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Shanmuganathan Rajasekaran
Ganga Hospital

Rishimugesh Kanna
Ganga Hospital

Gregory D. Schroeder
Thomas Jefferson University, Gregory.Schroeder@jefferson.edu

Frank C. Oner
University Medical Centre, Utrecht

Luiz Vialle
Catholic University

See next page for additional authors

Authors
Shanmuganathan Rajasekaran, Rishimugesh Kanna, Gregory D. Schroeder, Frank C. Oner, Luiz Vialle, Jens R. Chapman, Marcel Dvorak, Michael Fehlings, Ajoy P. Shetty, Klaus J. Schnake, Frank M. Kandziora, and Alex R. Vaccaro

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Does the Spine Surgeon's Experience Affect Fracture Classification, Assessment of Stability, and Treatment Plan in Thoracolumbar Injuries?

Shanmuganathan Rajasekaran, PhD[1], Rishi Mugesh Kanna, MS[1], Gregory D. Schroeder, MD[2], Frank Cumhur Oner, PhD[3], Luiz Vialle, PhD[4], Jens Chapman, MD[5], Marcel Dvorak, MD, FRCSC[6], Michael Fehlings, MD, PhD[7], Ajoy Prasad Shetty, MS[1], Klaus Schnake, PhD[8], Frank Kandziora, PhD[8], and Alexander R. Vaccaro, MD, PhD[2]

Abstract

Study Design: Prospective survey-based study.

Objectives: The AO Spine thoracolumbar injury classification has been shown to have good reproducibility among clinicians. However, the influence of spine surgeons' clinical experience on fracture classification, stability assessment, and decision on management based on this classification has not been studied. Furthermore, the usefulness of varying imaging modalities including radiographs, computed tomography (CT) and magnetic resonance imaging (MRI) in the decision process was also studied.

Methods: Forty-one spine surgeons from different regions, acquainted with the AOSpine classification system, were provided with 30 thoracolumbar fractures in a 3-step assessment: first radiographs, followed by CT and MRI. Surgeons classified the fracture, evaluated stability, chose management, and identified reasons for any changes. The surgeons were divided into 2 groups based on years of clinical experience as <10 years (n = 12) and >10 years (n = 29).

Results: There were no significant differences between the 2 groups in correctly classifying A1, B2, and C type fractures. Surgeons with less experience had more correct diagnosis in classifying A3 (47.2% vs 38.5% in step 1, 73.6% vs 60.3% in step 2 and 77.8% vs 65.5% in step 3), A4 (16.7% vs 24.1% in step 1, 72.9% vs 57.8% in step 2 and 70.8% vs 56.0% in step3) and B1 injuries (31.9% vs 20.7% in step 1, 41.7% vs 36.8% in step 2 and 38.9% vs 33.9% in step 3). In the assessment of fracture stability and decision on treatment, the less and more experienced surgeons performed equally. The selection of a particular treatment plan varied in all subtypes except in A1 and C type injuries.

Conclusion: Surgeons' experience did not significantly affect overall fracture classification, evaluating stability and planning the treatment. Surgeons with less experience had a higher percentage of correct classification in A3 and A4 injuries. Despite variations between them in classification, the assessment of overall stability and management decisions were similar between the 2 groups.

Keywords
thoracolumbar trauma, classification, experience, stability, computed tomography, magnetic resonance imaging, survey

Introduction

Management of thoracolumbar fractures depends significantly on the assessment of fracture morphology and estimation of stability. Various fracture classification systems described so far aid in evaluating the mechanism of injury and fracture morphology.[1-4] Ultimately, fracture classification systems should guide the surgeon in determining the need for surgery and the type of surgical approach. However, none of the classification systems described to date have been able to be simple

[1] Ganga Hospital, Coimbatore, Tamil Nadu India
[2] Thomas Jefferson University and the Rothman Institute, Philadelphia, PA, USA
[3] University Medical Centre, Utrecht, Netherlands
[4] Catholic University, Curitiba, Brazil
[5] Harborview Medical Centre, Seattle, WA, USA
[6] Vancouver General Hospital, Vancouver, British Columbia, Canada
[7] University of Toronto, Toronto, Ontario, Canada
[8] Unfallklinik Frankfurt am Main, Frankfurt, Germany

Corresponding Author:
Shanmuganathan Rajasekaran, Department of Orthopaedics and Spine Surgery, Ganga Hospital, No. 313, Mettupalayam Road, Coimbatore, Tamil Nadu, India.
Email: rajasekaran.orth@gmail.com

but also be comprehensive in their evaluation. Therefore, apart from classification systems, spine surgeons have relied on different information acquired from imaging modalities including radiographs, Computed tomography (CT) and magnetic resonance imaging (MRI) to guide their treatment. The earliest classification systems used plain radiographs alone to assess the extent and severity of injury.[1,2] CT provides the best information with respect to bony injury and has been the major imaging modality used in evaluating spinal trauma.[5] MRI provides visualization of injury to the discoligamentous complex and to the neurologic elements, both of which have been acknowledged and incorporated into more recent classification systems.[6,7]

Although our knowledge about thoracolumbar fractures has improved in the past few decades, there remains ongoing controversy regarding the "ideal" classification to evaluate stability and guide appropriate treatment. Recently, the AOSpine Knowledge Forum Trauma developed the AOSpine Thoracolumbar Injury Classification System based on CT images. Studies have shown good intra- and interobserver reliability for this classification.[8] Apart from reliability and reproducibility, a good classification should be easy to understand and to follow, and hence should have good reproducibility irrespective of the surgeon's experience. In this study, we evaluated how surgeon's experience affected the reproducibility of fracture classification according to the AOSpine Thoracolumbar Injury Classification System. We also determined the influence of surgeon's experience on the assessment of stability and on treatment decision-making for different fracture subtypes, based on evaluating conventional radiographs (CR), CT, and MRI.

Material and Methods

Institutional review board approval from the principal investigator's institution was acquired before conducting the study. A complete set of images (anteroposterior and lateral CR, axial, sagittal, and coronal CT images and sagittal and axial MR images) of 30 patients with thoracolumbar spine trauma of varying severity were selected and classified based on the AOSpine Thoracolumbar Injury Classification System. The classification is a morphologically based classification with 3 major types: type A—compression injury, type B—tension band injury, and type C—translational injury. The fractures were classified by 2 spine surgeons and a radiologist, experienced in the AOSpine Classification System (interobserver reliability >80%), which provided the "reference standard" to compare and assess the results provided by the participants. The 30 cases for evaluation had a fair representation of all fracture subtypes except for A2 and B3 subtypes.

A group of 41 volunteer AOSpine members from different geographic areas participated in the study. In particular, 14 surgeons were from Asia-Pacific region, 12 from Latin America, 7 from the Middle East, 5 from Europe, 2 from North America, and 1 from Africa. A questionnaire was sent to the study participants and the assessment of the images was performed in 3 steps. In the first step, all the participants were provided with a short clinical description together with AP and lateral CRs of the patients and asked to answer questions regarding fracture classification, stability and the type of treatment and the need for further investigations. For the type of management, the following options were provided to the participants: conservative treatment, anterior only decompression and fixation, combined anterior and posterior stabilization, posterior short segment fixation and posterior long segment fixation. After completing this first questionnaire, a set of axial, coronal and sagittal CT images of the affected region was provided and the participants were asked to answer the same set of questions. Any change in the assessment of fracture classification, stability, need and type of surgical treatment was documented by the participant. The reasons for change in fracture classification was also documented as one of the following: CT showed additional fractures of posterior arch, CT showed fracture of posterior wall, CT showed fresh fractures of vertebral body, CT showed instability features not seen in CR and undefined. After completion of the second step, a set of MRI images including axial and sagittal T1 and T2 images of the fracture were provided in the last part of the survey and similar questions were asked as in the first 2 steps.

Surgeon experience was calculated as years of experience and grouped into 2 levels: less than 10 years or 11 and more years of experience. Descriptive statistics were performed to describe differences according to surgeon's experience in the percentage of correctly classified fractures, in the evaluation of fracture stability and in fracture management. Differences in the assessments by methodology of evaluation (CR, CT, and MRI) were described. McNemar test was used to determine treatment changes between CR and CT and subsequently between CT and MRI. Level of significance was set at $\alpha = .05$ and a P value less than .05 indicates a significant change in evaluation. The statistical analysis was performed using the software SAS version 9.2 (SAS Institute Inc, Cary, NC).

Results

Forty-one participants analyzed 30 cases amounting to a total of 1230 assessments. The participants were classified into 2 groups as less experienced (<10 years after starting spine practice, n = 12) and more experienced (>10 years, n = 29).

Fracture Type Assessment

As per the Reference Standard, 40% (12/30) were classified as type A, 40% (12/30) as type B, and 20% (6/30) as type C morphology. The classification of the fractures by the participants in each of the 3 steps has been described in the part 1 of the study.[9] In short, more fractures initially classified as type A fractures were changed to type B fractures based on CT. With MRI, the assessments remained unchanged. Type C fractures were unique in that correct classification by radiographs alone was possible and CT or MRI did not add extra information.

Table 1. Frequency of Correct Assessments (According to Gold Standard) by the 2 Groups of Surgeons for the 3 Different Imaging Modalities.[a]

	Radiographs		Computed Tomography		Magnetic Resonance Imaging	
Gold Standard Classification	4-10 Years	11+ Years	4-10 Years	11+ Years	4-10 Years	11+ Years
A1	16 (66.7)	34 (58.6)	15 (62.5)	38 (65.5)	16 (66.7)	39 (67.2)
A3	34 (47.2)	67 (38.5)	53 (73.6)	105 (60.3)	56 (77.8)	114 (65.5)
A4	8 (16.7)	28 (24.1)	35 (72.9)	67 (57.8)	34 (70.8)	65 (56.0)
B1	23 (31.9)	36 (20.7)	30 (41.7)	64 (36.8)	28 (38.9)	59 (33.9)
B2	18 (25.0)	48 (27.6)	34 (47.2)	82 (47.1)	39 (54.2)	100 (57.5)
C	66 (91.7)	155 (89.1)	70 (97.2)	163 (93.7)	70 (97.2)	163 (93.7)

[a]Values are given as n (%).

Table 2. Assessment of Fracture Stability Based on the 3 Imaging Modalities by the 2 Groups of Surgeons.

	4-10 Years			11+ Years		
	Radiographs	CT	MRI	Radiographs	CT	MRI
Gold Standard Classification	Injury Is Stable			Injury Is Stable		
A1	21 (87.5)	20 (83.3)	21 (87.5)	50 (86.2)	51 (87.9)	54 (93.1)
A3	43 (59.7)	37 (51.4)	42 (58.3)	106 (60.9)	79 (45.4)	85 (48.9)
A4	20 (41.7)	7 (14.6)	6 (12.5)	43 (37.1)	15 (12.9)	19 (16.4)
B1	22 (30.6)	11 (15.3)	9 (12.5)	46 (26.4)	15 (8.6)	14 (8.0)
B2	8 (11.1)	2 (2.8)	3 (4.2)	26 (14.9)	16 (9.2)	12 (6.9)
C	0 (0.0)	0 (0.0)	0 (0.0)	3 (1.7)	2 (1.1)	4 (2.3)

Abbreviations: CT, computed tomography; MRI, magnetic resonance imaging.
[a]Values are given as n (%).

Variations Based on Surgeons' Experience

Table 1 shows the percentage of correct assessments (according to Reference Standard) by radiographs, CT, and MRI. For A1, B2, and C fractures, the percentage of correctly classified fractures were similar between the more and less experienced surgeons for all the 3 evaluations (radiographs, CT, and MRI). For A3 fractures, surgeons with less experience achieved a higher percentage of correctly classified fractures for all 3 evaluations. For A4 fractures, the less experienced surgeons showed a lower percentage of correct assessments based on radiograph evaluation, but after CT and MRI evaluation, they had a higher percentage of correctly classified fractures (73% vs 58% in CT and 71% vs 56% in MRI). For B1 fractures, surgeons with less experience also had a higher percentage of correctly classified fractures for all 3 evaluations.

Evaluation of Fracture Stability and Influence of Surgeon's Experience

Based on radiographs, 68.5% of cases were initially labeled as unstable by the participants (Table 2). This percentage increased after the CT evaluation to 79.3%. Exceptions were A1 and C fractures, where the percentages remained the same. Despite the variations on the classification of the fractures, less and more experienced surgeons tended to agree well on the assessment of fracture stability in all subtypes. In subtypes A1, A3, A4, and C fractures, a similar percentage of more and less experienced surgeons classified the fractures as stable. In subtype B1 fractures, the assessment of stability was similar between the groups after radiographic assessment. But after additional CT and MRI, less experienced surgeons tended to classify more fractures as stable when compared with more experienced surgeons. In type B2 fractures, the less experienced surgeons classified more fractures as unstable as compared with more experienced surgeons.

Decision on Need for Surgery and Variations Based on Experience

The percentage of cases that were deemed to require surgical fixation based on plain radiographs was 72%; this increased to 81.7% with CT images ($P < .0001$). The assessment for need of surgery did not change after an MRI ($P = .77$). For C fractures and B2 fractures, the vast majority of the cases were classified as needing surgery (>90% in all 3 imaging modalities) (Table 3). For A1, B2, and C, the percentage of fractures classified to need surgery remained approximately the same in the first 2 steps of assessment. For A3, A4, and B1 fractures, the percentage of fractures classified to need surgery increased after CT evaluation compared with plain radiographs. No differences were observed based on the surgeon's experience on the need of surgery in any fracture subtype, except for type A3

Table 3. Percentage of Surgeons' Assessments That Indicated the Need for Surgery Based on the 3 Imaging Modalities.

Subtype	Total Participants			Surgeons of Experience 4-10 Years			Surgeons of Experience 11+ Years		
	Radiographs	CT	MRI	Radiographs	CT	MRI	Radiographs	CT	MRI
A1	15.9	13.4	12.2	16.7	16.7	12.5	15.5	12.1	12.1
A3	44.7	59.8	56.5	44.4	54.2	47.2	44.8	62.1	60.3
A4	67.1	89.0	89.6	62.5	85.4	89.6	69.0	90.5	89.7
B1	74.8	91.5	91.5	70.8	86.1	86.1	76.4	93.7	93.7
B2	90.7	93.9	96.3	90.3	97.2	95.8	90.8	92.5	96.6
C	100.0	99.6	99.6	100.0	98.6	98.6	100.0	100.0	100.0

Abbreviations: CT, computed tomography; MRI, magnetic resonance imaging.
[a]Values are given as percentage.

where more experienced surgeons tended to perform surgery after CT and MRI (Table 3).

Decision on Treatment Plan and Variations Based on Experience

The decision to select a particular treatment plan differed for each fracture subtype depending on the surgeon's experience (Table 4). For A1 fractures, the clearly predominant choice of treatment was the conservative treatment in both groups irrespective of the type of investigation. For A3 and A4 fractures, it seemed that the surgeons did not have a clear preference between the different surgery types. Based on radiographs, 64.2% patients were initially planned for conservative treatment by the more-experienced surgeons in A3 fractures (Table 4). This reduced to 41.9% after providing the CT images. They changed their decision and felt that more patients required surgical intervention after evaluating CT images. But the less experienced did not change their decision on conservative treatment after CT and MRI images.

In A4 fractures too, the management decisions varied between the 2 groups of surgeons. In the first step based on radiographs, less-experienced surgeons did not opt for combined anterior-posterior surgery as a treatment option in any of the patients (0%), while the more experienced surgeons planned it in 32.4% of patients. After evaluating CT images, the less experienced surgeons felt the need for combined anterior-posterior surgery in 10% patients whereas the more experienced surgeons opted for less percentage of combined approach surgeries (20% only) after CT imaging.

For B1 fractures, the 2 surgical treatments that were chosen most frequently were either short or long segment fixation. The more experienced surgeons chose the posterior short segment fixation more often than the less experienced surgeons. For B2 fractures, less experienced surgeons chose a posterior long fixation construct (>46% of cases), while the more experienced surgeons chose most frequently a posterior short surgery (45% of cases). For C fractures, both groups of surgeons mainly chose a posterior long fixation construct as the preferred treatment (more than 70% of assessments). Only very few of the surgeons chose a conservative treatment for both B2 and C fractures in any of the assessment.

Reasons for Change of Decision on Treatment Plan and Variations Based on Experience

The reasons for a change of decision either in the classification or management was also quite variable for the different subtypes. A1 and C type fractures showed little changes in decision in the three steps of evaluation. For A3 fractures, the reason for a change in management or classification provided most frequently was "CT showed fracture of posterior wall" in both groups of surgeons (41.4% for the less experienced group and 50.0% in the more experienced group) (Table 5). For A4 fractures, the most frequently provided reason for a change in management/classification in both group was "CT showed fresh fractures of vertebral body" (30.0% and 34.1%, respectively). For B1 and B2 fractures, the most frequently specified reasons for a change in evaluation were "CT showed additional fractures of posterior arch" and "CT showed instability features not seen in plain radiology."

Discussion

Thoracolumbar spinal fractures are a heterogeneous group of injuries and several classifications have been developed in the past 30 years to help in communication, identifying stability, and develop indications for surgical management. In this international study, we studied the influence of the surgeon's experience in accurately classifying a fracture based on the AOSpine Thoracolumbar Injury Classification System, and in the assessment of fracture stability and planning of treatment.

It was observed that for the most stable (A1) and the unstable (B2 and C) injuries, both the less and more experienced surgeons had similar percentage of correct classifications, irrespective of the type of imaging modality. For A3 and B1 injuries, surgeons with less experience had more correct classifications in all the three steps. Both groups of surgeons had poor diagnosis of A4 fractures based on radiographs, but more than 70% of less experienced surgeons correctly diagnosed A4 injuries after CT and MRI. Kepler et al[10] studied the reliability of AOSpine Thoracolumbar Injury Classification System among 100 spine surgeons by providing the CT images of 25 patients with thoracolumbar injury. It was observed that the kappa values describing interobserver agreement were 0.80 for type A injuries, 0.68 for type B injuries and 0.72 for type C

Table 4. Assessment of Type of Treatment for Different Fracture Subtypes Based on the 3 Imaging Modalities by the 2 Groups of Surgeons (Only Assessments Correctly Classified According to Gold Standard Are Included).

		4-10 Years of Experience			11+ Years of Experience		
Classification	Type of Treatment	Radiographs (%)	CT (%)	MRI (%)	Radiographs (%)	CT (%)	MRI (%)
A1		n = 16	n = 15	n = 16	n = 34	n = 38	n = 39
	Conservative	93.8	100	100	100	94.7	94.9
	Anterior only	0	0	0	0	0	0
	Anterior and posterior	0	0	0	0	0	0
	Posterior short	0	0	0	0	5.3	5.1
	Posterior long	0	0	0	0	0	0
	Others/not defined	6.3	0	0	0	0	0
A3		n = 34	n = 53	n = 56	n = 67	n = 105	n = 114
	Conservative	55.9	54.7	58.9	64.2	41.9	43.0
	Anterior only	2.9	1.9	1.8	1.5	1.0	1.8
	Anterior and posterior	0	1.9	3.6	0	3.8	3.5
	Posterior short	26.5	34.0	28.6	19.4	37.1	35.1
	Posterior long	5.9	5.7	5.4	6.0	7.6	8.8
	Other/Not defined	8.8	1.9	1.8	9.0	8.6	7.9
A4		n = 8	n = 35	n = 34	n = 28	n = 67	n = 65
	Conservative	0	17.1	11.8	3.6	3.0	3.1
	Anterior only	12.5	8.6	11.8	7.1	11.9	13.8
	Anterior and posterior	0	11.4	17.6	32.1	20.9	20
	Posterior short	37.5	31.4	32.4	28.6	34.3	33.8
	Posterior long	37.5	31.4	26.5	28.6	26.9	24.6
	Not defined	12.5	0	0	0	3.0	4.6
B1		n = 23	n = 30	n = 28	n = 36	n = 64	n = 59
	Conservative	21.7	16.7	17.9	2.8	6.3	8.5
	Anterior only	0	0	0	0	0	0
	Anterior and posterior	4.3	3.3	3.6	5.6.	3.1	1.7
	Posterior short	43.5	43.3	35.7	63.9	54.7	52.5
	Posterior long	30.4	36.7	42.9	22.2	28.1	30.5
	Other/ Not defined	0	0	0	5.6	7.9	6.8
B2		n = 18	n = 34	n = 39	n = 48	n = 82	n = 100
	Conservative	0	0	0	4.2	1.2	2.0
	Anterior only	0	2.9	2.6	0	0	0
	Anterior and posterior	27.8	23.5	20.5	12.5	19.5	22.0
	Posterior short	22.2	23.5	25.6	58.3	40.2	45.0
	Posterior long	50.0	50.0	46.2	22.9	37.8	28.0
	Other/Not defined	0	0	5.1	2.1	1.2	3
C		n = 66	n = 70	n = 70	n = 155	n = 163	n = 163
	Conservative	0	1.4	1.4	0	0	0
	Anterior only	0	0	0	0	0	0
	Anterior and posterior	19.7	24.3	24.3	13.5	20.2	20.9
	Posterior short	0	1.4	1.4	1.9	1.8	1.8
	Posterior long	77.3	71.4	71.4	79.4	72.4	70.6
	Other/Not defined	3	1.4	1.4	5.2	5.5	6.7

Abbreviations: CT, computed tomography; MRI, magnetic resonance imaging.

injuries, all representing substantial reliability. The lowest level of agreement for specific subtypes was for fracture subtype A4 ($\kappa = 0.19$). In this study, though A4 injuries were poorly diagnosed in radiographs, a higher percentage of surgeons diagnosed it in CT. This could probably be due to the inability to visualize the posterior vertebral wall and identify coronal split fractures ("pincer" injuries) in radiographs.

Not surprisingly, the simplest and the most unstable injuries were diagnosed consistently between both groups of surgeons. Interestingly, surgeons with less experience (<10 years) were better at diagnosing A3, A4, and B1 injuries than the more experienced colleagues. This is similar to the results observed in previous studies. Sadiqi et al[11] studied the influence of spine surgeons' experience on the classification and intraobserver reliability of AOSpine Thoracolumbar Injury Classification System among a group of 100 spine surgeons. The participants were divided into 3 groups based on their experience as <10 years, 10 to 20 years, and >20 years. They observed that though all 3 surgeon subgroups demonstrated excellent reliability ($\kappa = 0.79\text{-}0.83$) for fracture morphology type regardless of subtype, the fractures were most frequently misclassified by the most experienced surgeons. The possible explanation given by the

Table 5. Frequency of Surgeons' Reasons for Their Change in Evaluation (Management or Classification) of Fractures After Computed Tomography (CT) in Comparison to Gold Standard Classification.

Gold Standard Classification	Reason	4-10 Years of Experience; n (%)	11+ Years of Experience; n (%)
A1		n = 2	n = 9
	CT showed fresh fractures of vertebral body	1 (50.0)	2 (22.2)
	Not defined	1 (50.0)	5 (55.6)
	Other	0 (0)	2 (22.2)
A3		n = 29	n = 66
	CT showed additional fractures of posterior arch	1 (3.4)	2 (3.0)
	CT showed fracture of posterior wall	12 (41.4)	33 (50.0)
	CT showed fresh fractures of vertebral body	5 (17.2)	4 (6.1)
	CT showed instability features not seen in plain radiology	2 (6.9)	5 (7.6)
	Not defined	6 (20.7)	17 (25.8)
	Other	3 (10.3)	5 (7.6)
A4		n = 30	n = 41
	CT showed additional fractures of posterior arch	1 (3.3)	2 (4.9)
	CT showed fracture of posterior wall	5 (16.7)	3 (7.3)
	CT showed fresh fractures of vertebral body	9 (30.0)	14 (34.1)
	CT showed instability features not seen in plain radiology	4 (13.3)	12 (29.3)
	Not defined	8 (26.7)	7 (17.1)
	Other	3 (10.0)	3 (7.3)
B1		n = 20	n = 44
	CT showed additional fractures of posterior arch	11 (55.0)	18 (40.9)
	CT showed fracture of posterior wall	0 (0)	1 (2.3)
	CT showed fresh fractures of vertebral body	2 (10.0)	0 (0)
	CT showed instability features not seen in plain radiology	3 (15.0)	8 (18.2)
	Not defined	3 (15.0)	15 (34.1)
	Other	1 (5.0)	2 (4.5)
B2		n = 18	n = 48
	CT showed additional fractures of posterior arch	7 (38.9)	18 (37.5)
	CT showed fracture of posterior wall	1 (5.6)	2 (4.2)
	CT showed fresh fractures of vertebral body	1 (5.6%	0 (0)
	CT showed instability features not seen in plain radiology	5 (27.8)	14 (29.2)
	Not defined	2 (11.1)	11 (22.9)
	Other	2 (11.1)	3 (6.3)
C		n = 9	n = 25
	CT showed additional fractures of posterior arch	2 (22.2)	3 (12.0)
	CT showed fracture of posterior wall	1 (11.1)	0 (0)
	CT showed fresh fractures of vertebral body	0 (0)	2 (8.0)
	CT showed instability features not seen in plain radiology	2 (22.2)	7 (28.0)
	Not defined	2 (22.2)	7 (28.0)
	Other	2 (22.2)	6 (24.0)

authors for this paradox was that the more experienced surgeons are less inclined to learn and follow a new classification system due to their longer experience with older systems.

The assessment of fracture stability and decision on operative treatment is a complex decision, based on patient's age, presence of comorbidities, associated spinal conditions, neurological status, timing of presentation, and the fracture morphology.[12-15] Among these factors, fracture morphology is the most important factor that determines bony stability. Most classifications are predominantly morphological based on information acquired in radiographs and CT. The AOSpine Thoracolumbar Injury Classification System used in the present study is a morphologically based classification with 3 major types: type A—compression injury, type B—tension band injury, and type C—translational injury, with subtypes in A and B. Despite the variations on the classification of the fractures, less and more experienced surgeons tended to agree well on the assessment of fracture stability and surgical decision making in all subtypes, with only slight differences. Similarly, no differences were observed based on the surgeon's experience on the need for surgical stabilization for any fracture subtype.

Once a decision on surgical intervention is made, the type of approach and extent of surgical fixation can vary depending on the surgeon's training, preference toward a technique, personal experience, geographical variations, and the patient's ability to tolerate a particular procedure. Different surgical approaches and techniques have been described for thoracolumbar fractures, including posterior, anterior, and combined approaches.[16-20] However, scientific evidence is lacking to support the selection of one surgical technique as advantageous over the other.

In the present study, surgeons had a clear decision on the type of treatment for A1 and C fractures irrespective of their experience. But for A3, A4 fractures, there was no clear preference for the surgeons to select a particular technique. For B1 fractures, posterior short and posterior long segment fixation surgeries were equally preferred. The more experienced surgeons chose the posterior short surgery more often than the less experienced surgeons. In B2 fractures, the less experienced surgeons probably perceived more instability and selected posterior long surgery in 50% of the assessments followed by posterior short and combined anterior and posterior surgery. On the other hand, the more experienced surgeons chose most frequently a posterior short surgery (40.2%) followed by posterior long and combined surgeries. B1 and B2 injuries indicate disruption of the posterior tension band and hence posterior pedicle screw fixation was preferred. In the absence of clear criteria to fix long segments and reconstruct anteriorly, the variations in the decisions chosen by the surgeons may not be significant.

Similarly, the reasons for a change of decision either in the classification or management in each of the assessment steps was also quite versatile for the different subtypes. Expectedly, A1 and C type fractures showed little changes in decision in the 3 steps of evaluation. Since the diagnosis of A3 and A4 fractures depend on critical assessment of posterior vertebral wall, the reasons provided most frequently were "CT showed fractures of posterior wall" and "CT showed fresh fractures of vertebral body" for a change in management or classification. B1 and B2 fractures have posterior tension bend failure and consequently the most frequently specified reasons for a change in evaluation were "CT showed additional fractures of posterior arch" and "CT showed instability features not seen in plain radiology."

Conclusion

There were no differences, based on experience, in correctly classifying A1, B2, and C type injuries according to the AOSpine Thoracolumbar Injury Classification System. Surgeons with less experience were more accurate in classifying A3, A4 and B1 injuries. About 30% to 50% more assessments were made correctly in A3 and A4 injuries after provision of CT images, indicating the importance of CT in this classification. In the assessment of fracture stability and decision on operative treatment, the less and more experienced surgeons performed equally without much difference. The selection of a particular treatment plan varied in all subtypes except the most stable A1 and unstable C type injuries, where there was uniformity between the 2 groups.

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