



Original Article

Subaxial spine arthrodesis in patients with spine fractures and facet joint dislocations: Is magnetic resonance imaging required to determine the optimal surgical approach?

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ABSTRACT

Background: The medical literature suggests that facet dislocations (FDs) must be managed surgically, even in the absence of spinal cord injury. In fact, there is no standard guideline for managing FD cases and whether magnetic resonance imaging (MRI) should be utilized for optimizing treatment planning.

Methods: Fifteen cases of FD were evaluated twice by nine spine surgeons. The first assessment included computed tomography (CT) images only. Secondly, original CT studies were supplemented with MRI. In each case, the participating surgeon had to acknowledge whether and what surgical treatment they would offer. Data for the two responses from all nine surgeons were then compared.

Results: Based on CT images alone, there was no consensus regarding treatment choices in 13 cases, and a trend toward consensus in just two instances ($\kappa = 0.01$). When MRI scans were added to CT studies, among the 15 cases evaluated, 10 cases demonstrated a trend toward consensus, and in 1 case consensus was achieved. The Kappa interpersonal agreement based on MRI was 0.13. The analysis of the answers by each contributor in each case demonstrated that in 58.51% of cases the surgical treatment options were changed when analyzed by CT + MRI, in comparison to the options indicated based on CT alone.

Conclusion: It appears that obtaining an MRI in addition to a CT before spine surgery for FD is essential mandatory, as it changed the treatment option in nearly 60% of cases.

Keywords: Arthrodesis, Cervical vertebrae, Fracture dislocation, Spinal fusion, Spine

INTRODUCTION

The Subaxial Injury Classification System and Severity Score (SLICS) suggests that unilateral or bilateral facet dislocations (FD) should be managed surgically, even in the absence of a spinal cord injury (SCI).^[2,4] Surgical realignment, decompression, reconstruction, and adequate facet

positioning are the treatment goals, along with cervical spine stabilization utilizing anterior, posterior, or circumferential approaches. The efficacy of preoperative planning with CT is well documented, while the “value added” of magnetic resonance imaging (MRI) is still debated.^[3] To better evaluate this, here we surveyed 9 spinal surgeons (twice) who evaluated 15 SCI cases initially utilizing CT alone vs. both CT and MR for surgical planning in the treatment of FD.

MATERIALS AND METHODS

Contributors profile questionnaire

Nine spine surgeons, members of the Brazilian Spine Society (2018), responded to questionnaires; they provided personal data and obtained Institutional Review Board/Hospital consent to participate in the study.

Study design

A cross-sectional study surveyed 15 cases of traumatic subaxial unilateral or bilateral FD (2016–2017). Each surgeon was asked to evaluate each case at two different intervals, using the first CT alone followed by both CT and MR studies. They subsequently recommend anterior, posterior, or circumferential cervical surgery. If the latter was chosen, they had to choose the order in which to perform the anterior and posterior cervical procedures. They first analyzed the 15 cases; secondarily, the cases were presented in a different order (typically within the next 30 days). Following the second questionnaire, the authors were asked if they believed that their indications for each case were similar utilizing CT versus CT and MR findings.

Statistical analysis

Statistical analysis was performed using the SPSS program (IBM v22.0, Chicago, IL). Categorical data will be presented as counts and percentages. The Fleiss' kappa index was used to analyze the intrapersonal concordance between the first and second questionnaires and the interpersonal concordance. The Fleiss' kappa index concordance ranges from 0 to 1 and is classified as low (0–0.4), moderate (0.5–0.7), or high concordance (0.8–1). The clinical scenarios were allocated in three different categories according to the agreement of the responses: established consensus (>80%), consensus tendency (between 60% and 80%), and no consensus (<60%).

RESULTS

Sample characteristics

Table 1 summarizes various characteristics regarding; trauma mechanism, Frankel score, fracture level, and facet involvement [Table 1].

Table 1: Descriptive findings of the sample.

Age	48 (25–84) ¹
Trauma mechanism* (%)	
Car accident	5 (33)
Diving	4 (26)
Fall	6 (40)
Frankel* (%)	
A	2 (13)
B	3 (20)
C	2 (13)
D	-
E	8 (53)
Fracture level* (%)	
C3-C4	1 (6)
C4-C5	9 (60)
C5-C6	5 (33)
Facet dislocation* (%)	
Right	5 (33)
Left	2 (13)
Bilateral	8 (53)

¹Mean (variance); *Number of cases (percentage)

Contributors profile

The mean age of the contributors was 45.66 years-old with a mean of 15.33 (+10.35) years of experience with spine surgery. The mean number of the annual spine and cervical spine surgeries per contributors was 185.33 (+82.04) and 33.33 (+25.49), respectively.

Treatment indications based on clinical data and CT images

When contributors analyzed clinical data and CT images, there was no consensus achieved in any of the 15 cases in this survey. Kappa statistic measures of interpersonal agreement of the answers based on CT evidenced a value of 0.01 [Table 2].

Treatment indication based on clinical data, CT, and MRI

When contributors analyzed the cases based on clinical data, and both CT and MRI studies, there was a more uniform pattern of treatment recommendations, with a trend toward consensus or consensus achievement in 10 cases and 1 case, respectively. The kappa statistic measure of the interpersonal agreement for the answers based on MRI was 0.13 [Table 2].

Comparison of answers in the two moments

The authors compared the answers by each contributor in each case when analyzing the CT versus CT + MRI. Surgical approach remained the same in 56 instances (41, 48%). However, in 79 (58, 51%) instances, the surgical treatment

Table 2: Comparison of the surgical approach indicated by each contributor.

	Anterior (%)	Posterior (%)	360° anterior (%)	360° posterior (%)	Total (%)	Kappa index
CT	57 (42)	29 (21)	41 (30)	8 (6)	135 (100)	0.01
MRI	74 (54)	16 (12)	43 (32)	2 (2)	135 (100)	0.13
Concordance CT versus MRI	33 (24)	1 (1)	22 (16)	0	56 (41)	0.089

CT: Computed tomography, MRI: Magnetic resonance imaging

based on CT alone was different versus CT + MRI. The kappa index for the comparison of surgical approach indicated by CT and CT + MRI was 0.089.

Of interest, most surgeons did not notice the change of indication for the surgical approach and believed that the treatment proposed was the same for each case regardless of the exam. A total of 79 indications changed when contributors analyzed the MRI. However, in only 33 cases, this modification was noticed. The kappa index for self-perception of treatment change and real treatment change was 0.081.

DISCUSSION

The authors identified a lack of uniformity regarding the optimal surgical approach to FD among experienced spine surgeons (e.g. anterior, posterior, circumferential) when the case analysis was based on CT alone. Notably, however, there was a tendency towards consensus in most cases when MRI scans were additionally performed. Here, most critically, MRI studies in addition to CT scans changed the surgical choice in nearly 60% of FD cases.

The literature reports no significant differences in neurological recovery, fusion rates or long-term complaints when anterior or posterior stabilization and fusion were compared.^[1,4] The absence of a standard guideline or a clear benefit from one approach over the other may explain the variability of opinions found in this study.

Even though creating a protocol is beyond the scope of this study, authors believe that, according to this study, MRI proved to be critical to the management of cervical spine trauma with FD. The higher therapeutic concordance among spine surgeons when MRI was added to the case demonstrates that MRI shows details (such as disc herniations ventral to the spinal cord or ligamentous injury) that help the spine surgeon to get a better understanding of the case and are important to the final therapeutic decision.

CONCLUSION

No single surgical technique/approach best provides surgical decompression/alignment for FD accompanying cervical

SCI. However, adding MR to CT examinations before making the final surgical decision altered the surgeon plan in nearly 60% of patients in this series.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms.

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Conflicts of interest

There are no conflicts of interest.

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