PROSPECTIVE-COMPARATIVE STUDY BETWEEN PSEUDARTHROSIS AND BONE FUSION IN LUMBAR STENOSIS

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ABSTRACT

Objective: Prospective-comparative study between pseudarthrosis and bone fusion in lumbar stenosis Methods: 38 patients operated on for lumbar spinal stenosis and submitted to arthrodesis were evaluated by the Visual Analogue Scale (VAS) and Roland Morris Disability Questionnaire. Radiographs were requested to evaluate spinal fusion. Results: An effective improvement was observed between the preoperative period and one year after the operation, in relation to VAS, both in the group that received a bone fusion and in the group with pseudarthrosis. With regard to the Roland Morris questionnaire, there was a tendency towards an improvement in the bone fusion group and a significant improvement in the pseudarthrosis group. Conclusion: There was no difference between the groups (bone fusion and pseudarthrosis) in relation to pain and disability. . Level of Evidence: Level II, longitudinal prospective study.

Keywords: Spinal stenosis. Spinal fusion. Spine. Pseudarthrosis.

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INTRODUCTION

Lumbar spinal stenosis (LSS) was described in 1954 by Verbiest, and was defined as a narrowing of the vertebral canal, lateral recess, or the neural foramina due to progressive degenerative hypertrophy of any surrounding osteocartilaginous and ligament structure, which may result in neurological or vascular compression at one or more levels.[1] This disorder is a consequence of advanced degenerative alterations such as: hypertrophy of the facet joints, bulging disc (herniated disc), ligamentum flavum hypertrophy, osteophyte formations, degenerative spondylolisthesis or a combination of these.[2]

Lumbar canal narrowing is a painful and potentially incapacitating condition frequently affecting the elderly population that today exhibits a significant increase of growth in our field.[3] It is a very significant cause of low back pain and is the main indication for lumbar spine surgery in patients over 65 years of age in the United States.[4,5] The neurogenic claudication provoked by this entity is the main cause of mobility impairment and loss of independence among senior citizens.[6]

In symptomatic patients, LSS has four different presentations, called characteristic syndromes: classical neurogenic claudication, radiculopathy, axial low back pain and nonradicular referred pain.[7,8] However, most of these patients have symptoms that prevent an exact definition of their presentation. The diagnosis is based on medical history, physical examination, spinal radiographies, computed tomography, magnetic resonance and electrophysiological studies. The sensitivity and specificity of Magnetic Resonance Imaging in the investigation of patients with lumbar stenosis, make it superior to the other imaging exams such as myelography and computed tomography.[7]

Conservative treatment presents a progressive improvement in 15 to 43% of patients during one to five years of follow-up,[9] while surgical treatment is aimed at decompressing the roots and, as needed, stabilizing the stenosed area.

Lumbar spinal fusion is indicated in the presence of preoperative instability or when large decompression is necessary.[10,11] A century has passed since the first fusion with autologous graft performed by Albee,[12] in 1911, with the association of pedicular screw fixation and bone graft, leading to an increase in the rates of bone consolidation in lumbar fusions.[13] Although several lumbar fusion techniques have been described, posterolateral grafting is most widely accepted.[14]

Literature reports a variance from 40% to 98% in the percentage of bone fusion in surgeries aimed at arthrodesis in association

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with surgical decompression.[15-18] The benefits of arthrodesis in patients with lumbar stenosis are also controversial, due to the fact that many of these patients have a reduction of physiological spinal mobility caused by the degenerative alterations of age.
The objective of this study was to verify whether there is any difference during follow-up among patients operated for lumbar stenosis that evolved with bone fusion or pseudarthrosis.

MATERIAL AND METHODS

Thirty-eight patients with established diagnosis of LSS were evaluated prospectively using tomography and lumbar magnetic resonance exams. Initially, they were all treated clinically with oral analgesics, anti-inflammatory drugs and physiotherapy for a minimum period of six months without success.
As regards gender, there were 17 men (44.74%) and 21 women (55.26%). The mean age at the time of surgery was 72 years, ranging from 62 to 85 years. The quantity of fixation levels with pedicular screws and posterolateral autologous graft ranged from one to five, with 2.47 levels per patient on average.
The surgical indication and the fusion levels were established by the clinical findings and consistent with the imaging exams: computed tomography, lumbar magnetic resonance and neurophysiological evaluations (ENMG). The criteria evaluated by the radiographies in the sagittal plane in flexion and maximum extension, used for fusion, were: presence of instability of the lumbar segments, when there was angulation above 5 degrees or translation above 3 millimeters between the vertebral segments. We also defined instability as the removal of more than 50% of the bilateral articular facet during surgery after extensive laminectomy.
All the patients had surgery for the treatment of lumbar stenosis through a posterior approach with laminectomy for decompression of the canal and vertebral foramina, associating pedicular screw fixation and posterolateral autologous grafting.
The patients were authorized to walk on the third postoperative day; we did not use any type of immobilization. The patients were asked to observe relative limitation of daily activities for three months, during which time the rehabilitation therapies were used more intensively.
For pain evaluation we used the visual analogue scale (VAS) with variation from 0 to 10 in intensity.[19] In the evaluation of physical disability and pain, we also applied the Rolland Morris disability questionnaire.[20] These questionnaires were applied in the preoperative phase and during the postoperative follow-up at 1 month, 6 months, 1 year and afterwards annually, always by the same professional from the Spinal Column Group of Faculdade de Medicine do ABC.
Radiographies were performed annually after surgery to evaluate signs of posterolateral lumbar fusion. It was defined as posterolateral fusion when the radiography, in the coronal plane, demonstrated bilateral continuity of bone mass between the cephalic and caudal transverse process and, in the radiographies of flexion and extension in the sagittal plane, demonstrated the non-occurrence of translation between the vertebrae and angulation below 2 millimeters, measured between the adjacent vertebral plateaus at the level of the posterolateral fusion. Fusion failure was established in the radiography when there was bone mass discontinuity at any point between the transverse processes on one or both sides, angulation above 2 degrees and any presence of vertebral translation.[21] (Figure 1)
We adopted the significance level of 5% (0.050), for the application of the statistical tests and used version 17.0 of the Statistical Package for Social Sciences (SPSS) program to obtain the results.

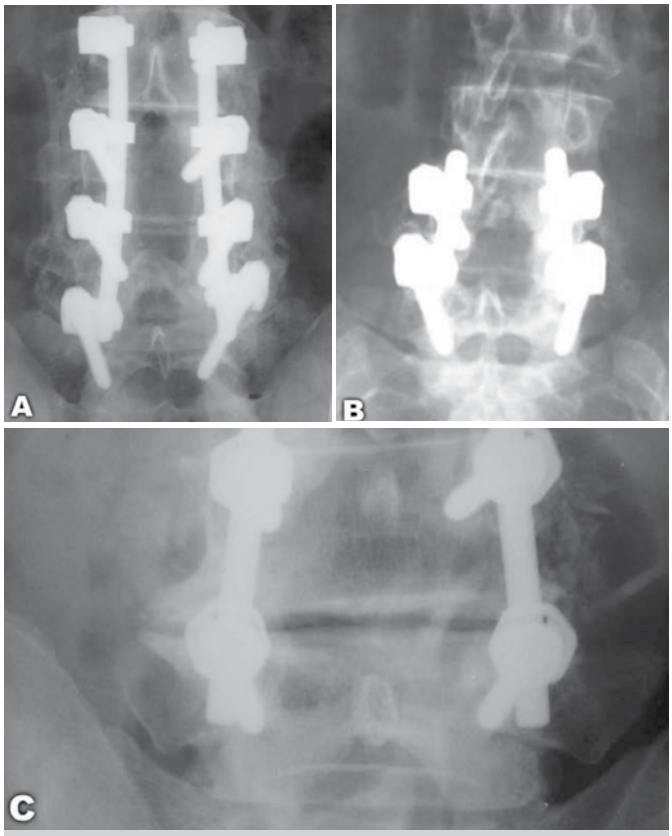

Figure 1. *A. Evidence of bilateral bone fusion B. Demonstrates discontinuity of unilateral bone bridge C. Demonstrates lack of bilateral bone fusion.*

RESULTS

A year after the surgery, 25 patients (65.79%) obtained posterolateral lumbar fusion and 13 patients (34.21%) evolved with pseudarthrosis, according to the criteria described previously. The results remained the same two years after surgery, that is, the same patients continued with pseudarthrosis and lumbar arthrodesis. Despite the difference in N between the groups of patients with pseudarthrosis and lumbar arthrodesis, there is homogeneity in relation to the parameters age and gender; in other words, both are statistically equivalent ($p>0.05$). The group of patients with pseudarthrosis presents mean age of 72.38 years, while the mean age in the group of patients with arthrodesis is 71.72 years. As regards gender, the pseudarthrosis group is made up of 69% female and 31% male patients, while the arthrodesis group contains 64% female and 36% male patients.
Fisher's exact test showed that there is a similar proportion in the outcome of the Rolland Morris and VAS questionnaires both in the patients that achieved bone fusion and in those

that evolved with pseudarthrosis in the evaluation at one and two years. (Figure 2)

When we applied the Friedman test, it was demonstrated that, in relation to the observation time on the three analysis occasions, there was a statistically significant difference within the group of patients that evolved with pseudarthrosis and bone fusion in comparison with the preoperative period. (Figure 3)

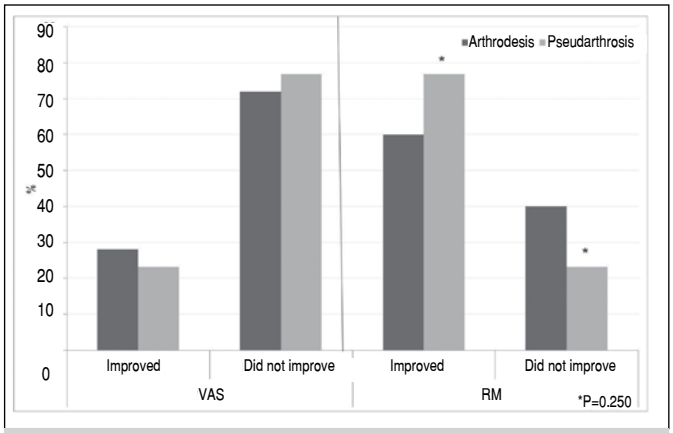

Figure 2. *Comparison between the percentage of patients from the arthrodesis and pseudarthrosis groups in relation to the improvement evaluated by the VAS and Rolland Morris (RM) questionnaires from 1 to 2 years after surgery.*

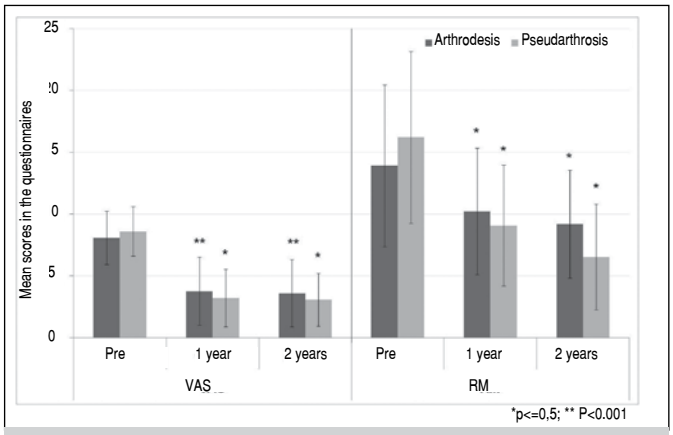

Figure 3. *Demonstration of the patients with arthrodesis and pseudarthrosis in relation to the VAS and Rolland Morris (RM) questionnaires at the preoperative moments, 1 year and 2 years after surgery.*

DISCUSSION

LSS is a chronic disorder that affects patients with associated pathologies that contribute to limitations in daily life activities and produce pain. Patients with LSS become symptomatic and are submitted to decompression around the fifth and sixth decade of life.[7] In our analysis, the mean age was 72 years.[7] Although literature demonstrates the predominance of the male gender,[22] in our study women predominated by approximately 56%.

In this study there was a lumbar fusion rate of 65.79% according to the radiographic criterion of Kornblum et al for lumbar arthrodesis evaluation.[21] In their revision article, Bono and Lee[23] reported a variation in the lumbar fusion rate between 40% and 89% in the various publications. It is difficult to evaluate lumbar fusion due to the lack of trustworthy methods. The solid fusion state can only be assessed by surgical exploration and direct inspection of the solid mass, yet this method is impracticable in clinical practice.[24]

If we use surgical exploration, the consolidation rate is 86% when both sides have undergone arthrodesis in the computed tomography.[25] Although radiographies are not the best method to evaluate lumbar fusion, they are used often as a low cost method of considerable practicality.[26]

In this study, when we compared the pain and disability factor, we obtained a similar result in the patients that evolved with solid fusion and with pseudarthrosis. Herkowitz and Kurz reported a rate of 36% of pseudarthrosis and 64% that obtained bone fusion in their series, with no difference in relation to quality of life after three years of follow-up,[27] a result similar to that obtained in our series. Fishgrund *et al*.[28] also published a prospective randomized study with follow-up of two years in which they did not demonstrate any difference comparing decompression with and without posterolateral arthrodesis either. Komblum *et al*.[21], in a long follow-up study (average of 7.7 years) demonstrated that patients evolving with pseudarthrosis presented deterioration of the clinical result compared with patients evolving with solid fusion, showing that solid fusion is an important factor that influences the surgical result on the long term. This study leads us to question whether, with a longer follow-up, the result of clinical improvement will continue at the same level presented in the cases with fusion failure, or whether there will be clinical deterioration in this group.

Our results demonstrated that there is effective improvement between the preoperative moment and the moment that occurs after one year of follow-up in relation to the VAS, both in the arthrodesis group and in the pseudarthrosis group. In relation to the Rolland Morris questionnaire, there is a tendency to observe an improvement in the arthrodesis group, and an effective improvement in the pseudarthrosis group. Therefore, both the patients that evolved with pseudarthrosis, and those with solid fusion, exhibited an improvement in relation to pain and disability.

It was not possible to define whether spinal column fixation is necessary and sufficient for clinical improvement or whether decompression alone would present the same results, since all the patients evaluated had undergone fixation, and the group that evolved with pseudarthrosis obtained the same results as those that obtained bone fusion. Neither were we able to define whether pedicular fixation alone can cause local ankylosis in these patients, whereas posterolateral arthrodesis is not necessary for clinical improvement during follow-up in this group of patients with mean age of 70 years. What demonstrates our work is that posterolateral bone fusion is not a factor directly related to the improvement of pain and disability in patients over 70 years of age with lumbar canal stenosis.

CONCLUSION

There was no difference between the results related to pain and disability among the patients submitted to decompression and fixation with pedicular screws and posterolateral autologous graft that evolved with solid fusion and pseudarthrosis.

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