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Evaluation of Posterior Element Injury in Traumatic Thoraco-Lumbar Burst Fractures[1]

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Purpose : The purpose of this study is to examine the frequency of posterior element injury in patients with traumatic thoraco-lumbar burst fractures and to evaluate the correlation between the MR imaging and CT findings.

Materials and Methods : The MR images of 38 patients with 39 thoraco-lumbar burst fractures and the results of the CT examinations of 28 patients with 29 fractures were retrospectively analyzed. Both procedures were performed within two weeks of injury. Twenty-one males and 17 females were included ; their average age was 51.3 (range, 11-75)years. MR images were evaluated for injury to the posterior ligamentous complex, comprising the supraspinous ligament(SSL), the interspinous ligament(ISL), the flaval ligament(FL), and the capsule of facets. Analysis of the CT findings focused on the posterior bony elements of the lamina, pedicle, spinous process, and facet joint.

Results : MR imaging revealed posterior ligamentous injuries in 18(46.2%) of 39 burst fractures ; there was tearing of the ISL in 15 cases(38.5%), of the SSL in 11(28.2%), of the capsule of facets in 11(28.2%), and of the FL in nine(23.1%). Among the 29 burst fracture cases examined by CT, posterior bony injuries were detected in 13(44.8%). Lamina and facet joint fractures were detected in six cases(20.7%), facet separation or dislocation in six(20.7%), and spinous process and pedicle fracture in one(3.4%). In 29 burst fracture cases, both MRI and CT were performed. Among the 18 cases in which MR imaging revealed posterior ligamentous injuries, CT failed to demonstrate posterior element fractures in seven. On the other hand, among the 13 cases in which CT indicated posterior bony fractures, MR failed to reveal posterior ligamentous injuries in two.

Conclusion : Posterior element injury is frequently found in patients with traumatic thoraco-lumbar burst fractures demonstrated by MR imaging(46.2%) and CT(44.8%). Both MRI and CT are useful tools for the evaluation of posterior element injury, which determines the degree of instability of traumatic burst fracture.

Index words : Spine, fractures
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A burst fracture is an injury characterized by loss of height of a vertebral body and disruption of the posterior cortex, with retropulsion of bony fragments into the spinal canal. These fragments cause a narrowing of the canal, and this contributes to neurologic injury (1). Burst fractures of the vertebral body most commonly occur at the thoraco-lumbar junction (2-4) and account for 64-81 % of all thoraco-lumbar fractures (3-5).

Whether a burst fracture is managed conservatively or surgically is determined by its stability. In the past, the three-column theory was used to determine stability, and all burst fractures were considered unstable (6). This is not always the case, however, and the present-day method for determining the spinal stability of burst fractures is based on examination of the ligament and bone injuries suffered by the posterior element (1, 7-9). In particular, the status of the posterior ligamentous complex is accepted as the key determinant of mechanical stability of the burst fracture, and is also a predictive marker for the future development of post-traumatic kyphosis(a late sequela of burst fracture) (9). It follows that in the evaluation of posterior bone and ligament injuries that are undetectable by plain radiographs, the role of MR imaging and CT has steadily increased.

This study was undertaken to evaluate the frequency and accuracy with which MR imaging and CT evaluation detect any posterior element injury in patients with traumatic thoraco-lumbar burst fractures. In addition, correlation between the MR imaging and CT findings was analyzed.

Materials and Methods

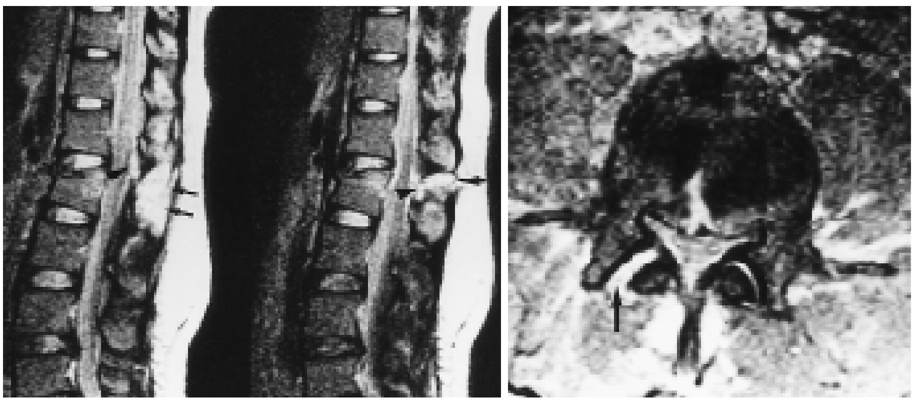
The MR and CT imaging findings of 38 patients with a total of 39 traumatic thoraco-lumbar burst fractures incurred between February 1994 and April 1997 were retrospectively analyzed. The subjects included 21 males and 17 females, with an average age of 51.3(range, 11-75)years. The injury was caused by a fall in 24 cases (63.2 %), a motor vehicle accident in ten(26.3 %), and under unknown circumstances in four(10.5 %). Thirty-seven patients(97.4 %) had a single burst fracture, and one(2.6 %) had two such fractures.

MR and CT images were obtained within two weeks of initial injury. MR imaging was performed in all 38 patients, and CT in 28 of the 38. All imaging studies were performed before conservative treatment(63.2 %) or surgical intervention(36.8 %).

For each MR examination, a 0.5 T Magnetom unit (Gyroscan T5, Philips, Netherlands) was used, and all patients underwent sagittal and axial, T1-weighted spin-echo(TR/TE 560/30 msec) and T2-weighted spin-echo(TR/TE 1800/90 msec) sequences. Sagittal images were obtained with a 205(256 matrix, a 320 mm field of view(FOV) and a 5-mm-thick slice, with a 0.5 mm gap. The axial sequence was also obtained with a 205(256 matrix and a 320 mm FOV, but with a 6-mm-thick slice and a 0.6 mm gap.

CT was performed using a Somatom III plus(Siemens, Erlangen, Germany), with a 4-mm-thick slice. Sagittal reconstruction images of both axial bone and soft tissue were obtained.

The images were evaluated by three radiologists, whose diagnosis was reached by consensus. MR images were evaluated for injury to the posterior ligamentous complex, i.e. to the supraspinous, interspinous, flaval ligament, or the capsule of facets. This was determined to have occurred when the normal band of low signal intensity that represents the ligament was absent or discontinuous, or if a high signal intensity hemorrhage or



A B

Fig. 1. Posterior ligamentous complex injuries on MR imaging.
A. Sagittal T2-weighted images(1800/90) show bright signal intensities with disruption of the low signal intensity bands in the supraspinous(short arrow), the interspinous(long arrows) and the flaval ligament(arrowheads) in 28 year-old woman with L2 burst fracture by a motor vehicle accident.
B. Axial T2-weighted image(1800/90) shows the widening of right facet joint with high signal intensity(arrow), representing the tear of the capsule of right facet in 23 year-old man with L4 burst fracture by a motor vehicle accident.

edema in the posterior ligament region was seen on sagittal T2-weighted images (Figs. 1A and 1B). CT images were analyzed with particular reference to posterior bony elements, including fracture of the lamina, pedicle, spinous process, or facet joint and the dislocation or separation of the facet joint (Figs. 2A and 2B).

MR and CT findings of any posterior element injury were correlated using Fisher's exact test.

Results

Cases with posterior element injuries determined by both MR imaging and CT are summarized in Table 1. According to the MR imaging findings, 18(46.2 %) of the 39 burst fracture cases had posterior ligamentous injuries. Among the same 39 cases, 15(38.5 %) showed some disruption of the interspinous ligament, which was the most common posterior ligamentous injury. Disruption was found in the supraspinous ligament in 11 cases(28.2 %), in the capsule of facets in 11(28.2 %), and in the flaval ligament in nine(23.1 %). Furthermore, five(27.8 %) of the 18 cases with posterior ligamentous injuries had an isolated injury, four(22.2 %) had two injuries, three(16.7 %) had three injuries, and six(33.3 %) had more than three injuries (Table 2).

CT images demonstrated posterior bony injuries in 13 (44.8 %) of the 29 burst fracture cases. Both lamina and facet joint fractures, which were the most common posterior bony injuries, were detected in six cases(20.7 %). Associated facet dislocation or separation was also detected in six cases(20.7 %), and only one case(3.4 %) involved fractures of both the spinous process and the pedicle. A single injury was seen in seven of these 13 cases(53.8 %), two injuries in five cases(38.5 %), and three injuries in only one case(7.7 %) (Table 3).

Correlation of the 29 burst fractures where both examinations were performed showed that among the 18 cases in which MRI revealed posterior ligamentous injuries, CT failed to demonstrate posterior bony fractures in seven. On the other hand, among the 13 cases in which CT indicated posterior bony fractures, MR failed to reveal posterior ligamentous injuries in two (Table 4). As regards the detection of posterior element injuries in burst fractures, there was thus no correlation between MRI and CT. There were, however, nine cases in which neither MR imaging nor CT detected posterior element injuries, but where T2-weighted MR imaging showed bright signal intensities at the pedicle and facet joint, implying micro-fractures or bone bruises (Figs. 3A and 3B).

Table 1. Cases of Thoraco-Lumbar Burst Fractures with Posterior Element Injuries of MRI and CT

No of Case	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Level of Fx	T_{11}	T_{11}	T_{11}	T_{12}	T_{12}	T_{12}	T_{12}	T_{12}	T_{12}	T_{12}	T_{12}	T_{12}	T_{12}	L_1	L_1	L_1	L_1	L_1	L_1	L_1	L_1	L_1	L_1	L_1	L_1	L_1	L_1	L_2	L_2	L_2	L_2	L_2	L_2	L_3	L_3	L_4	L_4	L_4	L_5
SSL				+	+		+		+	+										+	+	+								+			+			+			
ISL				+	+		+		+	+				+			+		+	+	+	+							+	+			+			+			
FL				+			+			+										+	+	+											+	+		+			
CF							+			+							+		+	+	+	+			+					+					+	+			
Lamina Fx		N				N		N	+		N	N			N	N		N				+		+	+			N					+			+		N	
Pedicle Fx				+																																			
SP Fx														+																									
Facet Fx	+			+			+		+												+	+																	
Facet disloc.																				+	+	+			+														
Facet sepa.																														+						+			

+ = positive signs of injury, N = not available
Fx = fracture, SSL = supraspinous ligament, ISL = interspinous ligament, FL = flaval ligament
CF = capsule of facets, SP = spinous process, disloc. = dislocation, sepa. = separation
Of total 39 cases, 10 cases had only MRI performed with none having posterior element injury
Of the remaining 29 cases, 9 cases were negative in both MRI and CT.

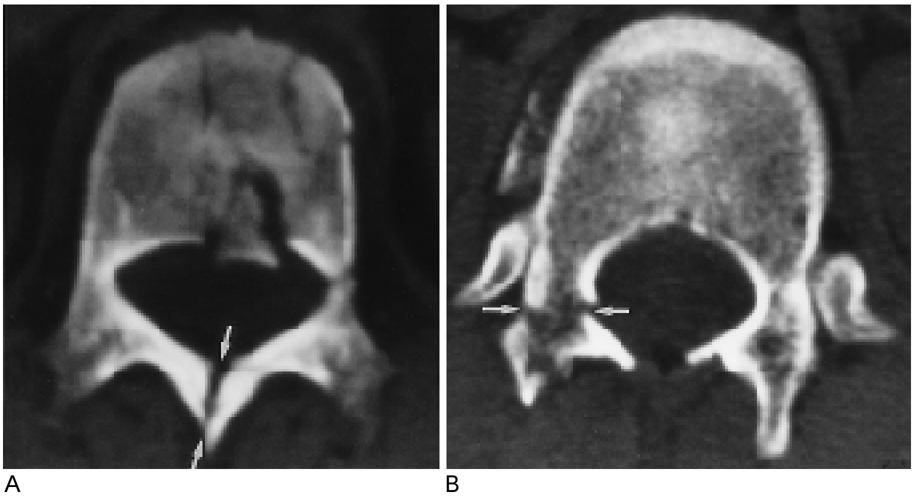


Fig. 2. Posterior bony element injuries on CT.
A. Axial CT scan shows the laminar fracture(arrows) in 42 year-old woman with L1 burst fracture by a fall.
B. Axial CT scan shows the fracture of right pedicle(arrows) in 28 year-old man with T12 burst fracture by a fall.

Table 2. Posterior Ligamentous Complex Injuries in Burst Fracture on MRI

Injury Type	No
ISL	2
ISL + SSL	2
ISL + CF	2
ISL + SSL + FL	2
ISL + SSL + CF	1
ISL + SSL + FL + CF	6
FL	1
CF	2

ISL = interspinous ligament, SSL = supraspinous ligament
CF = capsule of facets, FL = flaval ligament

Table 3. Posterior Bony Element Injuries in Burst Fracture on CT

Injury Type	No
Lamina Fx	2
Lamina Fx & Facet Fx	1
Lamina Fx & Facet disloc.	1
Lamina Fx & Facet sepa.	1
Lamina Fx, Facet Fx & Facet disloc.	1
Facet Fx	2
Facet Fx & Pedicle Fx	1
Facet Fx & Facet disloc.	1
Spinous process Fx	1
Facet disloc.	1
Facet sepa.	1

Fx = fracture, disloc. = dislocation, sepa. = separation

Of the 39 cases of burst fracture, 27 were tracked through the full clinical course. In nine such cases (Table 1: cases 4, 7, 14, 20, 21, 22, 25, 33 and 36), where surgery was performed, intraoperative findings confirmed the diagnosis based on MR and CT imaging. Posterior instrument fixations for stabilization were performed in all nine cases, and as verified on plain radiographs obtained after 14 to 18(mean, 15.5)months, spinal stability was well

Table 4. Correlation of Posterior Element Injury of Burst Fracture on MRI and CT

CT	MRI		Total
	+	-	
+	11	2	13
-	7	9	16
	18	11	29

Fisher's Exact Test, p-value = 0.052

maintained. All nine cases showed both posterior ligamentous injuries on MR images and posterior bony fractures on CT. In seven cases in particular(all but cases 14 and 25), MR imaging revealed severe injuries with at least three sites of posterior elements. Among the nine cases in which MRI demonstrated ligamentous injuries but in which surgery was not performed, CT failed to reveal posterior bony fractures in seven.

Discussion

In 1949, Nicoll recommended that in order to determine the appropriate method of treatment, fractures be divided into stable and unstable groups (10). In 1963, Holdsworth further clarified the concept of spinal stability based on an anatomic complex, dividing the spine into the anterior and posterior column. He suggested that the posterior column was central to spinal stability (11, 12). Denis later expanded upon Holdsworth's original two-column analysis by proposing a 'three-column concept of spinal stability'. Since it was noted that instability resulted from injury to two adjacent columns, any disruption of the middle column was determined to be a key factor contributing to instability (6). White and Panjabi further expanded the definition of an unstable

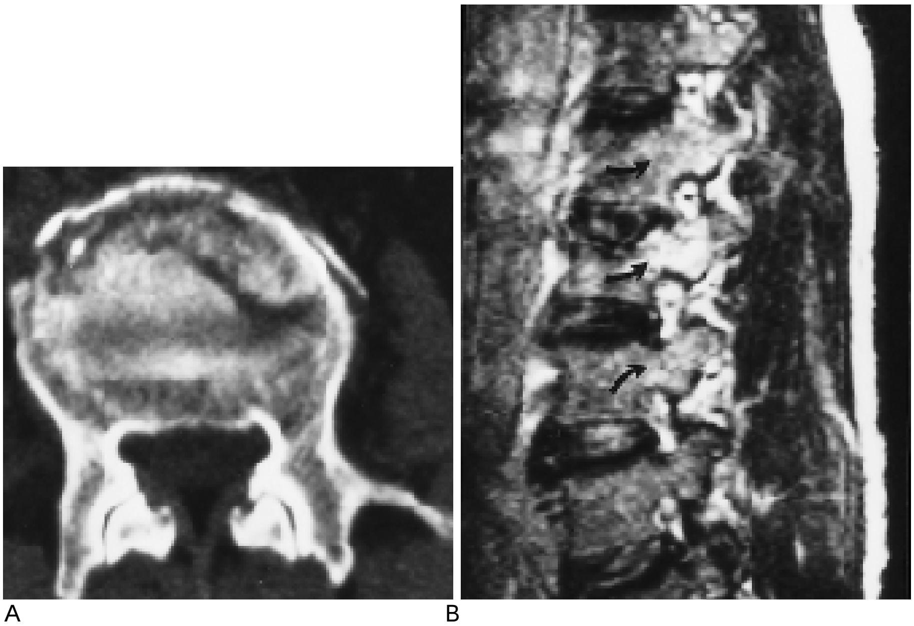


Fig. 3. L2 burst fracture in 61 year-old man by a fall.
A. Axial CT scan shows no evidence of fracture of the pedicle or the facets. There is minimal retropulsion of the bony fragment into the spinal canal.
B. Sagittal T2-weighted image(1800/90) shows no evidence of the posterior ligamentous injury, but there are bright signal intensities of bone marrow edema at the pedicle and the articular process(arrows).

fracture by adding a class of injury which causes progressive deformity, further neurological injury or chronic back pain (13).

Many surgeons have used the three-column concept defined by Denis to determine whether a fracture is stable or unstable. According to Denis, however, all burst fractures are unstable, though this is not actually the case. Ligamentous structures are important for maintaining spinal stability, and their disruption is an important feature that differentiates stable from unstable injury (11, 12, 14, 15) and helps determine the appropriate therapy (7, 16, 17). The integrity of the posterior ligamentous structure is a better indicator of spinal stability than that of the middle osteo-ligamentous column. More specifically, the posterior ligamentous structure has been found to play a crucial role in resisting flexion, such that if the posterior ligamentous complex remains intact, thoracolumbar fracture involving anterior and middle column injury will likely function as stable injury (9).

Accepted plain radiographic manifestations of an unstable fracture include widening of the interspinous or interlaminar distance, kyphosis of more than 20 degrees, translation of more than 2 mm, dislocation, and a height loss of more than 50 % or articular process fracture (2, 12, 18-20). Of the radiologic manifestations, a high association between more than 50 % anterior vertebral body height loss and middle column failure may indicate the need for CT examination. This is in order to exclude unrecognized middle column involvement whenever severe anterior height loss is present (21). Thus, CT may identify fractures not visible on plain film examination, especially those of the posterior elements, and provides a more accurate assessment of spinal canal compromise by retropulsed fragments, sagittal splitting, rotation or superior or inferior displacement of bony fragments (3, 19, 21, 22). Moreover, sagittal reconstruction will aid in the recognition of interspinous widening, subluxation of the vertebral body, fracture of the vertebral end plate, kyphosis, height loss of the vertebral body and facet joint distraction (23).

Plain radiographic findings of spinal instability include a widening of the interspinous or interlaminar distance, or kyphosis of more than 20 degrees, which implies the disruption of a posterior element. MR imaging clearly identifies the presence of associated ligamentous injury, particularly to the posterior longitudinal, supraspinous or interspinous ligament and demonstrates the degree of residual neural compression, intrinsic cord abnormality and extradural hematoma, and the status of the intervertebral discs. Direct signs of disruption include visualization of the torn margins and discontinuity or absence of the ligament. Hemorrhage into the interspinous soft tissue is an indicator of supra- or interspinous ligament disruption (1, 24, 25).

The majority of early studies comparing MRI with CT in cases involving acute spinal trauma found that MR imaging less satisfactorily identified neural arch fractures (26-29). Further research showed that several characteristics of the fracture (including the degree of height loss, the extent of spinal canal narrowing and the degree of subluxation and kyphosis) might be determined by means of MR examination (26, 27, 29). Saiffudin et al.

found that modern MRI scanners were as capable as CT of demontstrating neural arch fractures and facet dislocations (30).

Terk et al. recently found that 42 % of all burst fractures involved complex posterior ligamentous injury, a figure somewhat higher than the 28 % determined by Petersilge et al. (7, 8), but similar to the 46 % found in our study. We used both CT and MRI to examine and compare the findings in 29 cases, and the diagnostic rate for detecting posterior element injury in burst fractures was higher with MRI than with CT. However, there was no obvious correlation between injury to the posterior ligamentous complex, as revealed by MR imaging, and injury to the posterior bony element, as shown by CT (Table 4, Fisher 's exact test ; p-value = 0.052). This implies that a complete diagnosis will include the evaluation of soft tissue injury by MR imaging, while bony lesions of the posterior element will be evaluated by CT.

Among the 29 cases examined by both MR imaging and CT, there were nine in which neither modality revealed evidence of posterior element injury but in which T2-weighted MR images demonstrated bright signal intensity of bone marrow edema at the pedicle and facet joint. These findings suggest micro-fractures or bone bruises, such as previously reported at the knee and wrist (31, 32).

The management of a patient with a thoraco-lumbar burst fracture may be either conservative or surgical. Since neurological damage occurs at the time of injury, conservative treatment is preferred where the decompression of neural tissue has not been shown to produce a consistent improvement in neurological outcome. It is also widely accepted that an incomplete neurological deficit indicates the need for surgical intervention (30). Thus, because the healing of major ligamentous injury is rarely complete, injury to the posterior ligamentous complex may result in chronic instability, eventual kyphotic deformity or chronic back pain. In contrast, a burst fracture without ligamentous injury is acutely, but not chronically, unstable because there is usually a high degree of bone healing. For the surgeon, then, knowledge of the status of the posterior ligamentous complex is indispensable when deciding between surgical and non-surgical intervention (8).

In conclusion, a thoraco-lumbar burst fracture is frequently accompanied by posterior element injury, as verified by MR imaging(46.2 %) and CT(44.8 %). More specifically, the highest rate of incidence was found in cases involving interspinous ligament injury(38.5 %) on MR imaging and facet injury(41.4 %) on CT, and such cases should therefore be examined with a high degree of suspicion. Both MR imaging and CT examinations are useful tools for the evaluation of posterior element(ligament and bone) injury. In fact, these methods are complementary rather than mutually exclusive, and are valuable for determining the instability of a traumatic burst fracture and the direction that treatment should take.

References

1. Petersilge CA, Emery SE. Thoraco-lumbar burst fracture: Evaluating stability. *Semin US CT MR* 1996;17:105-113
2. Atlas SW, Regenbogen V, Rogers LF, et al. The radiographic characterization of burst fractures of the spine. *AJR* 1986;147:575-582
3. Brant-Zawadzki M, Jeffrey RB Jr., Minagi H, et al. High resolution CT of thoraco- lumbar fractures. *AJR* 1982;138:699-704
4. Mumford J, Weinstein JN, Spratt KF, et al. Thoraco-lumbar burst fractures: The clinical efficacy and outcome of nonoperative management. *Spine* 1993;18:955-970
5. Gertzbein SD. Scoliosis research society multicenter spine fracture study. *Spine* 1992;17:528-540
6. Denis F. The three column spine and its significance in the classification of acute thoraco-lumbar spinal injuries. *Spine* 1983;8:817-831
7. Petersilge CA, Pathria MN, Emery SE, Masaryk TJ. Thoraco-lumbar burst fractures: Evaluation with MR imaging. *Radiology* 1995; 194:49-54
8. Terk MR, Hume-Neal M, Fraipont M, Ahmadi J, Colletti PM. Injury of the posterior ligament complex in patients with acute spinal trauma: Evaluation by MR imaging. *AJR* 1997;168:1481-1486
9. James KS, Wenger KH, Schlegel JD, Dunn HK. Biomechanical evaluation of the stability of thoraco-lumbar burst fractures. *Spine* 1994;19:1731-1740
10. Nicoll EA. Fractures of the dorso-lumbar spine. *J Bone Joint Surg* 1949;31-B:376-394
11. Holdsworth FW. Fractures, dislocations and fracture-dislocations of the spine. *J Bone Joint Surg* 1963;45-B:6-20
12. Holdsworth FW. Fractures, dislocations and fracture-dislocations of the spine. *J Bone Joint Surg* 1970;52-A:1534-1551
13. White AA III, Panjabi MM. The problem of clinical instability in the human spine: *A systematic approach*. In: White AA III, Panjabi MM, ed. *Clinical biomechanics of the spine*. 2nd ed. Philadelphia: JB Lippincott 1990;277-378
14. Ferguson RL, Allen BL Jr. A mechanistic classification of thoacolumbar spine fractures. *Clin Orthop* 1984;189:77-88
15. Jelsma RK, Kirsch PT, Rice JF, et al. The radiographic description of thoraco- lumbar fractures. *Surg Neurol* 1982;18:230-236
16. Willen JAG, Gaekwad UH, Kakulas BA. Acute burst fractures: A comparative analysis of a modern fracture classification and pathologic findings. *Clin Orthop* 1992;276:169-175
17. Brightman RP, Miller CA, Rea GL, et al. Magnetic resonance imaging of trauma to the thoracic and lumbar spine. *Spine* 1992;17:541-550
18. Daffner RH, Deeb ZL, Goldberg AL, et al. The radiologic assessment of post-traumatic vertebral stability. *Skeletal Radiol* 1990;19: 103-108

19. McAfee PC, Yuan HA, Lasda NA. The unstable burst fracture. *Spine* 1982;7:365-373
20. Nagel DA, Koogle TA, Piziali RL, et al. Stability of the upper lumbar spine following progressive disruptions and the application of individual internal and external fixation devices. *J Bone Joint Surg* 1981;63-A:62-70
21. McAfee PC, Yuan HA, Fredrickson BE, et al. The value of computed tomography in thoraco-lumbar fractures. *J Bone Joint Surg* 1983; 65-A:461-472
22. Guerra J Jr., Garfin SR, Resnick D. Vertebral burst fractures: CT analysis of the retropulsed fragment. *Radiology* 1984;153:769-772
23. Post MJD: *Radiographic evaluation of the spine: Current advances with emphasis on computed tomography*. 1st ed. New York, Masson publishing USA Inc. 1980;88-107
24. Blumenkopf B, Juneau PA. Magnetic resonance imaging(MRI) of thoraco-lumbar fractures. *J Spinal Disord* 1988;1:144-150
25. Grenier N, Greselle JF, Vital JM, et al. Normal and disrupted lumbar longitudinal ligaments: Correlative MR and anatomic study. *Radiology* 1989;171:197-205
26. Tarr RW, Drolshagen LF, Kerner TC, Alten JH, Partain LC, James AE Jr. MR imaging of recent spinal trauma. *J Comput Assist Tomogr* 1987;11:412-417
27. Tracy PT, Wright RM, Hanigan WC. Magnetic resonance imaging of spinal injury. *Spine* 1989;14:292-301
28. Goldberg AL, Rothfus WE, Deeb EL, et al. The impact of magnetic resonance on the diagnostic evaluation of acute cervico-thoracic spinal trauma. *Skeletal Radiol* 1988;17:89-95
29. McArdle CB, Crofford MJ, Mirfakhraee M, et al. Surface coil MR of spinal trauma: Preliminary experience. *AJNR* 1986;7:885-893
30. Saifuddin A, Noordeen H, Taylor BA, Bayley I. The role of imaging in the diagnosis and management of thoraco-lumbar burst fractures: Current concepts and a review of the literature. *Skeletal Radiol* 1996;25:603-613
31. Newberg AH, Wetzner SM. Bone bruises : Their patterns and significance. *Semin US CT MR* 1994;15:396-409
32. Kettner NW, Pierre-Jerome C. Magnetic resonance imaging of the wrist : Occult osseous lesions. *J Manipulative Physiol Ther* 1992;15: 599-603

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외상성 흉요추 방출성 골절에서 후방요소 손상의 평가[1]

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목적 : 방출성 골절(burst fracture)의 불안정성(instablity) 여부는 후방요소의 손상 여부에 의해 결정된다는 새로운 시각이 있다. 따라서, 흉요추부의 방출성 골절에서 후방요소의 손상이 얼마나 동반되는지 알고자 하였다.

대상과 방법 : 외상으로 인한 흉요추부의 방출성 골절 38명의 MRI 및 CT 소견을 분석하였다. 손상 후 MRI 및 CT 검사까지의 기간은 2주이내이었다. 남녀비는 21:17 이었고, 연령 분포는 11세에서 75세(평균 51.3세)였다. 38명, 39예의 MRI 소견과 28명, 29예의 CT 소견을 분석하였는데, MRI에서는 후방요소에 해당하는 상극상(supraspinous), 내극상(interspinous), 황색(flava) 인대, 면관절(facet) 피막의 손상 여부를 평가하였고, CT에서는 추궁판(lamina), 추궁근(pedicle), 극상돌기(spinous process), 면관절(facet joint) 골절 및 면관절 탈구, 분리 등의 유무를 분석하였다.

결과 : MRI상 방출성 골절 39예 중 18예(46.2%)에서 후방요소 손상이 있었고 그 중 내극상 인대 파열이 15예(38.5%)로 가장 많았으며, 상극상 인대 파열 11예(28.2%), 면관절 피막 파열 11예(28.2%), 황색 인대 파열 9예(23.1%) 있었다. CT에서는 방출성 골절이 있던 29예 중 후방요소 골절은 13(44.8%)에서 동반되었으며 그 중 추궁판 골절과 면관절 골절이 각각 6예(20.7%)로 가장 많았으며 동반된 면관절 탈구 혹은 분리 6예(20.7%), 추궁근 골절 1예, 극상돌기 골절 1예가 있었다. 한편, MRI 및 CT를 모두 시행한 29예를 비교 분석한 결과, MRI상 후방인대 손상이 있었던 18예 중 7예에서는 CT상 후방요소 골절이 없었고, 반면 CT상 후방요소 골절은 있었으나 MRI상 후방인대 손상이 없었던 예는 2예 있었다.

결론 : 흉요추 방출성 골절시 후방요소의 손상이 MRI 및 CT 검사상 각각 46.2 %와 44.8 %로 흔히 동반되었으며, 척추의 불안정성을 결정하는데 중요한 요소가 되는 후방요소의 손상을 진단하기 위해서 MRI와 CT는 모두 필요한 검사 방법이라고 생각된다.

회원으로 초빙합니다

대한방사선의학회는 1945년 10월 한국 방사선의학의 중흥이라는 기치 아래 회원 상호간의 친목과 방사선의학 발전을 위한 사명을 다하기 위하여 설립된 반세기의 역사를 가진 국내의 의학관련 학회 중 가장 모범적인 학회입니다. 이번 우리 학회에서는 방사선의학 관련 학문을 보다 광범위하고 상호 유기적으로 발전시키기 위해 관련 학문을 전공하는 박사학위 소지자를 초빙회원으로 영입하는 제도를 마련하였습니다.

이 제도는 우리나라 방사선의학의 발전과 학술진흥에 크게 기여하리라 믿으며 아래 내용을 참고하시어 많은 신청 있으시길 바랍니다.

— 아　　래 —

1. 입 회 자 격: 방사선의학 관련 학문을 전공하는 박사학위 소지자 또는 이와 동등한 자격의 소지자로서 대한방사선의학회 정회원의 추천을 받은자

2. 의　　무: 소정의 회비를 납부하여야 회원으로 유지 가능
1) 입회비 - 100,000원
2) 년회비 - 50,000원

3. 혜　　택
1) 각종 학술대회 참석
2) 학회지(년 12회 발간) 무료 배포
3) 학회에서 모든 행사 및 각종 정보 제공
4) 학회에서 발행한 각종 간행물 배포
5) 권리제한 내용을 제외한 모든 사항은 정회원과 동일함.

4. 권 리 제 한: 발언권은 주어지나 선거권, 피선거권 및 의결권이 제한됨

5. 제 출 서 류:
1) 입회 신청서(소정 양식 536page 참조)
2) 이력서 및 자기 소개서
전공분야 및 주요 경력이 포함되어야 합니다.

6. 기　　타: 제출된 입회 신청서의 각종 서류를 검토하여 이 사회에 승인 후 개별 통보합니다.