

# NONOPERATIVE TREATMENT IN THORACOLUMBAR BURST FRACTURE AND MCCOMACK CLASSIFICATION

ALEXANDRY DIAS CARVALHO, ROBERT MEVES, RODRIGO REZENDE, MARIA FERNANDA SILBER CAFFARO, ÉLCIO LANDIM, OSMAR AVANZI

## ABSTRACT

**Objective:** To correlate the McCormack classification and functional outcomes in patients with thoracolumbar burst fractures submitted to conservative management. **Methods:** We performed a retrospective study on a consecutive series of 31 patients with thoracolumbar burst fractures treated with cast or brace immobilization between 1996 and 2005. The functional result at the end of the treatment was obtained through Denis' functional scales of pain and work. **Results:** Of the 31 patients evaluated, five presented total or partial inability to

return to work at the end of the follow-up period; 26(83.9%) were able to return to work with or without a change in work activity. In relation to pain ( $r=0.258$ ;  $p=0.161$ ) and functional scores ( $r=0.204$ ;  $p=0.272$ ) there was no correlation between the classification score and function at the end of the follow-up. **Conclusion:** Considering functional criteria focused on the patients, we did not observe any correlation between McCormack's Classification and the results of the conservative treatment. **Level of Evidence:** Level IV, case series.

**Keywords:** Spinal cord injuries; Spinal fractures/therapy. Lumbar

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vertebrae.

## INTRODUCTION

Holdsworth was the first to describe the thoracolumbar burst fracture with radiographic details. His classification defines the skeletal lesion according to the degree of impairment of the anterior and posterior spinal columns. However, the author stresses that posterior spinal column rupture is sufficient to produce vertebral instability and not the failure of the posterior ligamentous complex in defining biomechanical stability.<sup>1</sup> Denis<sup>2</sup> describes three columns - formed by the posterior part of the vertebral body, posterior longitudinal ligament and annulus fibrosus portion - and determines the importance of the middle column for biomechanical stability of the spinal column. According to Denis,<sup>2</sup> burst fractures are characterized by impairment of the middle column, which involves the posterior part of the vertebral body, annulus fibrosus and posterior longitudinal ligament. Recent classifications consider the fracture anatomy in a more detailed manner in subtypes. The classification proposed by McCormack, for example, evaluates in increasing order the total number of points obtained at the level of the fractured vertebra according to the degree of comminution of the vertebral body, degree of distraction of the fragments and degree of correction

required to restore sagittal alignment of the spinal column. Besides including the lesion characteristics, this classification also considers other factors capable of influencing the functional and radiographic outcome of the treatment of these patients.<sup>3,4</sup> There are descriptions of studies on the association between this classification and the radiographic results as regards sagittal collapse and instrumentation failure in these patients, yet there is no functional analysis focused on patients submitted to non-operative treatment. Moreover, there are reports of articles on the functional analysis of these patients submitted to conservative treatment, but without the study of fracture severity. This severity is detailed by the McCormack classification. These observations in literature motivated this study.<sup>5-14</sup>

## MATERIAL AND METHOD:

We conducted a retrospective analysis of 31 patients with thoracolumbar burst fracture according to the Denis<sup>2</sup> classification, treated conservatively, in the period from 1996 to 2005 in the Orthopedics and Traumatology Department - "Pavilhão Fernandinho Simonsen", of Santa Casa de Misericórdia de São Paulo. After approval by the Committee of Research on Human Beings of our institution, patients with fractures of the thoracolumbar region (involving levels T11, T12 and L1), with a history

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Faculdade de Ciências Médicas da Santa Casa de Misericórdia de São Paulo, SP, Brazil.

Study conducted in the Orthopedics and Traumatology Department of Faculdade de Ciências Médicas da Santa Casa de Misericórdia de São Paulo (DOT-FCMSCMSP). Service of Prof. Dr. Osmar Avanzi.

Mailing address: Alameda Casa Branca, no 438. Apto 61. Jardim Paulista. São Paulo, Brazil. CEP 0140800. Email: robertmeves@hotmail.com

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of less than 10 days from trauma occurrence, and with lesions involving only one vertebra separately, were included in the study. We excluded patients with pathological fractures, those with vertebral involvement at more than one level, with a clinical history over 10 days from fracture occurrence and secondary lesions to the wound inflicted by a firearm.

The minimum follow-up period was six months and the maximum was 72 months, averaging 38 months. Of the total 31 patients analyzed, 58% (18 patients) were male, aged between 13 and 85 years, with mean age of 49 years. The non-operative treatment was established for all the patients, with 18 (58%) submitted to orthosis use and 13 (42%) to the use of hyperextension cast.

The vertebral fractures were classified according to McCormack *et al*<sup>3</sup> who use the degree of comminution of the vertebral body, the degree of distraction of fragments of the injured vertebral body and the degree of correction of kyphosis at the fracture site, after treatment establishment. To this end, the classification of McCormack *et al*<sup>3</sup> assigns scores that range from one to three points, where the final result is the sum of the scores obtained in the analysis of the three variables.

To calculate the degree of distraction of the vertebral body fragments, we used axial cross-sectional computed tomography and assigned scores that range from one to three points, according to the fragment distraction. One point is assigned to fractures with up to 1mm of distraction, two points to distractions of up to 2mm or with impairment of less than 50% of the cross-sectional area of the vertebral body and three points to distractions above 2mm or with impairment covering more than 50% of the cross-sectional area of the vertebral body.<sup>3</sup>

Sagittal cross-sectional computed tomography is used to calculate the degree of comminution of the vertebral body, assigning one point when the comminution is less than 30% of the body, two points when the comminution represents 30 to 60% and three points for cases of comminution above 60% of the vertebral body.

The degree of kyphosis was evaluated by Cobb's method, which consists of the angle encountered by the intersection of two lines drawn through the superior vertebral plateau above and through the inferior vertebral plateau below the lesion site.<sup>3</sup> According to the degree of correction at the end of the treatment, we assign values from one to three points, with one point for correction below 3 degrees, two points when there is correction between 4 and 9 degrees and three points for corrections above 10 degrees.<sup>3</sup> (Table 1 and Figures 1 to 3)

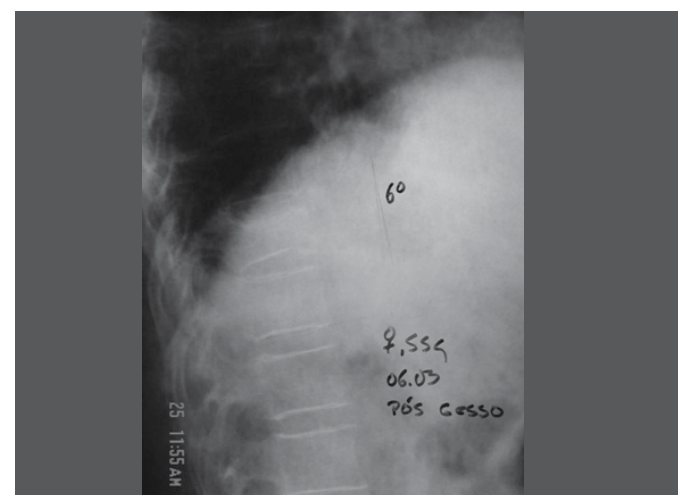
**Table 1.** Classification of McCormack *et al* 1994 (Load Sharing Classification).

Score	1 point	2 points	3 points
Sagittal collapse	30%	>30%	60%
Displacement	1mm	2mm	>2mm
Correction	3 degrees	9 degrees	10 degrees
Total	3 points	6 points	9 points

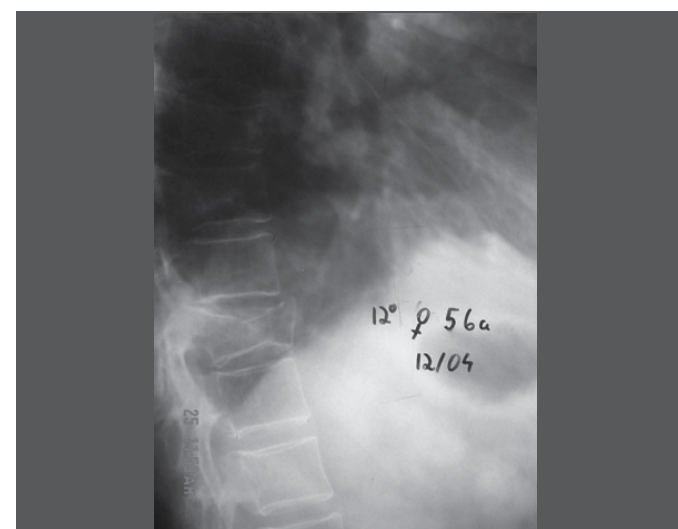
Source: McCormack T, Karaikovic E, Gaines RW. The load sharing classification of Spine fractures. *Spine* 1994; 19:1741-4.



**Figure 1.** Lateral view radiography with 10 degrees of kyphosis.



**Figure 2.** Plaster cast correction to 6 degrees.



**Figure 3.** Radiography with 12 degrees of kyphosis at the end of the follow-up. Despite the loss, patient without pain and with full return to non-sedentary work.

The Load Sharing classification is obtained by adding up the scores of the three parameters analyzed, which can vary from a minimum score of three to a maximum score of nine points. To evaluate the clinical and functional outcome of our patients, we used Denis<sup>2</sup> scale of pain and work, where all the patients included in the study answered a questionnaire, in which they were queried about the degree of pain and work capacity, before and after the injury, receiving scores between one and five. (Tables 2 and 3)

At the end of the questionnaire, the values obtained for degree of pain and work capacity were added up to arrive at a total value. This value was correlated with the final score obtained in the classification of McCormack *et al.*<sup>3</sup> Version 13.0 of the SPSS (Statistical Package for Social Sciences) program was used for statistical analysis and obtainment of results.

We adopted the significance level of 5% ( $\alpha = 0.050$  - significance adopted), to apply the statistical tests; i.e., when the calculated significance (p) is below 5% (0.050), we found a statistically significant difference (or relation); when the calculated significance (p) is 5% (0.050) or above, we found a statistically non-significant difference (or relation), meaning a similarity. We used Spearman's Correlation analysis to ascertain the correlation of the variables in question.

**Table 2.** Denis' functional pain scale.

SCORE	PAIN SCALE CRITERIA
1	No pain
2	Minimum pain, without use of medication
3	Moderate pain, with occasional use of medication
4	Moderate to severe pain, with constant use of medication
5	Severe pain, with chronic use of medication

**Table 3.** Denis Work Scale.

SCORE	WORK SCALE CRITERIA
1	Return to heavy work
2	Return to sedentary work, without weight restriction
3	Return to work, but in a different activity
4	Return to work, but part-time
5	Incapable of working

## RESULTS

Of the thirty-one patients assessed with thoracolumbar burst fracture, the mean follow-up was 38 months, with a minimum of six and maximum of 72 months. Five patients (16.1%) presented total or partial inability to return to work (four with score of 5 points and 1 with score of 4 points) at the end of the follow-up period, while 26 patients (83.9 %) were able to work with or without change of work activity (score 1 - 2 - 3 points). (Table 3) Six patients (19.3 %) presented severe pain with frequent absences or permanent inability to work (three with 5 points and 3 with 4 points), while 25 patients presented minimum to moderate pain, without interruption of work (score 1 - 2 - 3 points). (Table 4) In relation to McCormack's classification, two patients (6.4%) presented a score of six points or higher. Of these, one presented minimum or absent pain and one moderate to incapacitating pain. Of the patients scoring below six (83.6%), 25 were capable of heavy work and four patients were disabled or working only part time. In relation to pain ( $r=0.258$ ;  $p=0.161$ ) and function ( $r=0.204$ ;  $p=0.272$ ), there was no correlation between the classification score and function at the end of the follow-up.

**Table 4.** Distribution of patients, according to Denis' scale of pain.

Scale of pain	Number of patients
No pain	3
Minimum pain, without medication	9
Moderate pain, without interruption of work	13
Severe pain, with absence from work	3
Constant, incapacitating pain	3

Source: SAME-SCSP

## DISCUSSION

Many classifications were created with the intention of better defining the treatment proposal, but only the Classification of McCormack *et al.*<sup>3</sup> shows that comminution of the vertebral body, displacement of the fracture fragments and kyphosis correction are elements that can influence the failure of subsequent metallic instrumentation and sagittal collapse in patients submitted to thoracolumbar sacral orthosis brace or plaster cast. In analyzing the anatomy of fragments at the fracture site, the Load Sharing classification provided important information on the biomechanics of the lesion, allowing us to predict the treatment method and the fracture prognosis. In our study, we used the Load Sharing classification due to its simplicity, excellent reproducibility and inter- and intra-observer concordance, as already reported in literature by Dai and Jin.<sup>4</sup> In 1984, Denis *et al.*<sup>5</sup> developed two new scales with the purpose of evaluating the functional result (degree of pain and capacity to return to work) of the patients with thoracolumbar burst

fracture with and without neurological lesion. As it is a functional evaluation system, of easy applicability and comprehension, the decision was made to use it in the analysis of the clinical and functional result obtained by the patients after treatment.

The performance of this study was based on the fact that there are few studies in literature that directly correlate the Load Sharing classification values with the clinical and functional results (degree of pain and capacity for work), obtained by patients after establishment of the conservative treatment.

The results obtained in our study demonstrate the nonexistence of positive correlation between the values obtained in the Load Sharing classification and the final score in Denis' functional scales of pain and work<sup>2</sup>. This finding differs from that found by Aliagizakis *et al.*<sup>6</sup> in 2002, which by means of a prospective study with 60 patients with thoracolumbar burst fracture treated conservatively with plaster cast or orthosis, recognized

that values in the Load Sharing classification above five or six points were related to severe pain and permanent incapacity for work. In 2008, Dai *et al.*,<sup>11</sup> with 127 patients, showed positive correlation between the exacerbation of kyphosis and the Load Sharing classification, in a manner similar to our findings in 2007,<sup>13</sup> yet did not mention statistical correlation between the Denis<sup>2</sup> score and the Classification of McCormack *et al.*<sup>3</sup> Since the relationship between residual kyphosis and symptomatology is not consensual in literature, we question the relevance of this conclusion. In our view, these conflicting results verified in these retrospective case series justify controlled prospective clinical trials for greater consistency of these conclusions.

## CONCLUSION

Using evaluation criteria focused on the patients, we question the relevance of McCormack's classification as a predictor of the outcome of conservative treatment in these patients.

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