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ANALYSIS OF THE DECOMPRESSIVE TREATMENT OF THE VERTEBRAL CANAL THROUGH THE TRANS-SPINAL APPROACH

ANÁLISE DO TRATAMENTO DESCOMPRESSIVO DO CANAL VERTEBRAL PELA VIA TRANSESPINHOSA

ANÁLISIS DEL TRATAMIENTO DESCOMPRESIVO DEL CANAL VERTEBRAL MEDIANTE EL ENFOQUE TRANSESPINAL

JULIANO SILVEIRA LUIZ VIEIRA[1], RODRIGO ARNOLD TISOT[1], MATHEUS BACKES SALLET[1], DIEGO DA SILVA COLLARES[1], AUGUSTO WAWGINIAK[1], GUSTAVO VALENTE[1], JOÃO OTÁVIO POLESE MARCELLI[1]

1. Orthopedic Hospital of Passo Fundo, Passo Fundo, RS, Brazil.

ABSTRACT

Objective: The spinous process separation technique is a less invasive surgical technique for treating lumbar canal stenosis. The objective is to evaluate this technique's results in treating lumbar canal stenosis. Method: Thirty patients with lumbar spinal canal stenosis underwent surgical treatment using the spinous process separation technique and were evaluated in the 3-year postoperative period using the Denis Pain and Work Scale and by the SF-36 questionnaire and radiographic evaluation of the operated segment. Results: In the evaluation of the Denis pain scale, 21 (70%) patients had no pain (P1), and nine (30%) patients reported minimal low back pain, not needing medication (P2). Denis' work schedule showed that nine (30%) patients had restrictions on returning to their previous work activity (W2), and 21 (70%) patients were classified as W1. The SF-36 questionnaire showed results of 81.25 for physical aspects (PA), 81.9 for functional capacity (FC), 81.3 for emotional aspects (EA), 64.3 for vitality (V), 65.9 for mental health (MH), 81.98 for social aspects (SA), 75.6 for pain (P) and 68.1 for general health status (GHS). In addition, there were no radiographic signs of instability of the operated vertebral segment in the radiographic evaluation. Conclusion: The decompression of the lumbar spinal canal using the spinous process separation technique showed good results in the evaluated patients three years after the operation. ***Level of Evidence II, Retrospective Comparative Study.***

Keywords: Spinal Stenosis; Spine; Orthopedic Procedures.

RESUMO

Objetivo: A técnica de separação do processo espinhoso é uma técnica cirúrgica menos invasiva para o tratamento da estenose do canal lombar. O objetivo é avaliar os resultados dessa técnica no tratamento da estenose do canal lombar. Método: Trinta pacientes portadores de estenose do canal vertebral lombar foram submetidos ao tratamento cirúrgico por meio da técnica da separação do processo espinhoso, tendo sido avaliados no período de três anos de pós-operatório, por meio da escala de dor e de trabalho de Denis, pelo questionário SF-36 e avaliação radiográfica do segmento operado. Resultados: Na avaliação da escala de dor de Denis, 21 (70%) pacientes não apresentavam dor (P1) e nove (30%) pacientes relataram dor mínima lombar, não necessitando medicação (P2). A escala de trabalho de Denis evidenciou que nove (30%) pacientes apresentavam restrições ao retorno à atividade prévia de trabalho (W2) e 21 (70%) pacientes foram classificados como W1. O questionário SF-36 apresentou resultados 81,25 para aspectos físicos (AF), 81,9 para capacidade funcional (CF), 81,3 para aspectos emocionais (AE), 64,3 para vitalidade(V), 65,9 para saúde mental (SM), 81,98 para aspectos sociais (AS), 75,6 para dor (D) e 68,1 para estado geral de saúde (EGS). Não foram observados sinais radiográficos de instabilidade do segmento vertebral operado na avaliação radiográfica. Conclusão: A descompressão do canal vertebral lombar por meio da técnica de separação do processo espinhoso apresentou bons resultados na avaliação num período de três anos de pós-operatório dos pacientes avaliados. ***Nível de Evidência II, Estudo Retrospectivo Comparativo.***

Descritores: *Estenose Espinal; Coluna Vertebral; Procedimentos Ortopédicos.*

RESUMEN

Objetivo: La técnica de separación de la apófisis espinosa es una técnica quirúrgica menos invasiva para el tratamiento de la estenosis del canal lumbar. El objetivo es evaluar los resultados de esta técnica en el tratamiento de la estenosis del canal lumbar. Método: Treinta pacientes con estenosis del conducto raquídeo lumbar fueron intervenidos quirúrgicamente mediante la técnica de separación de la apófisis espinosa, y fueron evaluados en el postoperatorio de tres años mediante la Escala de Dolor y Trabajo de Denis, mediante el cuestionario SF-36 y evaluación radiográfica del segmento operado. Resultados: En la evaluación de la escala de dolor de Denis, 21 (70%) pacientes no presentaron dolor (P1) y nueve (30%) pacientes refirieron dolor lumbar mínimo, sin necesidad de medicación (P2). La escala de trabajo de Denis mostró que nueve (30%) pacientes tenían restricciones para regresar a su actividad laboral anterior (W2) y 21 (70%) pacientes fueron clasificados como W1. El cuestionario SF-36 arrojó resultados 81,25 para aspectos físicos (AF), 81,9 para capacidad funcional (CF),

Study conducted by the Orthopedic Hospital of Passo Fundo, Passo Fundo, RS, Brazil.
Correspondence: Juliano Silveira Luiz Vieira. 817, 7 de Setembro street, Passo Fundo, RS, Brazil. 99010-121.jvieirav@hotmail.com

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81,3 para aspectos emocionales (AE), 64,3 para vitalidad (V), 65,9 para salud mental (SM), 81,98 para aspectos sociales (AS), 75,6 para dolor (D) y 68,1 para estado general de salud (EGS). No hubo signos radiográficos de inestabilidad del segmento vertebral intervenido en la evaluación radiográfica. Conclusión: La descompresión del canal espinal lumbar mediante la técnica de separación de apófisis espinosa mostró buenos resultados en la evaluación de un período de 3 años después de la operación de los pacientes evaluados. ***Nivel de Evidencia II, Estudio Retrospectivo Comparativo.***

Descriptores: *Estenosis Espinal; Columna Vertebral; Procedimientos Ortopédicos.*

INTRODUCTION

Degenerative spinal disease is the main cause of chronic disability. It is generally associated with pain and decreased mobility of the affected vertebral segment,[1] causing the compression of neural structures at the level of the vertebral canal and vertebral foramen, having been identified and described long ago.[2] Studies report that the compression of neural structures resulting from the narrowing of the spinal canal may be caused by hypertrophy of the ligamentum flavum, synovial cysts adjacent to the articular facet, and loss of intervertebral disc height.[3-5] At the beginning of treatment, symptomatic patients should undergo conservative treatment using medications and physical therapy. Surgical treatment is indicated in case of conservative treatment failure, the development of cauda equina syndrome, or progressive motor deficit.[6]

Surgical treatment of lumbar canal stenosis has been performed by decompressing the affected neural structures. This has classically been done by removing the vertebral lamina, articular facets, and ligamentum flavum.[7,8] Alternatively, laminoplasty has been performed as a form of decompression of the neural structures while preserving the integrity and continuity of the posterior vertebral elements (paravertebral musculature, spinous process, and vertebral lamina).[4] In the use of classical vertebral canal decompression, there is exposure and manipulation of the posterior vertebral elements, promoting the detachment of the paravertebral musculature, which can trigger ischemia, denervation, and muscle detachment, causing increased morbidity. These changes were the reason for the development of minimally invasive surgical techniques.[7]

Preserving the integrity of the paravertebral musculature has been the central goal of several surgical techniques that have been described for spinal canal decompression. The technique using longitudinal separation of the spinous process at the vertebral midline to preserve the integrity of the paravertebral musculature during decompression of the lumbar canal was described by Watanabe et al. in 2005.[8,9,10] This approach aims to preserve the paravertebral muscle insertion, reducing the incidence of paravertebral muscle injury that occurs in the classic open approach.[11]

Less invasive surgical procedures with lower morbidity have been targeted in modern spine surgery, and the spinous process separation technique is a procedure that stands out for its technical simplicity and the good results obtained.[8,12]

This study aimed to observe the clinical and radiographic results of using the spinal canal decompression technique by longitudinal separation of the spinous process in patients with lumbar spinal canal stenosis.

MATERIAL AND METHODS

A retrospective study was carried out by analyzing the medical records of a group of patients from the Orthopedic Hospital of Passo Fundo who had lumbar canal stenosis and underwent surgical treatment by decompression of the lumbar canal using the spinous process separation technique. Thirty patients were evaluated, all female, all aged between 60 and 65 years (mean 63.22), with an established diagnosis of spinal canal stenosis with progressive neurogenic claudication, through physical examination and lumbar magnetic resonance imaging, whose symptoms were refractory to conservative treatment for at least three months, and where decompression surgery was indicated.

Female patients, aged between 60 and 65, submitted to decompressive surgical treatment at the L4-L5 level, operated on, and evaluated pre and postoperatively by a single surgeon at the Orthopedic Hospital of Passo Fundo. Male patients, patients with decompressions at other spine levels, and patients with deformities, fractures, previous surgeries, or associated inflammatory diseases were excluded. In addition, medical records with insufficient information, absence of radiographs or magnetic resonance images, and failure to fill out the informed consent form were disregarded.

Clinical and functional parameters were considered in evaluating the patients in the preoperative and late postoperative periods (3 years). The visual analog scale for low back and lower limb pain (Table 1) and the functional work scale (Table 2) were evaluated retrospectively in the preoperative and late postoperative periods. In addition, radiographic evaluation was performed through AP and lateral lumbar spine radiographs. The MRI images were evaluated using sagittal and axial slices in T1 and T2 weighting. The study was approved by the Ethics and Research Committee of the University of Passo Fundo -UPF under register number 5.752.068, and the participating patients signed the Informed Consent Form.

The pain was assessed by the Denis pain scale (Table 1).

The functional evaluation was performed by the SF-36 questionnaire (MEDICAL OUTCOME STUDY SF-36 HEALTH SURVEY) and the Denis work scale (Table 2):

Surgical technique

The patients underwent general anesthesia and were in the ventral decubitus position. Through a median incision over the spinous process of the affected vertebral segment, it was exposed and divided in half lengthwise with a 2 mm diameter drill up to its base. Then the base of the spinous process was sectioned using a curved osteotome, exposing the base of the lamina. The two halves of the spinous process were separated to visualize the base of the vertebral lamina, thus preserving the paravertebral muscle insertion. (Figure 1A)

After exposure of the vertebral lamina and removal of the ligamentum flavum, decompression was performed through laminectomy and removal of the internal medial portion of the articular facets and foraminotomy according to the indication of decompression of the affected neural structures. (Figure 1B). The removal of the articular facet and foraminal decompression was performed to avoid the loss of stability of the vertebral segment, thus avoiding excessive removal of the articular facets.

After decompression and hemostasis by electrocoagulation, the separate parts of the spinous process were brought together and sutured using transosseous sutures between them (Figure 1C).

Table 1. Denis Pain Scale.

P1	Painless
P2	Minimal pain, occasional, no medication needed
P3	Moderate pain, occasional medication use, and no interruption of work or activities of daily living
P4	Moderate to severe pain, occasional lack of work, significant change in activities of daily living
P5	Constant severe pain, use of chronic pain medications

Table 2. Denis's work schedule.

W1	Return to previous work (heavy lifting) or physical activities.
W2	Able to return to previous activity (sedentary) or return to heavy work with restrictions
W3	Unable to return to previous work but works in another capacity.
W4	Unable to return to work full-time
W5	Unable to work

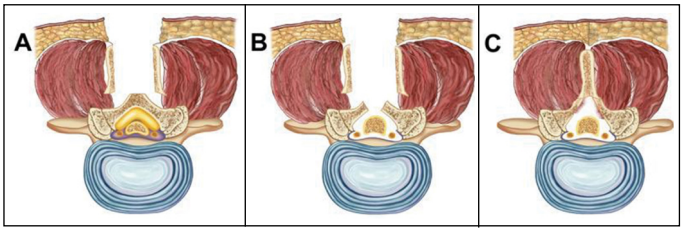

Figure 1. Surgical technique.

Statistical study

The values obtained from the different parameters evaluated were compared using the t-Student test with two-tailed distribution and equal variance between 02 samples. A significance level of 5% ($p<0.05$) was established.

A sample size of 5 pairs was calculated to test whether there is a minimum difference of 3.05 points on the low back pain and lower limb pain scale in the mean of the differences between the preoperative and one, seven, and thirty days postoperative times, using the data from the postoperative time that generated the lowest magnitude of effect, to encompass all other magnitudes, from a similar article published in the year 201916, with the addition of 20% for possible loss of information this number should be seven pairs (dependent sample). The calculation considered a power of 90%, a significance level of 5%, mean and standard deviation of the differences equal to 3.05 and 1.33 points on the Pain Scale, respectively. This calculation was performed using the PSS Health tool online version (Borges et al., 2021). Because we propose evaluating other secondary outcomes, such as the Denis Work Scale and quality of life through the SF-36 questionnaire, and because the study mentioned above used a sample of 20 patients, we propose a total sample of 15 participants for this research.

RESULTS

The 30 patients were followed for a period of 3 years. According to the Denis pain scale (Table 1), performed at the late assessment, 21 (70%) patients had no pain (P1), and 09 (30%) patients reported minimal low back pain, requiring no medication (P2). In addition, a statistical difference ($p<0.05$) was observed between the values obtained in the Denis pain scale between the preoperative and late postoperative periods.

The work capacity evaluation, according to the Denis work scale (Table 2), showed that 09 (30%) patients had restrictions to return to previous work activity (W2), and 21 (70%) patients were classified as W1. Furthermore, a statistical difference ($p<0.05$) was observed between the values obtained on the Denis work scale between the preoperative and late postoperative periods.

The functional evaluation employing the SF-36 questionnaire verified the score parameter obtained on a scale of "0 to 100", following the guidelines for the sum of the points by applying the Raw Scale calculation. Thus, in the evaluation during the late postoperative period of the group of patients, values of 81.25 were obtained for physical aspects (PA), 81.9 for functional capacity (FC), 81.3 for emotional aspects (EA), 64.3 for vitality (V), 65.9 for mental health (MH), 81.98 for social aspects (SA), 75.6 for pain (P), and 68.1 for general health status (GHS). A statistical difference ($p<0.05$) was observed between the values obtained in the SF-36 questionnaire between the preoperative and late postoperative periods.

Radiographic evaluations in the late postoperative period showed no radiographic signs of the approached vertebral segment instability arising from the surgical procedure. In addition, no changes were found compared to the images from the preoperative radiographs.

No postoperative complications were observed in the group of patients evaluated. All patients were discharged from the hospital on the first postoperative day.

DISCUSSION

The changes resulting from the aging process occur in all the constituent anatomical structures of the lumbar spine and contribute to the development of lumbar canal stenosis, mainly affecting the elderly. Spinal canal decompression in patients with lumbar canal stenosis showed a statistically significant reduction in visual analog assessment scores of low back pain and lower limb pain compared to preoperative scores. These results are in agreement with those reported in the literature.[7,8,12,13]

On the other hand, it is known that positive outcomes and low rates of complications and reoperations are directly associated with the choice of patients for certain surgical techniques, often based on the individual profile and specific coexisting comorbidities.[14] Furthermore, studies show that the incidence of spinal reoperations ranges from 5% to 16%, depending on risk factors.[15,16]

The effectiveness of surgical treatment of lumbar canal stenosis has been evidenced in several studies[17,18] and is established as a treatment that promotes symptom improvement. However, potential risks arising from the conventional surgical procedure caused by open dissection with a paravertebral musculature detachment, vertebral lamina resection, articular facets, spinous process, and injury to posterior ligamentous structures.[19,20,21] Alternative surgical treatment techniques have been developed to reduce complications from removing and injuring posterior vertebral elements.[9,22] The technique of spinous process division was described by Watanabe in 2005 and has shown good results with its use.[8,10,23] This technique is less invasive in the approach to the lumbar spine. It aims to reduce the possibility of iatrogenic instability compared with the conventional open approach, given the reduced injury to the paravertebral musculature and preservation of muscle insertion in the spinous process.[11,25] It was observed in an experimental study in rabbits that disinsertion of the multifidus muscle is an important cause of muscle atrophy and chronic pain.[26]

The integrity of the posterior vertebral elements and the continuity between the spinous process and vertebral lamina have been correlated in the literature as factors of good long-term results.[9]

Postoperative instability has been reported in about 3-20% of patients in long-term postoperative follow-up.[27,28,29] In the present study, no postoperative instability was observed in the cases evaluated, agreeing with the results reported in the literature in long-term postoperative evaluations.[7]

The clinical parameters selected for evaluation in this study were chosen considering they may be present in different types of lumbar stenosis (central, lateral recess, or foraminal).[17] Pain assessment has been criticized for the existence of wide variation in its tolerance and perception by patients.[30,31] The postoperative recovery of the patients was satisfactory; all could walk and were discharged on the first day. Watanabe et al. observed a lower intensity of postoperative lumbar pain in patients submitted to the spinous process separation technique concerning traditional open surgery in a randomized study.[7,8,13]

Decompression of the lumbar spinal canal using the spinous process separation technique provides excellent exposure for decompression of the vertebral canal structures, lateral recess, and vertebral foramen comparable to the conventional open surgery technique. The clinical and functional results evaluated in this study are satisfactory.

CONCLUSION

Decompression of lumbar spinal canal stenosis using the spinous process separation technique showed good clinical and functional results in the patients evaluated. In addition, no instability of the operated segment was observed in the evaluated postoperative period.

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

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