REVIEW OF MCCORMACK CLASSIFICATION FOR THORACOLUMBAR SEGMENT FRACTURES

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 com pontuação igual ou superior a 7, tratadas cirurgicamente com fixação posterior curta em três pontos. Resultados: Apesar do aumento de cifose e diminuição da altura vertebral, 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 curta en tres puntos. Métodos: Evaluamos 40 pacientes con fracturas toracolumbares y puntuación por la clasificación de load sharing mayor o igual a 7, tratados quirúrgicamente por cirugía posterior curta. Resultados: A pesar del aumento de la cifosis y de la disminución de la altura vertebral, no hubo repercusión clínica. Conclusión: Concluimos que la clasificación de McCormack no es un predictor fundamental para indicar la vía anterior complementaria a la fijación posterior curta.

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

### 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 GMReis8 screws, fixing one vertebral above and one vertebral 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., Frankel et al.11 score, Cobb angle between the vertebral body 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-value < 0.05 as significant.

### RESULTS

Forty 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 1. Load Sharing classification (McCormack).

<table>
<thead>
<tr>
<th>1 point</th>
<th>2 points</th>
<th>3 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comminution</td>
<td>Up to 30%</td>
<td>30% - 60%</td>
</tr>
<tr>
<td>Dislocation</td>
<td>1mm</td>
<td>2mm</td>
</tr>
<tr>
<td>Correction of kyphosis</td>
<td>5°</td>
<td>9°</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Level</th>
<th>Number/%</th>
</tr>
</thead>
<tbody>
<tr>
<td>T5</td>
<td>1/ 2.5%</td>
</tr>
<tr>
<td>T6</td>
<td>2/ 5%</td>
</tr>
<tr>
<td>T10</td>
<td>2/ 6%</td>
</tr>
<tr>
<td>T11</td>
<td>3/ 7.5%</td>
</tr>
<tr>
<td>T12</td>
<td>10/ 25%</td>
</tr>
<tr>
<td>L1</td>
<td>17/ 40%</td>
</tr>
<tr>
<td>L2</td>
<td>2/ 5%</td>
</tr>
<tr>
<td>L3</td>
<td>3/ 7.5%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Load-Sharing</th>
<th>Number/%</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>32/ 80%</td>
</tr>
<tr>
<td>8</td>
<td>2/ 5%</td>
</tr>
<tr>
<td>9</td>
<td>6/ 15%</td>
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</table>
DISCUSSION

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

McCormack et al., 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., 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. defined fixation failure as loss of correction of kyphosis of more than 10 degrees.

Avanzi et al. in a work published in 2010, showed a lack of correlation between the classification of McCormack and posterior instrumentation failure. Meanwhile, Yu et al. and McClain et al. 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 large-scale surgery, the patient loses more mobile segments of the spine due to the fixation. 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.

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.

REFERENCES