ORIGINAL ARTICLE
MINIMALLY INVASIVE SURGERY
http://dx.doi.org/10.1590/S1808-185120222201260636

INTERLAMINAR ENDOSCOPIC LUMBAR DISCECTOMY - CLINICAL OUTCOME

DISCECTOMIA LOMBAR ENDOSCÓPICA INTERLAMINAR - DESFECHO CLÍNICO

DISCECTOMÍA LUMBAR ENDOSCÓPICA INTERLAMINAR - RESULTADO CLÍNICO

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ABSTRACT

Objective: Evaluate the clinical outcome of patients with lumbar disc herniation (HDL) operated by endoscopic interlaminar microdiscectomy. We evaluated epidemiology, time to return to work, and technique-related complications as secondary outcomes. Method: Prospective longitudinal study, where patients with HDL with surgical indications were evaluated. They underwent endoscopic discectomy exclusively using the interlaminar technique. Clinical results were evaluated using the Oswestry 2.0 questionnaire (ODI) and the visual analog scale (VAS). In this study, we inserted the Macnab postoperative satisfaction index. In parallel with these indices, we analyzed the results regarding epidemiology variables, time to return to work, and complications. Such questionnaires were applied preoperatively, postoperatively the day after surgery, and one year after. Results: In 132 patients selected for the study, we obtained significant clinical improvement in the ODI and VAS questionnaires, and 81.3% of the patients had excellent and good Macnab index. The hospital stay was 22.7 hours, and the return to work was 30 days. The rate of complications with the method was 12.8%, with recurrence of disc herniation being the most common complication with 9.8% of cases. Conclusion: The endoscopic technique proved effective in treating lumbar spinal disc herniation with significant clinical improvement in the analyzed period, low incidence of complications, early postoperative rehabilitation, and results close to or superior to the gold standard technique. ***Level of Evidence III; Prospective cohort study***

Keywords: Spine; Intervertebral disc displacement; Endoscopy.

RESUMO

Objetivo: Avaliar o desfecho clínico dos pacientes com hérnia discal lombar (HDL) operados por microdiscectomia endoscópica interlaminar. Como desfechos secundários, avaliamos a epidemiologia, tempo de retorno ao trabalho e as complicações relacionadas a técnica. Método: Estudo longitudinal prospectivo, onde foram avaliados os pacientes portadores de HDL com indicação cirúrgica. Foram submetidos a discectomia endoscópica exclusivamente pela técnica interlaminar. Avaliou-se também os resultados clínicos por meio do questionário Oswestry 2.0 (ODI) e da escala visual analógica (EVA). Inserimos nesse estudo índice de satisfação pós-operatória de Macnab. Em paralelo a esses índices analisamos os resultados quanto as variáveis de epidemiologia, tempo de retorno ao trabalho e as complicações. Tais questionários foram aplicados no pré-operatório, no pós-operatório no dia seguinte a cirurgia e após 1 ano da cirurgia. Resultados: Em 132 pacientes selecionados para o estudo obtivemos significante melhora clínica nos questionários ODI e EVA, assim como 81,3% dos pacientes tiveram excelentes e bons no índice de Macnab. O tempo de internação hospitalar foi de 22,7 horas o retorno laboral de 30 dias. Já a taxa de complicações com o método foi de 12,8%, sendo a recidiva da hérnia discal a complicação mais comum com 9,8% dos casos. Conclusão: A técnica endoscópica se mostrou eficaz no tratamento da hérnia discal da coluna lombar com melhora clínica significante no período analisado, baixa incidência de complicações, precoce reabilitação pós-operatória e resultados próximos ou superiores à técnica padrão-ouro. ***Nível de Evidencia III; Estudo de coorte prospectivo.***

Descritores: *Coluna vertebral; Deslocamento do disco intervertebral; Endoscopia.*

RESUMEN

Objetivo: Evaluar el desenlace clínico de pacientes con hernia de disco lumbar (HDL) operados mediante microdiscectomía interlaminar endoscópica. Como resultados secundarios, evaluamos la epidemiología, el tiempo de regreso al trabajo y las complicaciones relacionadas con la técnica. Método: Estudio longitudinal prospectivo, donde se evaluaron pacientes con HDL con indicación quirúrgica. Se les realizó discectomía endoscópica interlaminar. Los resultados clínicos también se evaluaron mediante el cuestionario Oswestry 2.0 (ODI) y la escala analógica visual (VAS). En este estudio, insertamos el índice de satisfacción postoperatoria de Macnab. Analizamos los resultados cuanto a variables epidemiológicas, tiempo de reincorporación al trabajo y complicaciones. Dichos cuestionarios se aplicaron en el preoperatorio, en el postoperatorio al día siguiente de la cirugía y al año de la cirugía. Resultados: En 132 pacientes seleccionados para el estudio se obtuvo una mejoría clínica significativa en los cuestionarios ODI y EVA, así como el 81,3% de los pacientes tuvieron excelente y bueno en el índice de Macnab. La estancia hospitalaria fue de 22,7 horas y la reincorporación al trabajo de 30 días. Entre las

Study conducted by Orthopedic Service of Hospital do Trabalhador, Universidade Federal do Paraná, Curitiba, PR, Brazil.
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Received on 02/02/2022 accepted on 02/17/2023
Reviewed by: Rodrigo Amaral

complicaciones, la recurrencia de la hernia discal fue la más frecuente con el 9,8% de los casos. Conclusión: La técnica endoscópica demostró ser efectiva en el tratamiento de la hernia de disco espinal lumbar con mejoría clínica significativa en el período analizado, baja incidencia de complicaciones, rehabilitación posoperatoria y resultados cercanos a la técnica estándar de oro. ***Nivel de Evidencia III; Estudio de cohorte prospectivo.***

Descriptores: *Columna Vertebral; Desplazamiento del disco intervertebral; Endoscopía.*

INTRODUCTION

Lumbar disc herniation (LLH) is among the most common orthopedic diseases and is the main etiology of lumbosciatalgia.[1] Open microdiscectomy is still considered the gold standard among the various surgical treatment methods, and endoscopic discectomy stands out. It has shown similar results to microdiscectomy, associated with advantages such as lower incidence of postoperative pain complaints, shorter hospital stays, smaller surgical scar, earlier postoperative rehabilitation and return to work, lower incidence of epidural fibrosis, and lower complication rates than the traditional method.[2]

The two most common options for the endoscopic technique are the interlaminar and the transforaminal. Generally, foraminal and extraforaminal hernias tend to be treated by the transforaminal method or the extreme lateral approach. The interlaminar technique usually treats central or center-lateral hernias. The iliac crest acts as an anatomical barrier for transforaminal access at the L5-S1 level, so there is a predilection for performing the procedure through the interlaminar approach.[3]

The literature shows 61% of the hernias are at the L4-L5 and L5-S1 levels. The prevalence of central/central-lateral hernias is 2.4 times higher than that of foraminal/extraforaminal hernias, which justifies the increase in the indication of the interlaminar route.[4]

This paper aims to evaluate the clinical outcome of patients with HDL operated on using the interlaminar endoscopic technique. In addition, we assessed epidemiology, time to return to work, and technique-related complications as secondary outcomes.

MATERIAL AND METHODS

The prospective cohort study was conducted in a tertiary referral hospital for spine care from January 2014 to January 2020, totaling six years of endoscopic surgical procedures, and followed prospectively for at least 12 months postoperatively. The Research Ethics Committee approved this study under number 44903421.4.0000.5225.

Inclusion criteria for the study were patients with central or center-lateral HDL, refractoriness to analgesic therapy for at least six weeks, progressive neurological deficit, and age ranging from 18 to 80 years. After consenting to participate in the study and signing the informed consent form, the patients underwent lumbar discectomy by interlaminar endoscopic surgical technique. They were followed up for at least 12 months postoperatively.

Patients with previous lumbar spine surgery, patients who were lost to follow-up, and those who declined to participate in the research project were excluded from the analysis. In addition, patients with foraminal hernias were excluded from this study because their location is not the best indication for the interlaminar route.

The Oswestry 2.0 questionnaire (ODI) and the visual analog scale (VAS) were used to evaluate lumbosciatalgia clinically. These questionnaires were applied prospectively preoperatively, the day after surgery, and one year after. In addition, epidemiological data include gender, age, level operated on, and complications such as intraoperative neural lesions and iatrogenic durotomy; surgical site infection; neurological changes (paresthesia, paresis), cerebrospinal fluid leakage, and postoperative herniated disc recurrence were analyzed. This study did not include the variable Body Mass Index (BMI).

As for the surgical technique used, in endoscopic interlaminar discectomy, the patient is placed on a translucent table in a prone position under general anesthesia. In this technique, general anesthesia is used because the nerve roots need to be retracted, which can cause discomfort to the patient. The image intensifier is used to identify the interlaminar window at the desired level, and then a longitudinal approach of approximately 1 cm is made near the midline. Once access is achieved, an initial dilator is introduced, followed by the endoscope. First, the multifidus muscle is dissected, and the ligamentum flavum is exposed and opened to reach the epidural space. The nerve root is protected with the help of a beveled cannula. Once the herniation is exposed, a discectomy and decompression are performed with the help of specific instruments. At the end of the procedure, a thermonucleoplasty is performed. Generally, this technique is used for the L4 / L5 and L5 / S1 levels, where the wider interlaminar space allows for a larger working space.[5] (Figure 1)

All patients followed the same protocol of postoperative analgesia, in which a single dose of Methylprednisolone (125 mg), Gabapentin (300 mg 8/8 hours), and Dipyrone (1 g 6/6 hours) was given alternately until hospital discharge. In addition, all patients followed the same postoperative rehabilitation protocol. They were instructed to get out of bed after 6 hours of the procedure and walk with the help of the physical therapy team. Postoperative rehabilitation physical therapy was started three weeks after the procedure.

All procedures were performed in the same hospital and by a single surgeon. The material used for the procedures was the Vertebris Richard Wolf Endoscopes®.

The normality of the quantitative variables was assessed using the Shapiro-Wilk test. Since the normality assumption was violated for these variables, they were represented by the Median and Interquartile range (first quartile; third quartile) and compared between groups by the Mann-Whitney U-test. Qualitative variables were represented by their absolute and relative frequencies and compared using Fisher's exact test. Linear mixed models with random intercept were used to evaluate Oswestry and VAS scores over time. R software (R Core Team, 2020), version 4.0.2, was used for data analysis. A multivariate analysis conducted with a regression model for longitudinal data was used as a statistical method. A significance level of 5% was adopted, considering it significant if the p-value < 0.05.

RESULTS

Out of 186 patients, 132 were included in the study. Fifty-four patients were excluded from the study for failing to complete the 12 months of outpatient follow-up or refusing to participate. Seventy-six

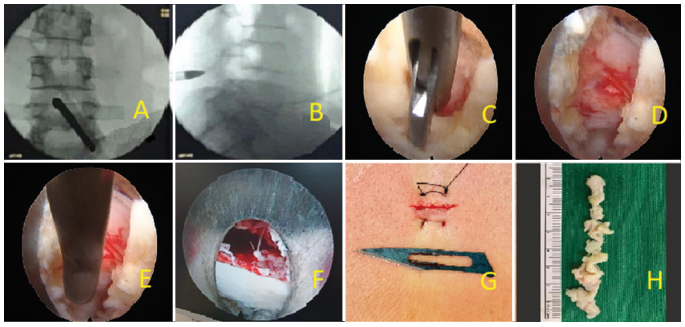

Figure 1. Percutaneous endoscopic interlaminar discectomy. (a) The entry point in the anteroposterior radiographic view at the L4-L5 level. (b) Dilator is positioned above the articular processes, considering the insured limit in the lateral radiographic view so as not to invade the canal. (d) Visualization of the epidural space. (e) Removal of the nerve root. (f) Visualization of the neurological structures with identification of the root axilla. (g) Surgical scar. (h) Disc material removed. Source: The author (2021).

(57.6 %) patients were male, and 56 (43.4 %) were female. The age of the patients ranged from 27 to 71 years, and the average age was 44.8 years.

Most patients (85.6%) were treated surgically at only one disc level, and the levels operated on in descending order were L5-S1 with 59 cases (44.7%), followed by L4-L5 with 46 cases (37.1%), L5-VT with 4 cases (3%), and L3-L4 with 2 (1.5%) cases. Nineteen cases (14.4%) were treated surgically at two levels, with all cases with a two-level procedure being at the L4-L5 and L5-S1 levels. (Figure 2)

The median Oswestry index (ODI) preoperatively was 81%; on the first day after the procedure, it reduced to 47%, and 12 months after, it was 20%. The visual analog pain scale (VAS) had a preoperative median of 10; in the immediate postoperative period, it reduced to 4; at month 12, it was 2. Both scores had a significant decline over time ($p<0.001$). (Figure 3)

In the Macnab index, 68 (51.5%) patients referred to the postoperative result as excellent, 38 (28.8%) as good, 24 (18.2%) as fair, and 2 (1.5%) as poor. (Table 1) A correlation was found between ODI and VAS with Macnab, where higher values were found in both indices with Macnab Fair/Poor and lower values of EVA and ODI in Macnab Excellent/Good. (Table 1) There was no significant difference in the VAS and ODI indices regarding age differences. (Table 2)

We compared EVA, ODI, and Macnab results between the most commonly operated levels, L5-S1 and L4-L5. Forty-eight (81.4%) patients operated on at the L5-S1 level had Excellent/Good Macnab, and 11 (18.6%) Fair/Poor Macnab. Of those operated on at L4-L5, 38 (77.6%) reported Excellent/Good results, and 11 (22.4%) were Fair/Bad. With a p-value of 0.639, there was no statistical difference. (Table 1) Similarly, VAS and ODI also did not show such a finding. (Table 3)

There was no significant difference between the sexes in the VAS, ODI (Figure 4, Table 4), and Macnab indices. (Table 1)

The average length of hospital stay for the patients was 22.7 hours, ranging from 12 to 36 hours. On average, the patients maintained postoperative rest for 12.2 hours after the procedure. One hundred and twelve (84.8%) patients returned to work within 12 months. In these, the average return was 30 days. Twenty (15.2%) patients did not return to work. Of those, 8 (6.0%) were retired, 7 (5.3%) were unable

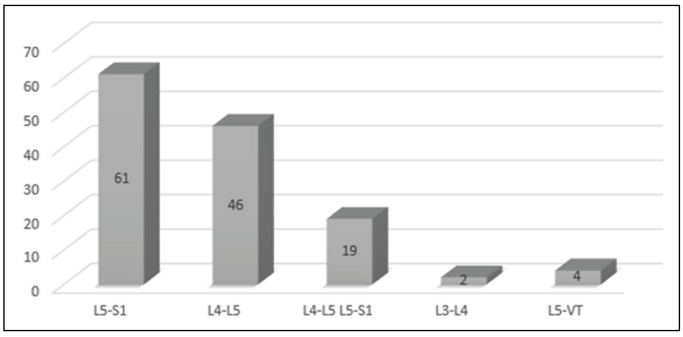

Figure 2. Distribution of patients according to the level operated on. Source: The author (2021).

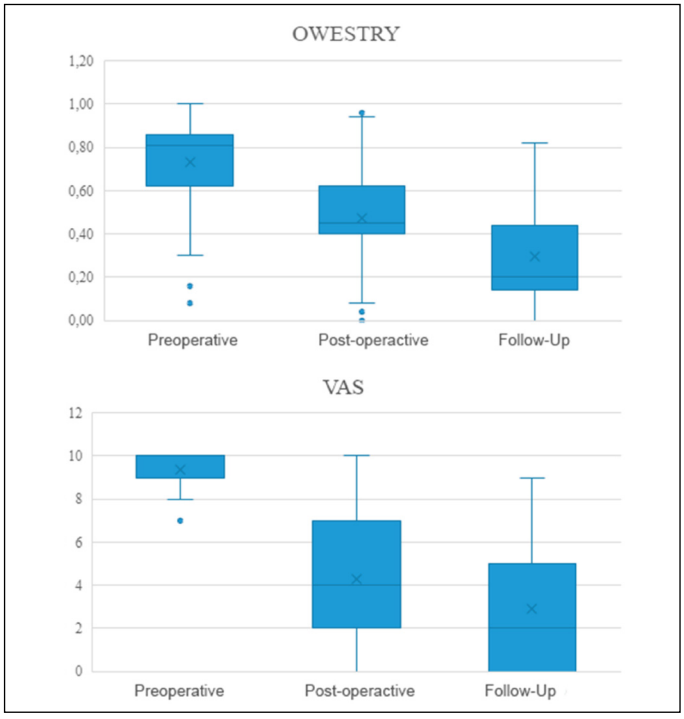

Figure 3. Relationship between the Oswestry index (ODI) and Visual Analog Scale (VAS) preoperatively, on the first day after the procedure, and after 12 months. Source: The author (2021).

Table 1. Relationship between MACNAB and its variables.

Variable		Full Sample	MACNAB		p-value
			Good Excellent	Fair Poor	
Return to work	Yes	112	95 (84,8%)	17 (15,2%)	0.004
	No	20	11 (55,0%)	9 (45,0%)	0.987
Time to return to work		30 (15;150)	30 (15;150)	30 (30;60)	0.808
Hospitalization time		22.7 hrs			
Lying Time		12.2 hrs			
Sex	Female	56	46 (82.1%)	10(17.9%)	0,825
	Male	76	60 (78.9%)	16 (21.1%)	
Age	>=60 years old	17	13 (76.5%)	4 (23.5%)	0,744
	<60 years old	115	93 (80.9%)	22 (19.1%)	
Durotomy	Yes	3	3 (100%)	0 (0.00%)	1
	No	129	103 (79.8%)	26 (20.2%)	
Operated level	L4-L5	49	38 (77.6%)	11 (22.4%)	0.639
	L5-S1	59	48 (81.4%)	11 (18.6%)	
Oswestry	Pre	0.81(0.62;0.86)	0.82 (0.62;0.85)	0.80 (0.61;0.86)	0.865
	Post	0.45(0.40;0.62)	0.40 (0.22;0.60)	068 (0.57;0.78)	<0.001
	Follow-up	0.20(0.14;0.44)	0.20 (0.08;0.36)	0.62 (0.58;0.65)	<0.001
EVA	Pre	10(9;10)	10 (8.5;10)	10 (9.2;10)	0.206
	Post	4(2;7)	4 (1;6)	6 (4.2;8)	<0.001
	Follow-up	2(0;5)	1 (0.3)	7 (6;8)	<0.001

Source: The author (2021).

Table 2. Relationship between Oswestry/EVA and age.

Variable		Age <60years	Age>= 60 years	p-value
Oswestry	Pre	0.78(0.62;0.86)	0.82(0.78;0.86)	0.597
	Post	0.44(0.40;0.62)	0.60(0.40;0.80)	0,169
	Follow-up	0.20(0.13;0.43)	0.40(0.20;0.46)	0.314
EVA	Pre	10(8.5; 10)	10(10; 10)	0.037
	Post	4 (2;6.5)	5 (1;7)	0.659
	Follow-up	2(0.5;5)	3 (0;6)	0.467

Source: The author (2021).

Table 3. Relationship between Oswestry/EVA and operated level.

Variable		L4-L5	L5-S1	p-value
Oswestry	Pre	0.78(0.58;0.84)	0.82(0.62;0.86)	0.431
	Post	0.42(0.38;0.60)	0.46(0.40;0.62)	0.285
	Follow-up	0.20(0.08;0.40)	0.26(0.14;0.45)	0.457
EVA	Pre	10(9;10)	10(9;10)	0.456
	Post	4 (2;6)	4 (2;6)	0.997
	Follow-up	2 (0;5)	2 (1;5)	0.726

Source: The author (2021).

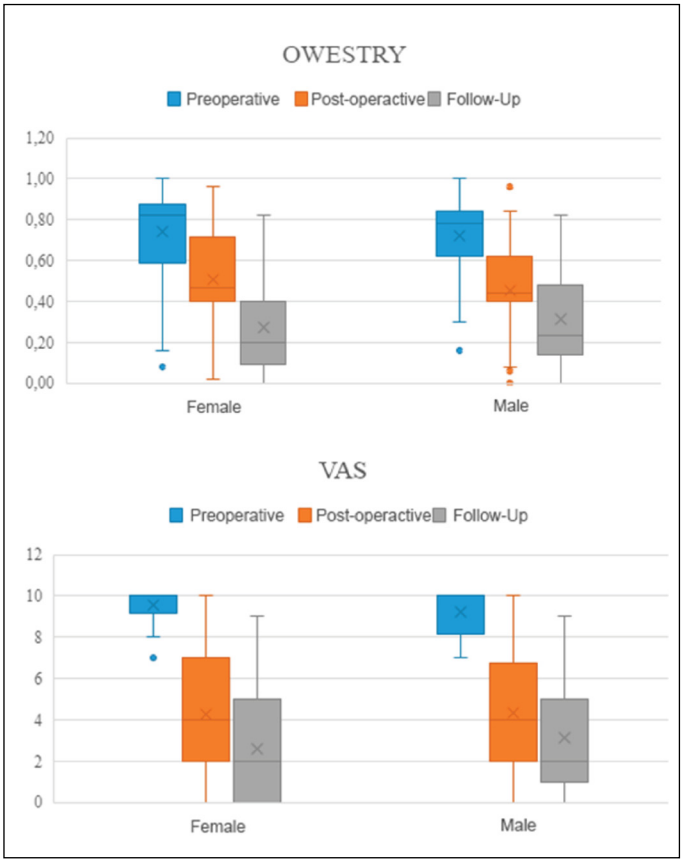

Figure 4. Relationship between the Oswestry index (ODI) and the Visual Analog Scale (VAS) compared to the male and female sexes. Source: The author (2021).

Table 4. Relationship between Oswestry/EVA and sex.

Variable		Female	Male	p-value
Oswestry	Pre	0.82(0.59;0.86)	0.78(0.62;0.84)	0.361
	Post	0.47(0.40;0.70)	0.44(0.40;0.62)	0.363
	Follow-up	0.20(0.12;0.40)	0.23(0.14;0.48)	0.364
EVA	Pre	10(9.4; 10)	10(8.4; 10)	0.050
	Post	4 (2;7)	4 (2;6.2)	0.968
	Follow-up	2 (0;5)	2 (1;5)	0.209

Source: The author (2021).

to get a job, and 5 (3.8%) were disabled due to lumbosciatalgia. There was no relationship between the time of return to work and Macnab's index. Of those who returned, 85% were rated Macnab Good/Excellent, while among those who did not return, this proportion was 55%, and this difference is significant. (Table 1)

There were an incidence of 17 (12.8%) complications overall. Thirteen (9.8%) patients underwent reintervention due to the recurrence of the herniated disc. All cases of recurrence were reoperated within the first six months postoperatively, with an average of 3.5 months for reoperation. There were nine cases of discectomy associated with 360° arthrodesis, three were performed partial lamina removal associated with open discectomy, and the endoscopic technique reapproved only 1. There were 3 (2.27%) durotomies during the procedures, which were asymptomatic and had no clinical repercussions, all with no evolution to CSF fistula. There was no case of inadvertent nerve root injury. Sixteen (12.19%) patients reported maintaining a degree of paresthesia in the lower limbs to a lesser or equal degree than preoperatively. We had 1 (0.76%) case of deep infection diagnosed on postoperative day 7. An open discectomy was performed due to discitis in residual disc content, debridement, and antibiotic therapy, with good evolution. The durotomy patients showed no significant difference in VAS, ODI (Figure 5), and Macnab assessment. (Table 1)

DISCUSSION

The VAS and the ODI indices showed that the patients improved significantly over the period. These findings are similar to those found in the study by Hua et al.[6] The same authors found excellent and good results of 90% in the L4-L5 group and 89.6% in the L5-S1 group in Macnab's index, values close to those found in the present study, which showed an average of 81.3% of excellent and good results. In the same study, Hua et al. found no significant difference in clinical improvement in patients who underwent endoscopic discectomy at L4-L5 compared to the L5-S1 level, just as no significant difference in clinical improvement was evident in patients who underwent surgery at the L3-L4 and L4-L5 levels. Similarly, we found no statistically significant difference regarding the L4-L5 and L5-S1 levels.

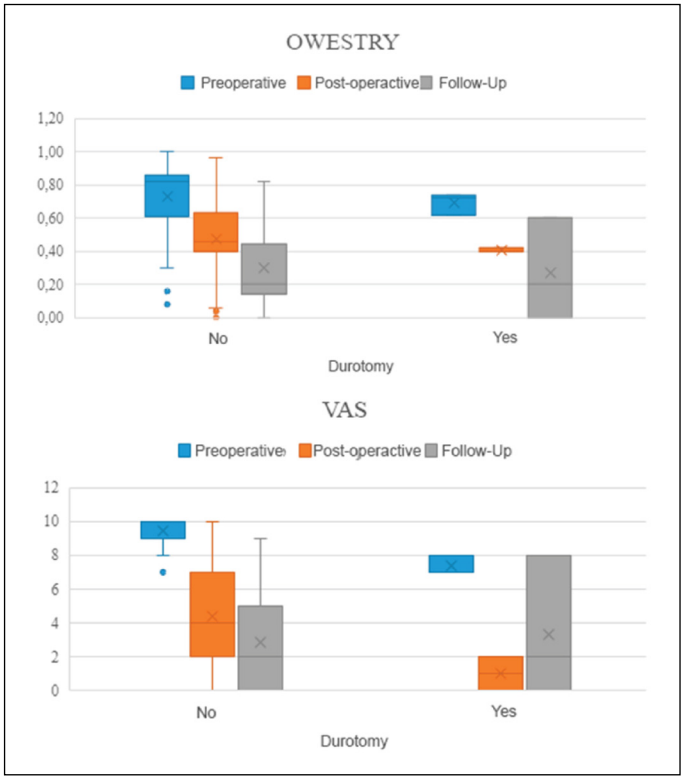

Figure 5. Relationship between the occurrence and non-occurrence of durotomy with ODI and EVA over time. Source: The author (2021).

Song et al.,[7] in their comparative study between the endoscopic and open technique, found an average length of hospital stay of 0.94 days in patients who underwent the minimally invasive procedure, a value similar to our sample, with the same 0.94 days of hospital stay found. However, the same authors found a mean hospital stay of 2.0 days in patients who underwent open microdiscectomy. In general, the length of hospital stays of patients operated on by endoscopy is significantly shorter than the patients treated with an open microdiscectomy, which the literature recommends for discharge on the first or second postoperative day; however, we found studies reporting an average of up to 6 days of hospital stay in the gold standard technique.[8]

Yang et al.[9] demonstrated in their paper that patients undergoing interlaminar endoscopic discectomy remained restricted to bed for 8 hours, significantly less than the mean of 17 hours for open microdiscectomy demonstrated in the same paper. Our figures are slightly higher, averaging 12.2 hours of rest. Cao, Jian, et al.,[10] in their work with 235 patients, found no significant difference between the clinical improvement of patients discharged on the same day as the procedure and those who had the surgery and were kept hospitalized. Still, it was shown that hospital costs are significantly reduced when they are discharged early.

Lewandrowski et al.[11] demonstrated in their paper that return to work depending on the occupation type, with jobs that require high physical demand tending to have lower rates of return. In this study, the average number of return days was 33.5 days for patients classified as high demand, values close to that found in our median of 30 days, where we did not classify the type of work performed per patient. In Peng et al.,[2] an early return was demonstrated with an average of 24.3 days. Thak et al.[12] had in their study an average of 60 days for the return to work in those who had conventional open surgery. In the 12 months, 84.8% of the operated patients returned to work, a number higher than the 72% found by Andersen et al.[13] analyzing microdiscectomy results. The difference between the proportions of each rating of those who did or did not return to work was significant, with 85% of those who did return having a Macnab Good/Excellent rating, while among those who did not return, this proportion was 55%.

Our complication rate was 12.8%, similar to the work of Wasinpongwanich et al.,[14] which also had an incidence of 12.8%. Regarding the gold standard technique, Shriver et al.[15] had a 12.5% incidence of complications with open microdiscectomy. The incidence of durotomy in our study was 2.27%, lower than the literature shows in the gold standard, around 3.1%.[16] Abdul et al.,[17] in their study of 96 cases of endoscopic interlaminar discectomy, presented an incidence of 3.5% of durotomy, with all cases managed conservatively and none evolving to CSF fistula, similar to our series. Post-procedure herniated disc recurrence was 9.8%, lower than open microdiscectomy, as shown by Soliman et al.[18] with 18.5% and Aichmair et al.[19] with 25%. Wasinpongwanich et al.[14] had a recurrence rate of 12.1%, while Ruetten et al.[20] reported a recurrence rate lower than our study, with an incidence of 6.6%. Sebben et al.[21] had a reoperation rate of only 3.6%, but the 6-month follow-up of the patients must be taken into consideration.

Choi et al.,[22] in a retrospective study of 7,184 patients, reported 9 cases of spondylodiscitis after endoscopic surgery, a rate of only 0.12%. Our single case of postoperative spondylodiscitis represents a rate of 0.76%, which, although higher than the work of Choi et al.,[22] has a similar small incidence. However, Peng et al.[2] had a higher infection rate than ours in endoscopic surgery, with one case out of 55 operated on, representing 1.8%. The literature shows that the incidence of surgical site infection after open discectomy is around 3%, but the incidence increases to up to 12% with the addition of instrumentation.[23]

We had no cases of inadvertent nerve root lesion, but 16 (12.19%) of the patients reported maintaining a degree of paresthesia in the lower limbs that was less or equal to the preoperative level, unlike the transforaminal technique, in which there are higher rates of lesion and paresthesia.[20]

However, endoscopic interlaminar discectomy has disadvantages, such as the steep learning curve. The surgeon must start his apprenticeship in specialized centers, practicing initially on cadavers, and, later on, patients, always supervised by experienced surgeons to ensure the procedure's safety. In addition, anatomical anomalies, such as cysts and hypertrophied ligaments, can increase the chances of iatrogenic injuries. During endoscopic discectomy the herniated disc cannot be sufficiently decompressed, due to excessive bleeding, migration, disc calcification, or anatomical obstruction. In that case, the surgeon should be able to convert to conventional techniques. Although the benefits of minimally invasive techniques are constantly being proven, we must remember their high cost and the limitations of their use in public services that are referenced in the training of new surgeons.[3]

CONCLUSION

The interlaminar endoscopic technique has proven effective in treating herniated discs of the lumbar spine, with significant clinical improvement in the analyzed period and postoperative satisfaction above 80%. We found a low incidence of complications, as well as early postoperative rehabilitation.

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

CONTRIBUTIONS OF THE AUTHORS: Each author contributed individually and significantly to the development of this article. RMSB: idea conception, article writing, literature review, and patient interview; ALS and ALK: data analysis and article writing; MLB: statistical analysis, article review; PGS: data processing and compilation and literature review; XSG: article review and intellectual concept; final approval of the submitted manuscript version.

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