ORIGINAL RESEARCH KERALA MEDICAL JOURNAL

Neurological Deficits in Thoraco-Lumbar Burst Fractures: A Descriptive Study

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ABSTRACT

Published on 23rd September 2019

Background: The majority of spinal fractures are found to occur in the thoraco-lumbar region, presumably as a result of transition from the relatively immobile thoracic spine to the mobile lumbar spine. The neurological deficits (ND) depend on the involvement of the cord, conus medullaris, or cauda equine. This is to study the patterns of spinal fractures and associated neurological deficit. Also to assess the spectrum of ND as assessed by Frankel's grading.

Materials & Methods: Data based descriptive study on patient came to orthopedic department in a tertiary care centre Kerala, India. Among 604 cases of vertebral fractures reported between Jan 2007 to April 2014 were studied and 260 cases of thoraco-lumber and lumber fractures were selected. 45 cases out of 58 cases of burst fracture of thoraco-lumbar and lumbar spine were included for analysis neurological deficit.

Result: 57.8% burst fracture of thoraco-lumber and lumber and lumber belongs to subtype-B of Denis classification. 57.8% patients had incomplete neurological deficit and 22.2% patients had complete neurological deficit at the time of admission.

Conclusion: Denis type-B is the commonest subtype of burst fracture of thoraco-lumbar and lumbar burst fractures, and type-C is rarely seen. Majority of the patients have incomplete neurological deficit at the time of admission.

Keywords: Burst Fracture, Vertebra, Spinal, Neurological Deficit, Lumbar Fracture

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BACKGROUND

The majority of spinal fractures are found to occur in the thoraco-lumbar region (T10-L3), presumably as a result of transition from the relatively immobile thoracic spine to the mobile lumbar spine.[1,2] Types of spinal fracture include the compression, burst, flexion-distraction, and fracture-dislocation injuries. Burst fractures which predominantly affects young men[3,4] and forms around 10-20% of all spine fractures,[5-7] are the most challenging and devastating form of spinal injury which contributes to extensive neurological deficits (ND) and disability.[4] Majority of burst fractures are also seen to occur in thoraco-lumbar region.[5] The neurological deficits of which depends on the involvement of the cord, conus medullaris, or cauda equine.[7]

Many authors have tried to correlate the amount of ND to various radiological parameters, like kyphosis in X-ray and Computerised Tomography,[8] canal compromise in CT,[7] retropulsed bone fragment in digitized CT scan,[9] and did not achieve convincing results. This has led to more extensive research into the etiopathogenesis of neurological deficits.[10,11] Despite of a deeper understanding of burst fractures of thoraco-lumbar and lumbar spine and great interest in their management, there are many unanswered questions. The relationships between the musculoskeletal injury and neurologic deficit have not been clearly defined, although attempts at determining these relationships have been undertaken.[12-14]

This is to study the patterns of spinal fractures and associated neurological deficit. Also to assess the spectrum of ND as assessed by Frankel's grading,[15] and the level and type of Burst fracture as described by Denis.[16]

MATERIALS AND METHODS

This study was a data based descriptive study on 45 cases of burst fracture of thoraco-lumbar and lumbar burst fracture. Total 260 cases of thoraco-lumbar fracture and lumbar fracture cases out of the 604 cases

Cite this article as: Krishnan J, Raffic M. Neurological Deficits in Thoraco-Lumbar Burst Fractures: A Descriptive Study. IMA Kerala Medical Journal. 2019 Sep 23;12(3):63–6.

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of spinal fractures reported during the study period. Among 58 cases of thoraco-lumber and lumbar burst fractures 45 cases were analysed for neurological deficit. 13 cases of patients with multiple level fractures & Pathological burst fractures and those who expired during the hospital stay were excluded from analysis for neurological deficit. The study was conducted in orthopedic department of a tertiary care centre in Trivandrum, Kerala, between January 2007 and April 2014.

The diagnosis of burst fracture was reached when radiological assessment of fractures showed an increased interpedicular distance in Antero-posterior view and reduced posterior vertebral body height in the lateral projection. Neurological status documented according to American injury Association's modified Frankel grading of traumatic parapelegias. Burst fractures were sub-classified according to Denis classification. The percentage of reduction of anterior or posterior body heights, and degree of Cobbs angle/ kyphotic angle were noted in the lateral projection. Burst fracture with multiple level fractures & pathological burst fractures, and those who expired during the hospital stay were excluded from the study. Percentage of increase in inter-pedicular distance was noted in anterior-posteior view.

Informed ethical clearance was obtained from institutional ethical committee. The data collected were entered in excel sheet and analysed using SPSS software. Fisher exact test was used to compare the severity of neurological deficit with the level of fracture and ANOVA test was done to look for association between the kyphotic angle and neurological deficit.

RESULT

Out of the 604 cases of vertebral fractures reported in the study period, thoraco-lumbar constitutes 32% and lumber constitute 11.1% of the vertebral fractures **(Table 1).**

Table 1. Distribution of vertebral fractures.

Vertebral Segments	No. of Cases	Percentage
Cervical spine	192	31.8
Thoracic spine	145	24
Thoraco-lumbar spine	193	32
Lumbar spine	67	11.1
Sacral	5	0.8
Coccyx	2	0.3
Total	604	100

Table 2. Distribution of thoraco-lumbar and lumbar fracture

Fracture type	Number of case	Percentage
Wedge compression	73	28.1
Burst fractures	58	22.3
Fracture dislocation	37	14.2
Pathological fractures	29	11.2
Translational injury	24	9.2
Multiple fractures	18	6.9
miscellaneous	21	8.1
Total	260	100

Among 604 cases of total spinal fractures, 260 cases (41.7%) had fractures at thoraco-lumbar and lumbar spine levels (T11-L5), and out of this 206 such cases 58 cases had burst fractures **(Table 2).**

Out of the 45 cases selected from the total of 58 cases of burst fracture 39 (86.7%) cases involves thoraco-lumbar spine and 6 (13.3%) cases involves lumbar spine. Among the 45 cases of burst fracture, 36 (80%) were males and 9 (20%) were females. The mean age at the time of injury was 36.2 years, and ranges from 17 to 68 years. Fall from height was the most common cause of burst fracture, 80% cases **(Table 3).**

Table 3. Causes of burst fracture

Causes	Frequency	Percentage
Fall from height	36	80%
Road traffic accident	6	13.3%
Fall of heavy object	3	6.7%
Total	45	100%

The anatomical distribution of burst fractures, the commonest vertebral involved was that of L1, 53.3% of cases (**Table 4).**

Table 4. Anatomical distribution of burst fractures

Level of fracture	Frequency	Percentage
T11	1	2.2%
T12	11	24.4%
L1	24	53.3%
L2	3	6.7%
L3	5	11.1%
L4	0	0%
L5	1	2.2%
Total	45	100%

Among 45 burst fractures, 26 (57.8%) belongs to subtype-B of Denis classification. There were no patients with subtype-C burst fracture **(Table 5).**

Table 5. Distribution based on Denis type

Denis type	Frequency	Percentage
A	11	24.4%
B	26	57.8%
C	0	0%
D	4	8.9%
E	4	8.9%
Total	45	100%

Neurological status at admission was assessed using Frankel's grading. 9 (20%) patients were neurologically intact, Frankels grade E. 26 (57.8%) patients had incomplete neurological deficit while 10 (22.2%) patients had complete neurological deficit **(Table 6).**

Kyphotic deformity ranged from 50-350 with a mean value of 16.74 in the thoraco-lumbar spine and 10.17o in lumbar spine respectively. In lumbar spine (L3–L5), the range of kyphotic deformity was 50-160. The difference between kyphotic deformity in thoraco-lumbar and lumbar spine was statistically significant ($t=2.137$; $P<0.05$).

DISCUSSION

The thoraco-lumbar junction is a mechanical transition zone between the relatively fixed thoracic region and the mobile lumbar spine. The resultant forces following trauma, hence, are centered over this region and results in greater incidence of fractures. In our study, 86.7% of burst fractures occurred at thoraco-lumbar level, T11-L2. The greater frequency of burst fractures in thoraco-lumbar spine has been found by Muford et al and Gertzbain.[17,18]

The commonest burst fracture subtype in this study was found to be Denis type-B, which constitute 57.8% of all burst fractures. This fracture has been called 'Classical' burst fracture, due to its similarity with the type of burst fracture that was explained by Holdsworth.[18] The subtype-C burst fracture is theoretically presumed as reported in Atlas et al's study,[19] and no such cases were identified in this study also.

The spinal canal in thoraco-lumbar spine is of intermediate size, and contains elements of the distal spinal cord, the conus medullaris, and the upper cauda equine. In contrast the neural canal in lumbar area contains roots and not cords. In addition, the proportion of neural contents to spinal canal decreases distally and

Table 6. Burst fracture based on Frankel Grade at Admission

Frankel Grade at Admission	Cases of Burst fracture			
	Thora-columbar spine	Lumbar spine	Total	Percentage
A	9	1	10	22.2
B	6	0	6	13.3
C	14	3	17	37.8
D	3	0	3	6.7
E	7	2	9	20
Total	39	6	45	100

occupies only about 30% if the canal in the low lumbar spine.[20] In our study, 9 (20%) patients had no neurologically deficit (Frankels grade E), and 7 of these 9 patients had fracture at thoraco-lumbar spine.

Kyphotic deformity of thoraco-lumbar spine found in this study was 16.740 and lumbar spine was 10.170. This supports the view of Chan et al, who stated that the overall degree of kyphosis in lumbar spine is small, due to normal lumbar lordosis.[20]

The neurological deficit may be related to the impact at the time of injury and aggravated by involvement of other factors which propagate neurological deficit even though bony encroachment of the neural canal is negligible, such as cord oedema and haematoma compressing the spinal cord.

CONCLUSION

Denis type-B is the commonest subtype of burst fracture of thoraco-lumbar and lumbar burst fractures, and type-C is rarely seen. Majority of the patients have incomplete neurological deficit at the time of admission. The degree of kyphotic deformity and in lumbar burst fractures were smaller when compared to thoraco-lumbar burst fracture.

END NOTE

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Conflict of Interest: None declared

REFERENCES

1. DENIS CLASSIFICATION [Internet]. [cited 2014 Jun 10].
2. Spinal Dislocations. 2012 Nov 6 [cited 2014 Jun 10]
3. Parizel PM, van der Zijden T, Gaudino S, Spaepen M, Voormolen MHJ, Venstermans C, et al. Trauma of the spine and spinal cord: imaging strategies. Eur Spine J. 2010 Mar;19(Suppl 1):8–17.
4. Briem D, Behechtnejad A, Ouchmaev A, Morfeld M, Schermelleh-Engel K, Amling M, et al. Pain regulation and health-related quality of life after thoraco-lumbar fractures of the spine. Eur Spine J. 2007 Nov;16(11):1925–33.
5. Gnanenthiran SR, Adie S, Harris IA. Nonoperative versus Operative Treatment for Thoraco-lumbar Burst Fractures Without Neurologic Deficit: A Meta-analysis. Clin Orthop. 2012 Feb;470(2):567–77.
6. Defino HLA, Canto FR. Low thoracic and lumbar burst fractures: radiographic and functional outcomes. Eur Spine J. 2007 Nov;16(11):1934–43.
7. SP Mohanty. Neurological deficit and canal compromise in thoraco-lumbar and lumbar burst fractures .Journal of Orthopaedic Surgery 2008;16(1):20-3. 2008. 16(1):20–3.
8. Ulmar B, Brunner A, Guhring M, Schmalzle T, Weise K, Badke A. Inter- and intraobserver reliability of the vertebral, local and segmental kyphosis in 120 traumatic lumbar and thoracic burst fractures: evaluation in lateral X-rays and sagittal computed tomographies. Eur Spine J. 2010 Apr;19(4):558–66.
9. Wessberg P, Wang Y, Irstam L, Nordwall A. The effect of surgery and remodelling on spinal canal measurements after thoraco-lumbar burst fractures. Eur Spine J. 2001 Feb;10(1):55–63.
10. Hasler RM, Exadaktylos AK, Bouamra O, Benneker LM, Clancy M, Sieber R, et al. Epidemiology and predictors of spinal injury in adult major trauma patients: European cohort study. Eur Spine J. 2011 Dec;20(12):2174–80.
11. Hoshino M, Nakamura H, Terai H, Tsujio T, Nabeta M, Namikawa T, et al. Factors affecting neurological deficits and intractable back pain in patients with insufficient bone union following osteoporotic vertebral fracture. Eur Spine J. 2009 Sep;18(9):1279–86.
12. Sjostrom L. Karlstrom G, Pech P, Rauchning W: Indirect spinal canal decompression in burst frctues treated with pedicle screw instrumentation. Spine 1996 : 21: 113-123.
13. Gertzbein SD : Multicentre spine fracture study. Spine 1992: 17: 528-540.
14. Herndon WA, Galloway D: Neurological return versus cross - sectional canal area in incomplete thoraco-lumbar spinal cord injuries. The Journal of Trauma 1988; 28: 680 - 683.
15. Mohanty SP, Venkatram N. Does neurological recovery in thoraco-lumbar and lumbar burst fractures depend on the extent of canal compromise? Spinal Cord. 2002 Jun;40(6):295–9.
16. Denis F. Spinal instability as defined by the three-column spine concept in acute spinal trauma. Clin Orthop. 1984 Oct;(189):65–76.
17. Mumford J, Weinstein JN, Spratt KF, Goel VK: Thoraco-lumbar burst fractures: The clinical efficacy and outcome of nonoperative management Spine 1993; 18: 955 - 970.
18. Holdsworth FW: Fractures, dislocations and fracture dislocations of spine. Journal of Bone and Joint Surgery 1963; 45-B: 6-20
19. Atlas S W. Regenebogen V, Rogers LF, Kim KS : The radiographic characterization of burst fractures of the spine. American Journal of Radiology 1986; 147 : 575- 582.
20. Chan DPK. Seng NK. Kaan KT. Nonoperative treatment in burst fractures of the lumbar spine (L2 - L5) without neurological deficits. Spine 1993 ; 18 : 320-325.