REVIEW OF MCCORMACK CLASSIFICATION FOR THORACOLUMBAR SEGMENT FRACTURES

REVISÃO DA CLASSIFICAÇÃO DE MCCORMACK PARA FRATURAS DO SEGMENTO TORACOLOMBAR

REVISIÓN DE LA CLASIFICACIÓN DE MCCORMACK PARA FRACTURAS DEL SEGMENTO TORACOLUMBAR

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ABSTRACT

Objective: The aim of this study was to evaluate the success and complications rates of thoracolumbar fractures with a score equal or superior to 7 according to the load sharing classification (McCormack), surgically treated with short posterior fixation at three points. Methods: We evaluated 40 patients with thoracolumbar fractures and score by the load sharing classification greater than or equal to 7, treated exclusively by surgery by short posterior fixation. We assessed epidemiological data, increased kyphosis, loss of vertebral body height and complications at 2-year follow-up. Results: Although there was a statistically significant increase in kyphosis and a decrease in vertebral height, there was no clinical repercussion. Conclusion: We conclude that the McCormack classification is not a fundamental predictor for indication of anterior approach complementary to the short posterior fixation.

Keywords: Spinal fractures; Lumbar vertebrae; Thoracic vertebrae; Fracture fixation/classification.

RESUMO

Objetivo: O objetivo deste estudo foi avaliar as taxas de sucesso e de complicações das fraturas toracolombares com pontuação igual ou superior a 7 segundo a classificação de load sharing (McCormack), tratadas cirurgicamente com fixação posterior curta em três pontos. Métodos: Avaliamos 40 pacientes com fraturas toracolombares e pontuação pela classificação de load sharing maior ou igual a 7, tratados exclusivamente por cirurgia por fixação via posterior curta. Avaliamos dados epidemiológicos, aumento de cifose, perda de altura do corpo vertebral e complicações em seguimento de 2 anos. Resultados: Apesar de ter havido aumento de cifose e diminuição da altura vertebral estatisticamente significativa, não houve repercussão clínica. Conclusão: Concluímos que a classificação de McCormack não é um preditor fundamental para indicação da via anterior complementar à fixação posterior curta.

Descritores: Fraturas da coluna vertebral; Vértebras lombares; Vértebras torácicas; Fixação de fratura/classificação.

RESUMEN

Objetivo: El objetivo de este estudio fue evaluar las tasas de éxito y de complicaciones de las fracturas toracolumbares con puntuación igual o superior a 7, según la clasificación de load sharing (McCormack), tratadas quirúrgicamente con fijación posterior corta en tres puntos. Métodos: Evaluamos 40 pacientes con fracturas toracolumbares y puntuación por la clasificación de load sharing mayor o igual a 7, tratados exclusivamente por cirugía por fijación vía posterior corta. Evaluamos datos epidemiológicos, aumento de la cifosis, pérdida de altura del cuerpo vertebral y las complicaciones en un seguimiento de 2 años. Resultados: A pesar del aumento de la cifosis y de la disminución de la altura vertebral estadísticamente significativa, no hubo ninguna repercusión clínica. Conclusión: Concluimos que la clasificación de McCormack no es un predictor fundamental para indicar la vía anterior complementaria a la fijación posterior corta.

Descriptores: Fracturas de la columna vertebral; Vértebras lumbares; Vértebras torácicas; Fijación de fractura/clasificación.

INTRODUCTION

Fractures of the thoracolumbar segment of the vertebral spine are characteristically injuries with high morbidity, with neurological symptoms affecting up to 40% of patients,[1-3] and commonly associated with other skeletal injuries, given that the majority are the result of high-impact traumas.[4-6]

The indication for surgery in these fractures depends on various factors, such as neurological dysfunction, instability and deformities.[7] Various classifications have been proposed aimed at stratifying these fractures in terms of their severity, and determining the most appropriate treatment.[7] Even in patients submitted to surgical treatment, there is still a risk of treatment failure, leading to complications such as pseudoarthrosis, post-traumatic deformity and deterioration of patients' neurological status.[3] McCormack et al.[8] in 1994, evaluated 28 patients with fractures of the three spinal segments proposed by the Dennis[9] classification, treated surgically with short posterior fixation (including one vertebra above and one below the fracture), in a prospective 4-year study, and arrived at a classification method

Study conducted in the Orthopedics Service of Hospital do Trabalhador, Universidade Federal do Paraná, Curitiba, PR, Brazil.
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based on a score that enables the risk of fixation failure and consequent collapse of the fracture to be predicted. This is known as the Load Sharing classification. This author concluded that fractures with a score of 7 or higher would be indicated for fixation by the anterior approach, in addition to short posterior fixation. The parameters, evaluated in this classification, and visualized in computed tomography, are: comminution of the vertebral body in the sagittal cut, dislocation of the bone fragments in the axial cut, and post-reduction angular correction of kyphosis.[8] (Table 1)

The objective of this study was to evaluate the success rates and complications of thoracolumbar fractures with a score of 7 or higher, according to the Load Sharing classification, treated surgically with short posterior fixation in three points.

Table 1. Load Sharing classification (McCormack).

	1 point	2 points	3 points
Comminution	Up to 30 %	30% - 60%	>60%
Dislocation	1mm	2mm	>2mm
Correction of kyphosis	3º	9º	10º

MATERIAL AND METHODS

This is a descriptive, retrospective study conducted at Hospital do Trabalhador – UFPR and approved by the Institutional Review Board under number CAAE: 41984915.0.0000.5225. As this was a retrospective study, an informed consent form was not required. Forty patients with burst fractures of the thoracolumbar spine were evaluated, according to Denis,[9] in only one level, with the injury being classified according to McCormack (Load-Sharing) with seven or more points, and who had been surgically treated with short posterior fixation without the anterior approach, in the period from January 2012 to December 2013. The fixation was performed using Schanz Exacta GMReis® screws, fixing one vertebra above and one vertebra below the fractured vertebra, as well as the fractured vertebra itself, using a total of 6 Schanz screws.[10] Transversal fixation systems were not used due to the absence of rotational or translational instability in the patients included in this study. The data were evaluated through medical records and imaging exams (radiographs in the anterior-posterior and profile views and computed axial tomography). The parameters evaluated were: sex, level of the fracture, score according to McCormack et al.,[8] Frankel et al.[11] score, Cobb angle between the vertebrae adjacent to the fracture, height of the vertebral body, and postoperative complications such as: infection, implant breakage and cerebrospinal fluid fistula. The angle of kyphosis (Cobb angle) was measured between the upper plateau of the adjacent vertebrae above the fracture and the lower plateau of the adjacent vertebra below the fracture. The height of the vertebral body was measured with a simple arithmetic measurement between the heights of the anterior and posterior bodies of the fractured vertebra. These measurements were performed immediately after surgery and two years after surgery. Patients were excluded who did not attend the postoperative follow-up, patients in whom fixation of 6 Schanz screws was not possible, those with pathological fractures, those with fractures caused by firearms, those who died during the research period, and those with a Load Sharing score of less than 7.

For the data analysis, the software *R* (R Core Team, 2015), version 3.2.3 was used, with the help of *lattice* and *gcmr* packages. The samples were submitted to analysis by the Student's t test, and a level of significance of 5% was adopted, considering a p –valor < 0.05 as significant.

RESULTS

Fourty patients were included in the study. All presented a Load Sharing score of 7 or higher, and were treated surgically with isolated short posterior fixation. There was a predominance of males, comprising 26 (65%) of the patients. The ages ranged from 15 to 73 years, with an average of 39.5 years. According to the statistics in the medical literature, the most affected levels were T12 and L1. Seventeen patients (42.5%) had fractures at level L1, and 10 (25%) at level T12. The other patients had fractures distributed throughout the thoracic and lumbar spine segments, as shown in Table 2.

In relation to the patients' neurological status, according to the Frankel score,[11] of the 40 patients included in the study, 26 (65%) were Frankel E, 8 (20%) Frankel D, 1 (2,5%) Frankel C, 1 (2,5%) Frankel B and 4 (10%) Frankel A. No patient had a worsening in neurological status following surgery, 10 patients had an improvement of 1 neurological level on the Frankel scale, and 2 had and improvement of 2 levels after one year of follow-up.

All the patients presented a Load Sharing score of seven or higher, as shown in Table 3.

The mean immediate postoperative Cobb angle was 19.5 degrees, and the mean angle after 2 years of follow-up was 20.5 degrees. This indicates a mean kyphotization of 1 degree in the postoperative follow-up ($p<0.05$). No patient developed kyphosis greater than 9 degrees in the follow-up, and individually, the greatest increase in Kyphosis was 8.2 degrees (Figure 1). For the Cobb angle, the Student t test was used for paired samples, obtaining $p = 0.0001599$.

The mean immediate postoperative vertebral height was 19.2 millimeters and in the 2-year follow-up, it was 18.2 millimeters ($p<0.05$). (Figure 2). For the height, the p-value was 0.01606.

Five (12.5%) patients suffered postoperative complications. One (2.5%) patient presented breakage of the implant material, 3 (7.5%) developed infection at the surgery site, and 1 (2.5%) presented a cerebrospinal fluid fistula. All evolved well with specific treatment for the complications. Of the patients with infection at the surgery site, besides antibiotics, they underwent a new procedure of surgical debridement and removal of the implant after consolidation. The other patient was treated with antibiotics alone, as the infection was superficial. The patient with breakage of the implant underwent removal of the synthesis material 9 months after the initial procedure, as the fracture had consolidated and the implant material was sticking out. The patient with the cerebrospinal fluid fistula underwent a new surgical procedure 6 days after fixation of the fracture, for effective treatment of the fistula, presenting good evolution thereafter.

Table 2. Ratio between fractured vertebra and number of patients.

Level	Number/%
T5	1/ 2.5%
T6	2/ 5%
T10	2 / 5%
T11	3 / 7.5%
T12	10 / 25%
L1	17 / 40%
L2	2 / 5%
L3	3 / 7.5%

Table 3. Load-Sharing score and number of patients.

Load-Sharing	Number/%
7	32/ 80%
8	2/ 5%
9	6 / 15%

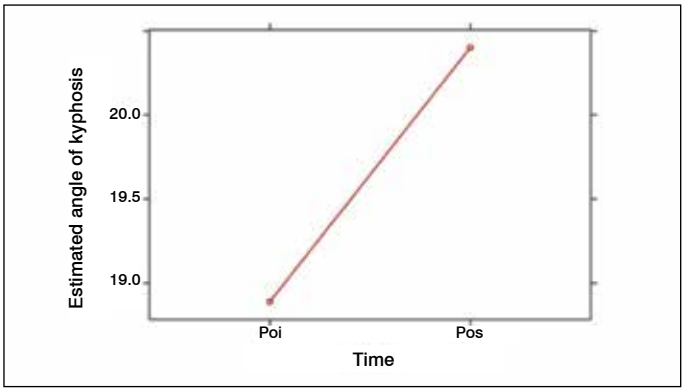

Figure 1. Mean immediate postoperative Cobb angle (POI) and at 2-year follow-up (POS).

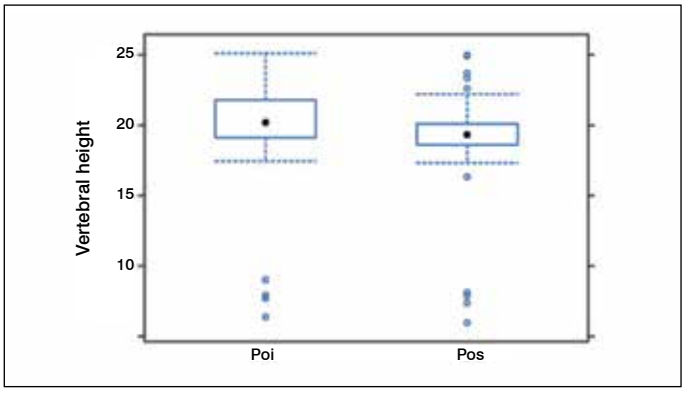

Figure 2. Immediate postoperative vertebral height (POI) and at 2-year follow-up (POS).

DISCUSSION

This results of this work show a satisfactory outcome of patients wth thoracolumbar fractures and a Load-Sharing score of 7 or more, treated surgically with short posterior instrumentation.

McCormack et al.,[8] in his classic work, in which the Load-Sharing classification was created, determined an algorithm that indicated the surgical complementation via the anterior approach in patients with a score of 7 or more. The classification states that the more dislocated and the more comminuted the bone fragments are, the lower the rate of consolidation and the lower the load-bearing capacity. He also inferred that the greater the degree of postoperative kyphosis, the more stress will occur on the implant, which could lead to its failure. Of the 28 patients studied by McCormack et al.,[8] all the patients with a score of 7 or more (10 out of 28) had breakage of the implant. The others, with a score of less than 7, evolved well.

Our results with 40 patients did not show these complications. No patient evolved with post-traumatic kyphosis of more than 9 degrees, vertebral body collapse, and less load-bearing capacity.

Alanay et al.[12] defined fixation failure as loss of correction of kyphosis of more than 10 degrees.

Avanzi et al.[13] in a work published in 2010, showed a lack of correlation between the classification of McCormack and posterior instrumentation failure. Meanwhile, Yu et al.[14] and McLain et al.[15] presented high rates of loss of correction of kyphosis during the follow-up of patients submitted to short posterior fixation.

It should be emphasized that short posterior fixation brings benefits for the patient, who is often the victim of multiple traumas, and where more extensive surgery could be harmful. The literature shows that longer instrumentations, and those associated with the anterior approach, present higher rates of bleeding, longer hospitalization times, longer surgery times, and more clinical complications. In long instrumentations, besides larger-scale surgery, the patient loses more mobile segments of the spine due to the fixation.[16,17]

An important point of this work is that the fixation included the fractured vertebra, which distributes the load applied on the implant material. The Load Sharing classification, in its original article, did not take into account the intermediate fixation of the fractured vertebra.[8] The current literature shows that fixation in the fractured vertebra is biomechanically superior, minimizing the number of complications related to the implant. There is a current tendency to fix the fractured vertebra. This was a decisive fator in our good results with the posterior approach alone, in patients who scored 7 or more.[10,18] Another factor that should be taken into consideration is the type and quality of the implants that were in use more than twenty years ago, when the procedures of the McCormack study were being conducted.

In our study, one patient of the 40 studied had breakage of the implant, but had a good clinical outcome, not requiring new instrumentation. The 3 patients who evolved with infection of the surgical site, and the one that had a cerebrospinal fluid fistula, evolved satisfactorily with the treatment.

The two-year follow-up of this work proved sufficient to evaluate the main complications. The literature shows that the complications occurred, mainly, in the first 6 months after the index procedure.[19]

CONCLUSION

This work showed that at the two-year follow-up, short pedicle fixation via the posterior approach, including the fractured vertebra, was effective in the treatment of thoracolumbar fractures with a Load Sharing score of 7 or higher.

There was a small increase in kyphosis and a decrease in height of the vertebral body at the two-year follow-up.

The Load-Sharing classification did not prove to be a fundamental predictor for indication of the complementary anterior approach when performing short posterior fixation with fixation in the fractured vertebra.

All authors declare no potential conflict of interest related to this article.

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