Lumbar Decompression in Patients with Parkinson's Disease: Series of Cases Treated with Minimally Invasive Surgery

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ABSTRACT

Introduction: Parkinson's disease mainly affects patients aged 65 and older. The degenerative condition at the lumbar spine in the context of a narrow canal added to the neuromuscular disorder and poor bone quality favors sagittal and coronal imbalance. Patients who need surgery have high rates of revision and reoperation with instrumented and non-instrumented techniques. The objective of this study was to evaluate the minimally invasive surgical decompression technique in patients with Parkinson's disease and radicular pain or neurogenic claudication in the lower limbs. **Materials and Methods:** Surgically treated patients with a diagnosis of lumbar spinal stenosis and Parkinson's disease were evaluated. The indication for the procedure was due to symptoms of the lumbar or foraminal stenosis of degenerative cause. All the patients were treated with decompressive surgery through a minimally invasive hemilaminectomy using tubular retraction and assistance with microscopy. **Results:** From January 2015 to December 2017, 6 patients with Parkinson's disease and lumbar spinal stenosis were treated. A total of 12 segments were decompressed, all patients were hospitalized for less than 24 hours. They did not require a transfusion nor suffered associated complications, with an average surgery time of 120 minutes. All with a minimum follow-up of 12 months and no relapse of the symptoms. **Conclusion:** The high rate of surgical complications in patients with Parkinson's disease, in contrast to the low rate of complications in the present study, suggests that minimally invasive surgery of the lumbar spine should be a surgical alternative in these patients.

Key words: Spinal stenosis; Parkinson's disease; minimally invasive decompression.
Level of Evidence: IV

Descompresión lumbar en pacientes con enfermedad de Parkinson: serie de casos tratados con cirugía mininvasiva

RESUMEN

Introducción: La enfermedad de Parkinson afecta principalmente a personas >65 años. El cuadro degenerativo lumbar en el contexto de un canal estrecho sumado a la alteración neuromuscular y la mala calidad ósea, favorece al desequilibrio sagital y coronal. Los pacientes que necesitan cirugía tienen altas tasas de revisión y reoperación con técnicas instrumentadas y no instrumentadas. El objetivo de este estudio fue evaluar la técnica quirúrgica de descompresión mininvasiva en pacientes con enfermedad de Parkinson y dolor radicular o claudicación neurogénica en los miembros inferiores. **Materiales y Métodos:** Se evaluó a pacientes con diagnóstico de canal lumbar estrecho y enfermedad de Parkinson tratados quirúrgicamente. El procedimiento se indicó por síntomas de canal estrecho o estenosis foraminal de causa degenerativa. Todos fueron tratados con una cirugía descompresiva a través de una hemilaminectomía mininvasiva mediante retracción tubular y asistencia con microscopia. **Resultados:** De enero de 2015 a diciembre de 2017, se trató a 6 pacientes con enfermedad de Parkinson y canal lumbar estrecho. Se descomprimieron 12 niveles en total, todos estuvieron internados <24 h. No se necesitaron transfusiones, no hubo complicaciones asociadas, el tiempo promedio de cirugía fue de 120 minutos. El seguimiento mínimo fue de 12 meses, los síntomas no reaparecieron. **Conclusiones:** La elevada tasa de complicaciones en pacientes operados con enfermedad de Parkinson y la disminución de las complicaciones en este estudio sugieren que la cirugía mininvasiva de columna lumbar debería ser una alternativa quirúrgica en estos pacientes.

Palabras clave: Estenosis de canal; enfermedad de Parkinson; descompresión mininvasiva.
Nivel de Evidencia: IV

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INTRODUCTION

Parkinson's disease (PD) is a neurodegenerative disorder that mainly affects adults with an incidence rate between 1% to 4% of the population over 60 years old.[1] It is characterized by a series of motor manifestations such as tremors, bradykinesia, muscle rigidity, as well as gait and posture abnormalities.[2]

Multiple spinal abnormalities, mainly associated with balance disorders in the coronal and sagittal planes, have been described (Figures 1-3).

Figure 1. Clinical and radiographic appearance of a patient with coronal and sagittal imbalance suffering from Parkinson's disease.

Figure 2. Pisa syndrome in a patient with Parkinson's disease.

Figure 3. Alteration of the sagittal plane in the lateral spinogram.

In this type of patients, postural deformities are related to axial and appendicular hypertonicity combined with the progressive loss of proprioception.[3,4] 3-12,9% of patients have camptocormia, an abnormal posture with a marked flexion of the thoracolumbar spine, which increases with time and fatigue during the day and when walking. It is a progressive postural insufficiency which is abated when lying down or sitting, or is corrected when the patient with PD leans against a wall. This condition is not only associated with PD, but also observed in patients with other diseases, such as myopathies, myositis, multiple system atrophy and conversion disorder. Generally, there are neither radiographic abnormalities nor structural changes related to this type of neuromuscular disorder.

At the same time, PD alters phosphocalcic metabolism, leading to osteoporosis and increasing the chances of spontaneous vertebral compression fracture, thus worsening the deformity.[4]

On the other hand, as it generally affects an adult population, the degenerative changes and their consequent spinal stenosis further alter the quality of life of these patients.

In these cases, surgical intervention is considered a highly challenging procedure due to its high complication and revision rates.[5,6]

Minimally invasive decompression surgery has yielded very good results in patients with symptoms secondary to spinal stenosis and it is increasingly indicated to patients with numerous comorbidities.[7]

The aim of this study is to communicate the preliminary results of a minimally invasive lumbar decompression surgical technique in patients with narrow canal and PD.

MATERIALS AND METHODS

We performed a retrospective study on a series of patients with diagnosed PD and associated lumbar spinal stenosis who had undergone a minimally invasive lumbar decompression between January 2015 and December 2017. The predominant symptoms were defined as neurogenic claudication symptoms or radicular symptoms. The signs of sensory or motor deficits, as well as postural deformities (camptocormia, Pisa syndrome, antecollis), were studied.

The patients included in the series had at least stage 3 PD according to the Hoehn-Yahr scale.[8]

The patients initially underwent physical rehabilitation therapies and, when the outcomes were unsatisfactory, CT-guided selective epidural or radicular blocks, depending on the predominant symptom, were performed.

Static and dynamic radiographs, spinograms, CT and MRI scans were performed on all patients.

The decision to proceed with surgical intervention was taken by a multidisciplinary team, which included the treating neurologist.

Patients with diagnosed PD and lumbar spinal stenosis whose predominant symptom was marked by neurological signs of gait claudication or radicular symptoms (cruralgia or sciatica) and who responded positively to CT-guided selective blocks were included.

Patients whose main symptom was lumbago or who had a history of hip surgery, or marked signs of instability or segment deformity or those who did not respond to treatment with blocks were excluded.

The surgical technique of choice was minimally invasive decompressive lumbar hemilaminectomy. All procedures were performed by the same surgical team. A progressive auto-static tubular system (Metrx,-Medtronic Inc.) was used for retraction, tubular diameters ranged from 18 to 22 mm. An OPMI Pentero 800 microscope (Zeiss) was used to amplify and illuminate the surgical field. The duration of the procedure, average hospital stay and complications arisen during the procedure and postoperative period were recorded.

Pain in the inferior limbs was assessed using the visual analog scale (range 1-10) before surgery, in the immediate postoperative period and a year after the procedure. Patient satisfaction one year post-surgery was determined according to Weiner's scale and modified MacNab criteria. Minimum follow-up was 12 months for all patients (average 24 months, the entire series).

RESULTS

The series consisted of six patients (5 males and 1 female) with an average age of 70.5 years (range 65-78) before surgery and PD stages 3 and 4 according to the Hoehn-Yahr scale for PD progression.

In the diagnostic imaging, the most common finding was lumbar spine stenosis, mainly on segments L2-L3, L3-L4 and L4-L5.

All patients were hospitalized for less than 24 hours. The total amount of treated segments was 12 (an average 2 levels per patient), the most frequent segment was L3/L4 (41.6%, n = 5) followed by L4/L5 (33.3%, n = 4) and L5/S1 (25%, n = 3). Demographic data are summarized in Table 1. The average surgical time was 120 min (range 103-140).

Table 1. Demographic data

Demographic data	
Number of patients	6
Sex F/M	(1-5)
Average age	70,5
Symptoms Sciatica Cruralgia Claudication	 (4-6) (3-6) (3-6)
Pharmacological blocks	6
Affected segments L2-L3 L3-L4 L4-L5	12 3 5 4

When a decompression of up to two segments was performed, a single approach was used (n = 5); in only one patient, who required decompression of three segments, a double approach was used (n = 1).

No patients required blood transfusions. There were no recorded postoperative complications, such as infection, revision due to relapse or dural injuries. The preoperative symptomatology improved in all the patients; this had an effect on their quality of life without interfering in the natural progression of the disease. After a year of follow-up, there were no signs of instability in the treated segments, which were evaluated with flexion and extension radiographs.

The average score in the visual analog scale for pain in the inferior limbs was 8.60; it improved to 2.6 in the immediate postoperative period and reached 2.8 a year after surgery (Figure 4).

83.3% (n = 5) of patients perceived the surgical treatment as very successful or quite successful, according to Weiner's questionnaire, and would recommend the procedure to another individual who required it. According to modified Macnab scale, five out of six patients considered the surgical outcomes as good or excellent and one as fair (Table 2).

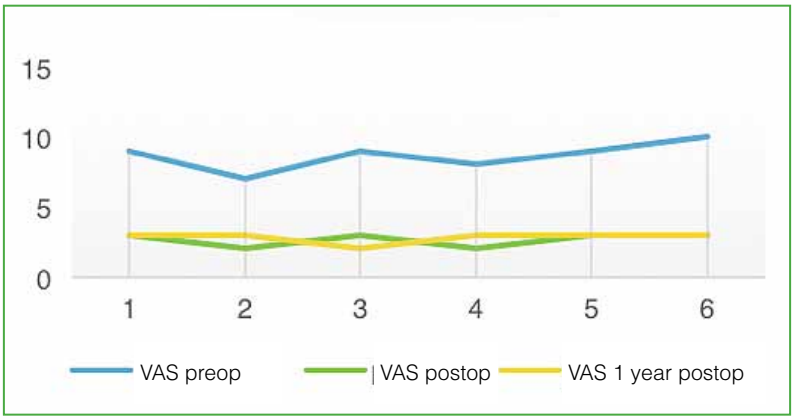

Figure 4. Visual analog scale values.

Table 2. Clinical outcomes

Clinical outcomes	
Modified macnab	
Excellent	3
Good	2
Fair	1
Poor	
Weiner	
Very successful	1
Successful	4
Not very successful	1
Failure	
Worse than before	

DISCUSSION

There is no consensus in the scant current literature on the surgical management of spinal pathology in patients with PD.[4,9-12]

Biomechanical complications arising from instrumentation are responsible for the high revision rate, fundamentally due to pseudoarthrosis, infections, implant loosening and alterations in the correction with progressive deformity.[1,3,7,9,13-15]

No articles recommending simple decompression in patients with PD have been published. In a six-patient series, Babat et al. report that, after open decompressions with laminectomy, all patients suffered negative outcomes within the first year post-surgery. The patients in that study had been operated upon due to a narrow lumbar canal, five of them underwent decompression, all of them developed instability and required fusion. Patient 6, who had undergone non-instrumented decompression and fusion, progressed with instability and pseudoarthrosis.

In these patients, lumbopelvic compensation is diminished; therefore, pelvic retroversion, decrease of thoracic kyphosis and flexion of the knees do not generate loss of lumbar lordosis.[9,16] Some authors have described this morphological change in the pelvis as pelvic kyphosis.[13,17] There is a tendency to lean forward, including the pelvis, probably due to muscle wasting. Wunderlich et al. have described cases where the camptocormia-like deformity

was related to a process of histopathological features compatible with paraspinal myositis; MRI scans showed a hyperintense signal and edema in the paraspinal area. The response to treatment with corticosteroids was good.[18]

In our series, we did not include patients with postural alterations such as those described in the literature.

The largest series of cases with PD published in a study includes 48 patients who underwent long fusions in seven centers, over the course of 30 years, in France. 20 of those 48 patients underwent revision surgery. In spite of the high complication rate and the fact that only a third of the sample experienced good results, 78% of the population was satisfied with the final outcome.[4,10]

Revision rates vary from 60% to 86%, and the main causes of revision are implant wear, screw pull-out, adjacent segment degeneration and infection of the surgical wound.[1,3,11]

In our series, there were no complications arising from infections of the surgical wound; some published studies report an infection rate between 14% and 17%.[1,14]

The need for surgery does not seem to be related to the neurological disorder, but rather with the alterations these patients experience in their quality of life and social life. Surgical treatment attempts to restore the patient's independence.[4,11]

We have not found publications about lumbar canal decompression by minimally invasive techniques in patients with PD. Most studies describe results from open surgical treatments, instrumented corrections and, less frequently, non-instrumented open decompressions. All of these options present complications.[1,3,4,9,13]

We believe it is a valid therapeutic option, considering these patients are limited and impaired, they experience numerous symptoms and a progressive disease. The minimally invasive technique provides the patients with the possibility of resuming their normal activities and regaining independence with minimal damage on the posterior muscles; this translates into a very satisfactory clinical outcome.

The high risk of revision and complications is attributed to a combination of severe neuromuscular disorder, poor bone quality and kyphosis of the adjacent segment, which is the most common mechanism of a failed outcome.[11,14,15]

In our series, the main advantage was that, in spite of being a preliminary case report, the patients had favorable evolution, without associated complications, with a significant improvement in postoperative pain and without a worsening of the symptoms or signs of postoperative instability a year after surgery.

The main limitation is its small size, with an average period of postoperative follow-up of 24 months. Considering certain characteristics of these patients, such as phosphocalcic metabolism alterations and the associated neuromuscular disorder, a lengthier follow-up period could be useful in order to assess the behavior of the decompressed segments.

CONCLUSION

Considering the complexity posed by patients with PD and lumbar spinal stenosis, current therapeutic options include fusion surgery and open decompression, with a high rate of morbidity and revision. Thus, offering a minimally invasive therapeutic option could be greatly beneficial to avoid mechanical complications due to instrumentation, decrease complications and reduce hospital stays.

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