose challenges to the patients and treating clinician as well. Despite so many researches and recent advances there has not been unanimous consensus regarding management of spinal injuries. However, the treatment aim of every injury to spine is restoring of max possible function in patients. This study was conducted to assess the outcome of short segment fixation in fractures of thoraco-lumbar spine.

Method & Material – This is a prospective cohort study done at our Tertiary Center during the period from April 2018 To September 2020. Patients of thoraco lumbar spine injuries were, included in the study. Study on short segment pedicle screw fixation and inter- transverse fusion for single level acute thoraco-lumbar fracture.

Result – Mean age of the sample size was40.58 year with male preponderance. The FRANKEL SCALE was used to grade the pre-op neurology; 17.2% were graded as E, 24.1% as D, 31 % as C, 13.8 % as B, and 13.8% A. ASIA motor and sensory score preoperative and post operative at one year follow up was compared was found to be significant ($p<0.05$). Preoperative VAS and Functyional independent measures also showed significant improvement.

Conclusion – Surgical stabilization and decompression is essential strategy for further neuroprotection and recovery after spine injury.Short segment fixation can be

an option for thoracollumbar fracture. However, unstable fracture may require extended fixation.

Keywords: spinal cord injury, thoraco-lumbar, fracture, fixation

INTRODUCTION

Most commonly affected group by spinal cord injuries (SCI) are young males, having a M:F = 4:1, with average age of 30 years.[1,2] The commonest etiology of these injuries are motor-vehicular accidents, accounting for almost half of all injuries. Classifying site wise, SCIs are most commonly encountered in cervical spine followed by thoraco-lumbar segment.

The treatment aim of every SCI is restoring of max possible function in patients, helping them lead a disability free life. For these patients the treatment aims at protection of healthy neural tissues, recovering of damaged cord and nerves, and providing optimum positioning for the muscle & bone to recover. Surgical stabilization of the spine prevents any more mechanical injury to the already injured cord. Surgical treatment gives the benefit of: (a) immediate stabilization of the spine, (b) deformity correction, and (c) aid to improvement of neurology by relieving any residual compression of the neural tissue.

This study aimed at obtaining clinical, functional and radiological results of the short-segment-fixation (SSF) for thoraco-lumbar (TL) fractures and to assess the advantages and complications of SSF with intertransverse fusion in TL fractures.

METHOD & MATERIALS –

This is a prospective cohort study done at our Tertiary Center during the period from April 2018 To September 2020. Patients with clinical and radiological diagnosis of traumatic thoraco-lumbar SCIs were, enrolled in the study. A detail medical history was taken, Detail physical and neurological examination of the patient was done as per the department protocol. The ASIA impairment scale and Frankel grading system were used for neurological charting. Radiological examination of the patient was done consisting of plain radiograph antero-posterior and lateral view. Fractures were classified using Magrel classification system. MRI was done to evaluate the injury to the neural structures and thecal sac compression due to hematoma or retropulsed bony fragments. Computed Tomography was used optionally to classify the fracture, calcified ligaments, which need to be decompressed surgically and to evaluate bony compression or retropulsed fragment in the canal.For Dorsolumbar spine injuries- Posterior decompression and stabilization was done with Pedicle screw fixation and fused with intertransverse fusion.

OBSERVATION & RESULTS -

Total 40 patients of thoraco-lumbar spine fracture presented to our hospital during the study duration.Out of 40 cases 5 had associated head injuries, 3 patients denied for surgical intervention, 2 patients had associated fractures of other bones, were excluded. Rest 29 patients were included. One patient died on 16th week of follow up.

All the patients presented in accident and emergency department were initially managed as per the ATLS protocol. This study had an average age of 40.58 years with Male dominance.

Most common etiology was fall from height followed by motor-vehicular accidents.

Table 1 - Correlation of type of fracture with Frankel scale

Fracture Type	Frankel Scale					
	A	B	C	D	E	Total
Anterior wedge compression fracture	1	3	3	2	4	13
Burst fracture	3	1	6	5	0	15
Incomplete burst fracture	0	0	0	0	1	1
Total	4	4	9	7	5	29

There was no statistical evidence to conclude that the Frankel scale can be related with particular type of fracture ($p>0.05$)

There was no statistical evidence to conclude that the ASIA motor score can be related with particular type of fracture. (p value >0.05)

	Mean difference	Standard Deviation	Standard Error Mean		
ASIA MOTOR on admission - ASIA-MOTOR after 1 year	-11.71	12.77	2.41	-4.854	.000
ASIA SENSORY- LIGHT TOUCH on admission - ASIA SENSORY - LIGHT TOUCH after 1 year	-8.57	12.71	2.40	-3.56	.001
ASIA SENSORY - PINPRICK on admission - ASIA SENSORY- PIN PRICK after 1 year	-6.21	8.49	1.60	-3.86	.001
VISUAL ANALOGUE SCALE on admission - VISUAL ANALOGUE SCORE after 1 year	8.14	1.53	0.28	28.11	.000
FIM on admission - FIM after 1 year	-39.14	12.36	2.3	-16.74	.000
ANGLE OF ANTERIOR WEDGE (in degree) on admission - after 1 year	8.46	6.49	1.22	6.89	.000

Table 2 - Paired t test of variable at admission and at 1 year follow-up

The ASIA motor score preoperative and post operative at one year follow up was evaluated by paired-'t'-test, and was calculated to be significant ($p<0.05$). ASIA sensory light touch, ASIA sensory Pin prick, Visual analogue scale, Functional Independence Measure, and Anterior wedge angle, assessed pre-op, post-op and at one year follow up were evaluated & found to be significantly improved ($p<0.05$).

The relation of type of fracture with vertebra affected was evaluated statistically. The proportion of patients with hardware loosening had no correlation with level of vertebra involved. (p-value > 0.05)

DISCUSSION

Management of the spinal injury is very challenging at the same time quite often frustrating. The definite protocol for management of spine injuries is yet to be established. These patients require individualized care for their rehabilitation and can be achieved at full-fledged spinal center.

This study had an average age of 40.58 years with male dominance, which is comparable to other studies. The explanation to this can be that, the young- middle age group of population are often indulge in outdoor activities. [1,2]

In our study there is male predominance of the patients, which is comparable to most of the studies. This is again in agreement with world literature and can be explained by the simple fact that majority of male are bread winner of the family, for which they have to travel, work in industries etc and so they tend to get more injuries. [1,2]

Most of the patients who had fall were labor by occupation. This can be explained that the fall from height could be related to safety measures they had while working on site.

Our study maximum number of patients had fracture of Thoraco-lumbar junction (T11- 10.3%, T12- 27.5%, L1- 31.3%, L2- 24.1%). Chung OM [3] reported that the most common site of involvement were L1 (35 cases) and L2 (31 cases), Dr.Nitin Kansal et al [4] and N Basheer et al [5]also found L1 vertevbra to be commonly involved in thoracolumbar spine injuries. Roman Pfeifer et al [6] noted that most patients had an isolated vertebral body fracture at thoraco-lumbar junction (L1 and D12). Alvine et al [11] found that 70% of fractures were between the level of T11 – L2; Sasso et al [7] and Razak et al [8] had similar findings with 80% and 92% fractures were between the level of T11 – L2, respectively.

The predilection of fracture for this area is due to 3 reasons.[1, 2]

(a) Curvature of spine changes from kyphosis to lordosis and hence concentration of forces occurs.

(b) This is the junction of fixed and mobile region with loss of stabilizing effect of rib cage obliterates

(c) Increased sagittal plane mobility due to sagittal orientation of facet joints.

In our study 44.82% of patients were having wedge compression fracture out of which 30.76% were having bowel and bladder involvement and burst fracture was reported in 51.72% of patient with 40% of patient having bowel and bladder involvement. However there was no statistical correlation between type of fracture and bowel and bladder involvement.

In our study there were13.7 % of thoracic spine injury, 27.5% of lumbar spine injury and 58.6% of thoracolumbar junction injury with burst fracture common at lumbar spine and anterior wedge compression at thoracolumbar junction. About the level of injury, M. Reinhold et al [9] found thoracic spine fractures in 19.8%, lumbar spine fractures in 13.2%, and thoraco-lumbar junction fractures in 67.0%. The

fracture type varied with spinal region involved, with thoracic spine having more B and C type injuries (Magerl classification).

As per the Frankel scale for neurology, pre operatively 13.8% were grade A, 13.8 % grade B, 31 % as grade C, 24.1% as grade D and17.2% as grade E.

In this study, at 1 year follow up, 3.57% were grade A, 10.7% B, 7.14% C, 14.28% D and 64.28% E.

Razak M et al [8], found that 64.4% of patients with incomplete lesions improved by at least 1 grade. Sasso et al [7], noted that patients having incomplete neurology deterioration had improvement of at least 1 grade. Alvine et al.[11], documented the neurology improvement being seen in half of the cases. Nasser R et al.[10], found neurology loss patients exhibited minimum improvement of 1 grade on the last follow up.

In the present study the average regional angle during pre operative stage was 14.344º and 2.068º post-op and 5.75º on last follow up. Here are the kyhotic angle readings for other similar studies:

Table 3: Kyhotic angle readings

	Kyphotic Angle (in degree)		
Study	Pre-op	Post-op	At 1 year
Current Study	14.344	2.068	5.75
Nasser MG et al [12]	23.6	7	11.5
Alvine et al.[7]	12	1	6
Razak M. et al.[7]	20	7	9

In this present study the mean VAS score pre-op was 9.0, 7.48 post-op, and 0.857 at 1 year follow up. Adalberto Bortoletto et al [13] found the mean VAS was 7 pre-op, 6 at 1 month post-op and, 4 at 6months post-op.

In our study the mean FIM on admission was 66.57 and at one year of follow-up was 105.714 with mean improvement of 93.14. Significant improvement was noted in all the patients. However, the functional betterment was more in patients with time between injury and surgery was less. Gelson Aguiar da Silv et al [14] found that more severe injuries, gained functionality more comparatively ($p<0.05$). The mean FIM gain seen in various levels, from lowest to highest, was: thoracic, thoraco-lumbar junction and lumbar.

Conclusion

It can be concluded that SSF can be a good choice for fixation of thoracolumbar fracture fixation especially for stable type. However, loss of kyphosis corrections are commonly seenwith unstable thoracolumbar fracture fixation.

Reference –

1. Parsons KC. The impact of spinal cord injury on long-term survival. J Insur Med 1991;23(4):227
2. Parsons KC, Lammertse DP. Rehabilitation in spinal cord disorders. 1. Epidemiology, prevention, and system of care of spinal cord disorders. Arch Phys Med Rehabil 2005;72(4-S):S293“S294
3. Chung OM. Epidemiology of acute thoracolumbar fractures of young adults in Hong Kong. Hong Kong Journal of Orthopaedic Surgery 2001;5(1):40-46

4. Dr.NitinKansal, Dr.Atul Agrawal. Management of unstable Dorsolumbar spine injuries with transpedicular rod and screw fixation. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS) e-ISSN: 2279-0853, p-ISSN: 2279-0861. Volume 4, Issue 3 (Jan.- Feb. 2013), PP 77-81
5. N Basheer MS, Deepak Gupta M Ch, GD Sathyarthi M Ch, Deepak Aggarwal MCh, S.Sinha M Ch, BS Sharma M Ch, AK Mahapatra M Ch. Unstable Dorsolumbar fractures: A prospective series of 94 cases. Indian Journal of Neurotrauma (IJNT) 2010,VOL 7,No.1,pp55-60.
6. Roman Pfeifer, Miguel Pishnamaz, Derek Dombroski, Nicole Heussen, Hans-ChristophPape and Bernhard Schmidt-Rohlfing. Outcome after thoracoscopic ventral stabilisation of thoracic and lumbar spine ractures. Journal of Trauma Management & Outcomes 2012, 6:10
7. Sasso RC, Cotler HB, Reuben JD: Posterior Fixation of Thoracic and Lumbar Spine Fractures using DC Plates and Pedicle Screws. Spine 16:S134-S139, 1991
8. Razak M, Mahmud MM, S.A. Hyzan MY, Omar A, Short segment posterior instrumentation, reduction and fusion of unstable thoracolumbar burst fractures – a review of 26 cases, Med J Malaysia, 2000, Sep, 55 Suppl, C: 9 – 13.
9. M. Reinhold • C. Knop • R. Beisse • L. Audige´ • F. Kandziora • A. Pizanis • R. Pranzl • E. Gercek • M. Schultheiss • A. Weckbach • V. Bu¨hren • M. Blauth. Operative treatment of 733 patients with acute thoracolumbar spinal injuries: comprehensive results from the second, prospective, internet-based multicenter study of the Spine Study Group of the German Association of Trauma Surgery. Eur Spine J (2010) 19:1657–1676 DOI 10.1007/s00586-010-1451-5
10. Nasser R, Yadla S, Maltenfort MG, Harrop JS, Anderson DG, Vaccaro AR, Sharan AD, Ratliff JK. J Neurosurg Spine. 2010 Aug; 13(2):144-57. Review.

11. Alvine GF, Swain JM, Asher MA, Burton DC. Treatment of thoracolumbar burst fractures with variable screw placement or Isola instrumentation and arthrodesis: case series and literature review. J Spinal Disord Tech. 2004; 17(4):251-264.
12. Nasser R, Yadla S, Maltenfort MG, Harrop JS, Anderson DG, Vaccaro AR, Sharan AD, Ratliff JK. J Neurosurg Spine. 2010 Aug; 13(2):144-57. Review.
13. Adalberto Bortoletto1, LuizCláudioLacerda Rodrigues2, Marcelo Hide Matsumoto3. Evaluation of Surgical Treatment of Fractures of Thoracolumbar Spine with Third-Generation Material for Internal fixation. Rev Bras Ortop. 2011;46(3):299-304
14. Gelson Aguiar da Silva2, Soraia Dornelles Schoeller3, Francine Lima Gelbcke4, Zuíla Maria Figueiredo de Carvalho5, Evelise Maria de Jesus Paula da Silva6. FUNCTIONAL ASSESSMENT OF PEOPLE WITH SPINAL CORD INJURY: USE OF THE FUNCTIONAL INDEPENDENCE MEASURE – FIM1. Text Context Nursing, Florianópolis, 2012 Oct-Dec; 21(4): 929-36.

Figure Legends

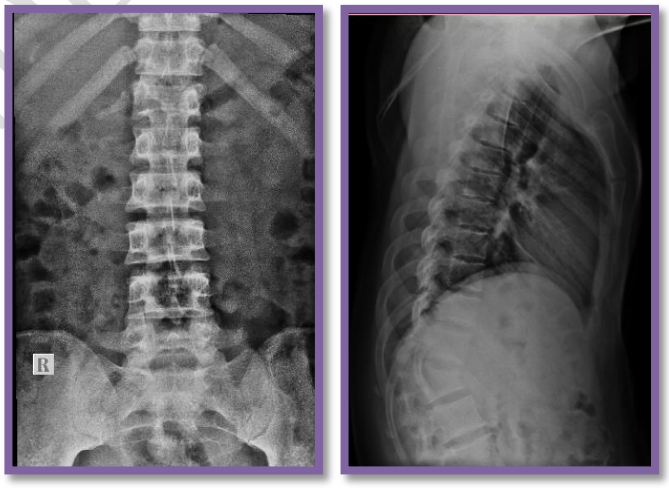

Figure 1 – Pre – operative X – ray of Spine Suggestive of Fracture

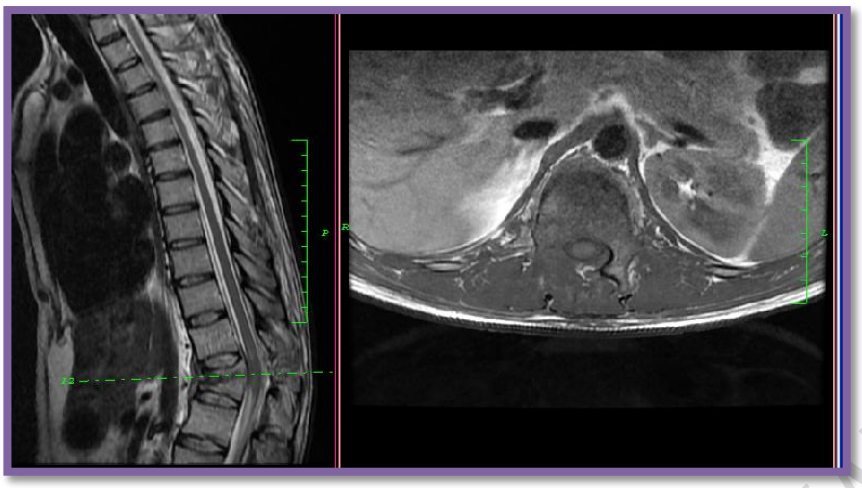

Figure 2 – Pre – operative Magnetic Resonance of Spine

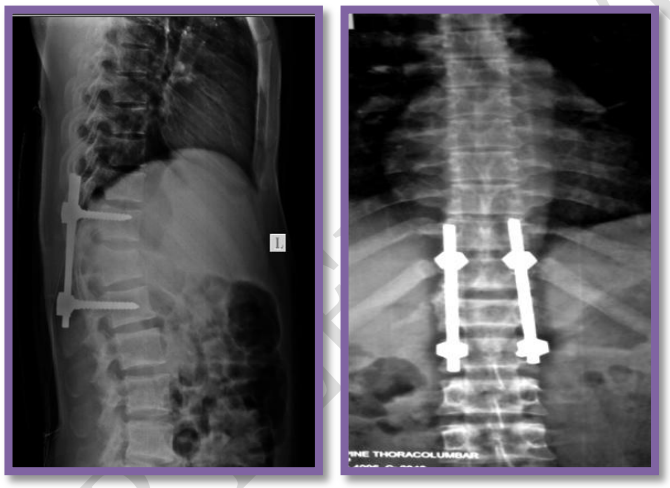

Figure 3 – Immediate Post – operative X – ray of Spine