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EMPLOYEE MEDICAL LEAVE IN MIS-TLIF OR OPEN-TLIF IN ELECTIVE SURGERY IN BRAZIL

LICENÇA MÉDICA DO EMPREGADO NO MIS-TLIF OU OPEN-TLIF EM CIRURGIA ELETIVA NO BRASIL

LICENCIA MÉDICA DEL EMPLEADO EN MIS-TLIF O OPEN-TLIF EN CIRUGÍA ELECTIVA EN BRASIL

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ABSTRACT

Objective: To compare the effects of the two techniques (minimally invasive transforaminal inter somatic lumbar fusion [MIS-TLIF] and open transforaminal lumbar interbody fusion [TLIF]) in the treatment of lumbar degenerative disease. Methods: This is a retrospective cohort study. The outcomes investigated were: intensity of low back pain, functional disability of the lumbar spine, discharge time, return to work, lumbar lordosis angle, cost of individual sources due to the period of work-related absenteeism, and societal perspective costs in the treatment of low-grade lumbar degenerative disease. The data was obtained through the analysis of data contained in the electronic medical records of 100 patients who underwent one of the two surgical techniques from January 2019 to May 2021 in a High Complexity Orthopedic Surgery. The outcomes investigated were set 12 months postoperatively. Results: No statistical differences were observed in terms of sex, age, employment, and diagnosis grade between groups. MIS-TLIF was associated with significant improvement in the intensity of low back pain, functional disability of the lumbar spine, discharge time, return to work, cost of individual sources due to the period of work-related absenteeism, and societal perspective costs. The variation in the lumbar lordosis angle of the MIS-TLIF group was smaller when compared to TLIF. Conclusion: Considering that MIS-TLIF was achieved with satisfactory short-term improvements, it may be used as an alternative strategy to TLIF to promote clinical and economical improvements in treating lumbar degenerative disease. ***Level of Evidence III; Comparative Retrospective Study.***

Keywords: Low Back Pain; Absenteeism; Return to Work; Spine; Lordosis.

RESUMO

Objetivo: Comparar os efeitos das duas técnicas (fusão intersomática lombar transforaminal minimamente invasiva [MIS-TLIF] e fusão intersomática lombar transforaminal aberta [TLIF]) no tratamento da doença degenerativa lombar. Métodos: Trata-se de um estudo de coorte retrospectivo. Os desfechos investigados foram: intensidade da dor lombar, incapacidade funcional da coluna lombar, tempo de alta, retorno ao trabalho, ângulo de lordose lombar, costa de fontes individuais devido ao período de absenteísmo relacionado ao trabalho e custos da perspectiva social no tratamento de doença degenerativa lombar de baixo grau. Os dados foram obtidos por meio da análise dos dados contidos nos prontuários eletrônicos de 100 pacientes submetidos a uma das duas técnicas cirúrgicas no período de janeiro de 2019 a maio de 2021 em uma Cirurgia Ortopédica de Alta Complexidade. Os resultados investigados foram definidos 12 meses após a cirurgia. Resultados: Não foram observadas diferenças estatísticas quanto ao sexo, idade, vínculo empregatício, grau de diagnóstico entre os grupos. O MIS-TLIF foi associado a melhora significativa na intensidade da dor lombar, incapacidade funcional da coluna lombar, tempo de alta, retorno ao trabalho, custo de fontes individuais devido ao período de absenteísmo relacionado ao trabalho e custos de perspectiva social. A variação do ângulo da lordose lombar do grupo MIS-TLIF foi menor quando comparado ao TLIF. Conclusão: Considerando que o MIS-TLIF foi alcançado com melhoras satisfatórias em curto prazo, pode ser usado como uma estratégia alternativa ao TLIF para promover melhorias clínicas e econômicas no tratamento da doença degenerativa lombar. ***Nível de Evidência III; Estudo Retrospectivo Comparativo****.*

Descritores: *Lombalgia; Absenteísmo; Retorno ao Trabalho; Coluna Vertebral; Lordose.*

RESUMEN

Objetivo: Comparar los efectos de dos técnicas (fusión lumbar intersomática transforaminal mínimamente invasiva [MIS-TLIF] y fusión intersomática lumbar transforaminal abierta [TLIF]) en el tratamiento de la enfermedad degenerativa lumbar. Métodos: Este es un estudio de cohorte retrospectivo. Los desenlaces investigados fueron: intensidad del dolor lumbar, incapacidad funcional de la columna lumbar, tiempo de alta, regreso al trabajo, ángulo de lordosis lumbar, costa de fuentes individuales debido al período de ausentismo relacionado con el trabajo y costos de perspectiva social en el tratamiento de enfermedad degenerativa lumbar de bajo grado. Los datos se obtuvieron a través del análisis de los datos contenidos en las historias clínicas electrónicas de 100 pacientes que se sometieron a alguna de las dos técnicas quirúrgicas durante el período de enero de 2019 a mayo de 2021 en una Cirugía Ortopédica de Alta Complejidad. Los resultados

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investigados se establecieron 12 meses después de la operación. Resultados: No se observaron diferencias estadísticas en cuanto a sexo, edad, ocupación, grado de diagnóstico entre grupos. MIS-TLIF se asoció con una mejora significativa en la intensidad del dolor lumbar, la discapacidad funcional de la columna lumbar, el tiempo de alta, el regreso al trabajo, la costa de fuentes individuales debido al período de ausentismo relacionado con el trabajo y los costos de perspectiva social. La variación en el ángulo de lordosis lumbar del grupo MIS-TLIF fue menor en comparación con TLIF. Conclusión: considerando que MIS-TLIF se logró con mejoras satisfactorias a corto plazo, puede usarse como una estrategia alternativa a TLIF para promover mejoras clínicas y económicas en el tratamiento de la enfermedad degenerativa lumbar. ***Nivel de Evidencia III; Estudio Retrospectivo Comparativo.***

Descriptores: *Lumbalgia; Absentismo; Reinserción al Trabajo; Columna Vertebral; Lordosis.*

INTRODUCTION

In 2003, Foley described minimally invasive TLIF, using a METRx tube for the minimally invasive TLIF procedure, but the 1-inch skin incision is made approximately 45 to 50 mm lateral to the midline. On the opposite side, a "mirror image" incision inserts the Sextant percutaneous pedicle screw. This contralateral incision can also be used for segmental distraction of the posterior elements and direct decompression of the contralateral nerve root, if necessary (see below). The proper location is checked fluoroscopically before making the incisions. Sequential dilators are used, and the distal end of a 22 or 26-mm diameter tube of appropriate length is positioned over the facet joint complex.[1]

Most orthopedic surgical techniques aim to mechanically stabilize the vertebral segments of the lumbar spine (LS) to reduce low back pain (LBP) and decompress the neural tissues. Arthrodesis of the lumbar spine is a surgical technique widely indicated for treating lumbar degenerative diseases.[2] This surgery involves open--field transforaminal lumbar interbody fusion (TLIF), which requires extensive dissection of the paravertebral musculature and bone removal for safe access and preparation of the interbody space. Complications of the TLIF technique (25% rate)[3] include excessive dissection of the paravertebral muscle, ischemic necrosis, tissue remodeling disorders, and extensive intraoperative bleeding.[4]

In the 2000s, with the introduction of minimally invasive surgery, there was a general reduction in surgical complications, which led to shorter hospital stays, faster postoperative recovery, and a reduction in the average time to return to work.[3-5] Concerning this topic, minimally invasive transforaminal inter somatic lumbar fusion (MIS-TLIF) may offer potential advantages at surgical sites, such as reduced trauma to the paravertebral muscles, minimized perioperative blood loss, faster recovery, and reduced risk of infection.[6] Besides, the direct hospital cost for MIS-TLIF was lower than TLIF, considering the advantage of shorter hospitalization.[7] Thus, MIS-TLIF is associated with a shorter return-to-work time and loss of productivity at work.[4,8]

To support surgeons using MIS-TLIF, include expandable or non--expandable tubular retractors, a paramedian or lateral incision, and an endoscope.[9] The benefits of MIS-TLIF over TLIF can be attributed to minimal soft tissue disruption, minimal destabilization of vertebral segments, the possibility of bilateral spinal decompression through a unilateral approach, and the possibility of indirect neural decompression.[9] Also, MIS-TLIF reduces the risk of complications in elderly patients and significantly improves patient-reported outcomes, such as pain and disability, compared to open procedures.[10] A short-term observational and prospective study showed that after three months, MIS-TLIF procedures tended to improve patient-reported quality of life.[11] After two years postoperatively, levels of disability and back and leg pain were significantly lower in MIS-LIFT.[12] Therefore, MIS-TLIF is an effective and safe alternative to traditional TLIF in the long term.[13]

Although the benefits of MIS-TLIF over TLIF are corroborated by the various systematic reviews reported above, no study in Brazil has compared the effects of these techniques. In addition, in Brazil (2016), approximately US$71 million was spent in direct costs by the public health system on the treatment of spinal disorders.[14] Societal costs in Brazil amounted to US$2.2 billion between 2012-2016, with lost productivity accounting for 79% of costs.[15] Considering that low back pain is considered a health and research priority in Brazil, this study aimed to compare the clinical, radiological, and economic impact of patients undergoing MIS-TLIF and TLIF.

METHODS

Study design

This is a retrospective cohort study comparing two surgical techniques (MIS-TLIF vs. OPEN TLIF). The outcomes were obtained by analyzing the data in the electronic medical records of individuals who underwent surgery between January 2019 and May 2021 at a High Complexity Orthopedic Surgery in Brasília (Federal District, Brazil). All the participants who received the surgical interventions recruited were treated by one of the three orthopedic surgeons from the same team. The surgeons had an average of 35 years of experience in spinal surgery. The study was approved by the Ethics Committee of the Hospital Oftalmológico de Brasília (CAAE: 54136521.0.0000.5667).

Participants

The medical records of individuals who met the following inclusion criteria were analyzed: over 18 years of age with a diagnosis of lumbar degenerative disease, lumbar spondylolisthesis, and lumbar stenosis. Exclusion criteria were individuals who had undergone lumbar arthrodesis surgery (3 levels of lumbar arthrodesis) before the study period or at any vertebral levels adjacent to the lumbar spine.

The sample size was calculated using the G*Power software (version 3.1.9.7), considering the return to work time outcome. Based on the results published by Adogwa et al.[16] we imputed an effect size (ES) of 0.55. Considering a study power of 80%, a significance level of 5%, and the analysis of the difference between the two groups using the Mann-Whitney test, 56 participants per group were estimated (112 participants).

Results

A total of 100 patients were retrospectively enrolled at the following time points: low back pain intensity (numerical pain rating [NPR])[17] LS functional disability (Oswestry Questionnaire)[11] and LLangle[18] after six weeks of surgery. Hospital discharge (days) was collected on the day the patient was discharged from the hospital. The following outcomes were collected six months after the surgeries: time to return to work (weeks),[19] use of the National Social Security Institute (INSS) (weeks); financial losses due to absenteeism from work (financial loss [weeks] according to the national minimum wage).

Data extraction

The participants were selected by convenience sampling. To avoid personally identifying the participants, a researcher, unaware of the study's objectives, extracted the study results, excluding information that could identify the participant. Data was extracted using Excel software (version 16.43). In the initial process, each participant was given a sequential numerical code for identification. After extracting the data and coding the patients, another statistical researcher managed the database to make the necessary adjustments for the statistical analysis.

Statistical analysis

Descriptive statistics were presented as mean and standard deviation (SD), median (M_d), and interquartile range (IQR). The Shapiro-Wilk test was used to verify the assumptions of data normality. The Levene test was used to test the homoscedasticity of the data, and the Chi-square test was used to analyze possible differences between the proportions of categorical variables.

For intra- and inter-group comparisons, *Student's t-test* was used for data with parametric distribution. The Wilcoxon and Mann-Whitney tests were used for data with a non-parametric distribution. The post-intervention values were used to compare the groups for the main outcomes in which the inter-group baseline data did not show statistically significant differences. However, when this assumption was not observed (e.g., LL angulation), the delta of variation (⊗) of pre- and post-intervention between the groups was used (⊗ = pre - post-intervention [MIS-TLIF] vs. ⊗ = pre - post-intervention [TLIF]).

Intra- and inter-group comparisons of ES were calculated using the formula: ES = $\frac{z}{\sqrt{n}}$ (z= z-statistic; n = sample size). We have adopted the following classifications: <=0.10 trivial, <=0.3 small effect; <0.5 moderate effect; and >=0.5 large effect.[20]

The data was analyzed using RStudio software (version 1.3.959), and a statistical significance level of 5% was adopted.

RESULTS

Table 1 shows the descriptive data of the sample. Only the gender variable showed a difference in proportions. Table 2 shows the descriptive data for the outcomes. Only lumbar angulation showed a statistically significant difference at baseline.

Table 1. Clinical and demographic characteristics by gender.

	Man (n = 44)	Woman (n = 56)	Sample (n = 100)	p.value
Age	56.3 (±8.48)*	54.1 (±9.71)	55 (±9.21)	
Occupation				
Administrative	18 (18)	32 (32)	50 (50)	
Retired	1 (1)	2 (2)	3 (3)	
Driver	10 (10)	0 (0)	10 (10)	
Operational	7 (7)	13 (13)	10 (10)	
Worker	1 (1)	1 (1)	2 (2)	
Professor	2 (2)	3 (3)	5 (5)	
Secretary	0 (0)	2 (2)	2 (2)	
General services	1 (1)	5 (5)	6 (6)	
Nursing technician	0 (0)	2 (2)	2 (2)	
Others	4 (4)	6 (6)	10 (10)	
Working relationship				**0.994**
Retired	1 (1)	2 (2)	3 (3)	
Self-employed	14 (14)	17 (17)	31 (31)	
CLT	29 (29)	37 (37)	66 (66)	
Clinical diagnosis				**0.82**
L4-L5	13 (13)	15 (15)	28 (28)	
L4-S1	18 (18)	18 (18)	36 (36)	
L5-S1	13 (13)	23 (23)	36 (36)	
Type of Surgery				**0.472**
Open TLIF	27 (61.4)	33 (58.9)	60 (60)	
MISTLIF	17 (38.6)	23 (41.1)	40 (40)	
Baseline pain intensity	8.02 (±0.82)	7.98 (±0.82)	8 (±0.81)	

Notes: *: p-value <0.05. ±: standard deviation. (): values in percent.

Table 2. Descriptive data on clinical outcomes.

Clinical outcomes	MIS-TLIF (n = 40)	OPEN TLIF (n = 60)
Pain intensity	8 (2)	8 (2)
Oswestry Questionnaire	45 (13)	45 (3.25)
Duration of admission and discharge (days)	2 (0.5)	4 (1)
Return to work (weeks)	3 (2)	8 (4.25)
Angulation of the lumbar lordosis (°)	49.6 (±8.71)	57.86 (±8.88)
Time spent using the INSS	0 (2)	6 (6.5)
Financial loss due to absenteeism from work (minimum wage)	5225 (4139.75)	17353.75 (10123.44)

Notes: *: p-value <0.05. Data presented in median (): IQR. ±: standard deviation.

Intra-group comparisons (MIS-TLIF)

For low back pain intensity, the MIS-TLIF technique showed a statistically significant reduction between pre-and post-intervention (Wilcoxon test; p<0.001; ES= 0.876 Power= 1), with a reduction in pain intensity from M d = $_8$ (IQR = 2) to M $_{d=}$ 2 (IQR = 1), with a large ES.

For functional disability, the MIS-TLIF technique showed a statistically significant reduction between pre-and post-intervention (Wilcoxon test; p<0.001; ES= 0.864; Power= 1), with a reduction in the disability score from M d $_{= 45}$ (IQR = 3.25) to M $_{d=}$ 14.5 (IQR = 4.25), with a large ES.

For the LL angle, the MIS-TLIF technique showed a statistically significant angular increase between pre- and post-intervention (Wilcoxon test; p<0.001; ES= 0.107; Power= 0.27), with increases from M d = 49° $_{(IQR}$ = 13) to M $_{d=}$ 50° (IQR = 12), with a small ES.

Intra-group comparisons (TLIF)

For the intensity of low back pain, the TLIF technique showed a statistically significant reduction between pre-and post-intervention (Wilcoxon test; p<0.001; ES= 0.874; power= 1), with a reduction in pain intensity from M d = 8 (IQR = 2) to M $_{d=}$ 5 (IQR = 1), with a large ES.

For functional disability, the TLIF technique showed a statistically significant reduction between pre- and post-intervention (Wilcoxon test; p<0.001; ES= 0.864; Power= 1), with a reduction in the disability score from M d = $_{45}$ (IQR = 3.25) to M $_{d=}$ 32 (IQR = 7), with a large ES.

For the LL angle, the TLIF technique statistically modified the LL angle from pre- to post-intervention (*Student's t* for paired samples; p<0.001; ES= 0.26; Power= 0.63). There was an increase in the angle between pre- and post-intervention from 57.9° (±8.9) to 60.2° (±8.72), respectively, with moderate SE.

Comparisons between groups (MIS-TLIF vs. TLIF)

For the intensity of low back pain (Figure 1), the MIS-TLIF technique showed a statistically significant reduction (post-surgery) compared to the TLIF technique (Mann-Whitney test; p<0.001; ES = 0.80; Power = 0.98). The final score about the NPR was MIS-TLIF M $_d$: 2 (IQR = 1) versus TLIF M $_{d=}$ 5 (IQR = 1), with large ES.

For functional disability (Figure 2), the MIS-TLIF technique showed a statistically significant reduction (post-surgery) compared to the TLIF technique (Mann-Whitney test; p<0.001; ES = 0.80; Power = 0.98). The final score was MIS-TLIF M $_d$: 14.5 (IQR = 4.25) versus TLIF M $_{d=}$ 32 (IQR = 7), with a large ES.

When comparing hospital discharges (Figure 3), the MIS-TLIF technique showed a statistically significant reduction compared to the TLIF technique (Mann-Whitney test; p<0.001; ES = 0.821; Power = 0.97). The time it takes to be discharged from the hospital: MIS-TLIF M $_d$: 1.5 days (IQR = 0.5) versus TLIF M $_{d=}$ 4 days (IQR = 1), with a large ES.

For return-to-work time (Figure 4), the MIS-TLIF technique showed a statistically significant reduction compared to the TLIF

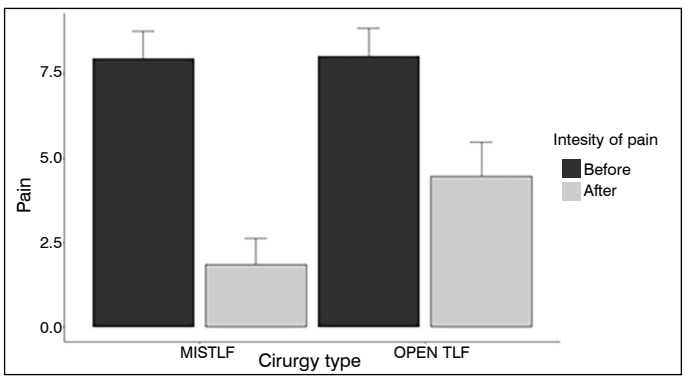

Figure 1. Comparison of pain intensity before and after procedures between groups

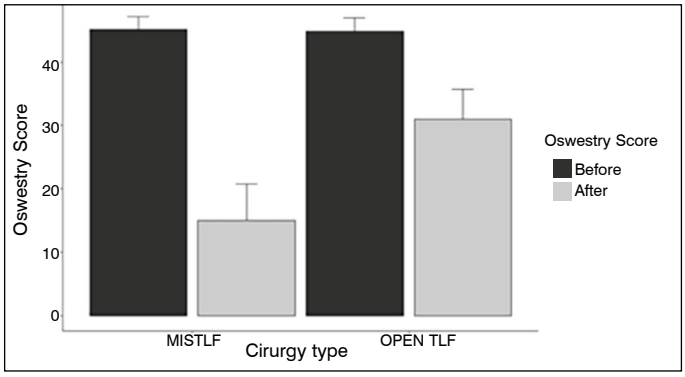

Figure 2. Comparison between level of functional disability between groups before and after the procedure.

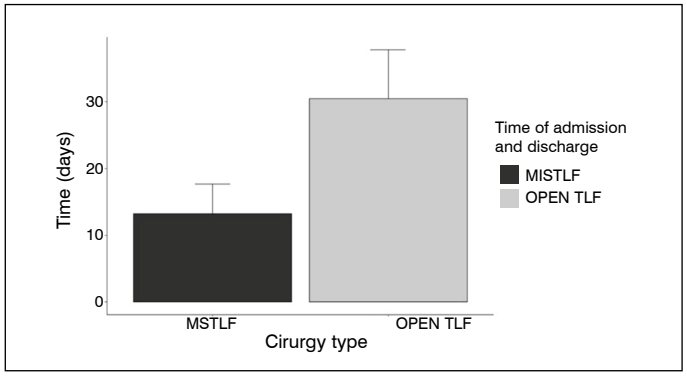

Figure 3. Comparison between hospital admission and discharge time between groups.

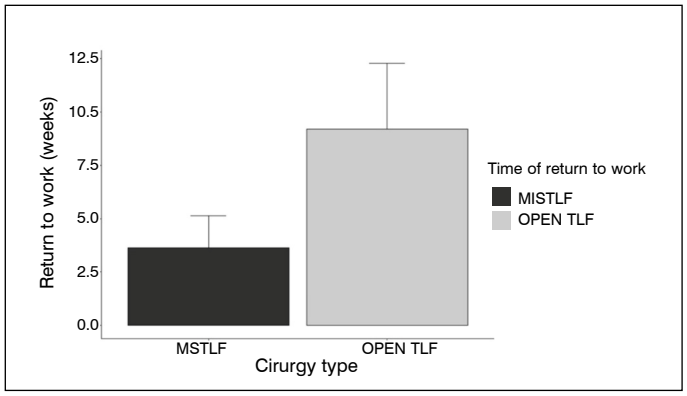

Figure 4. Comparison between types of surgery and return to work between groups.

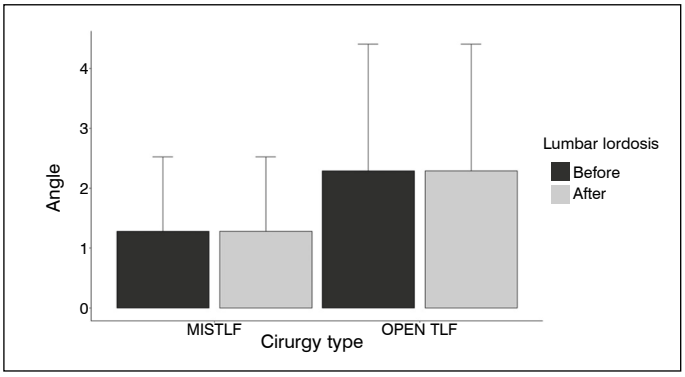

Figure 5. Comparison of lumbar lordosis measurement pre-surgical and post surgical.

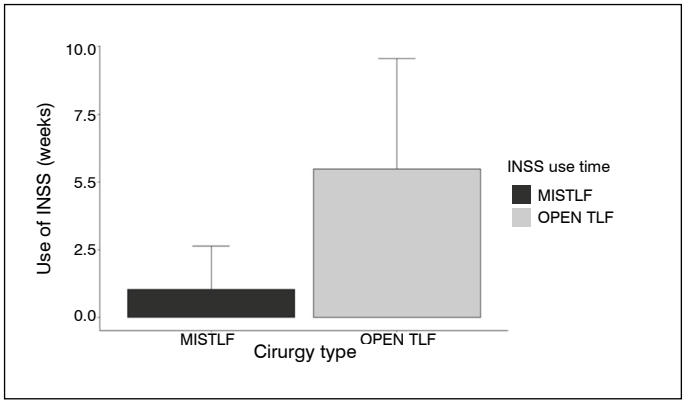

Figure 6. Comparison between the use of INSS in different types of surgeries.

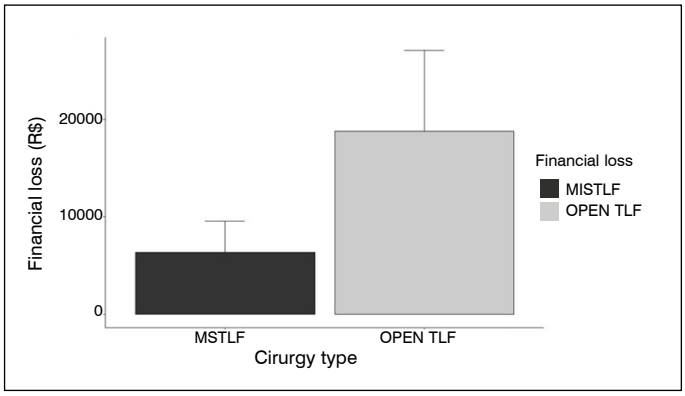

Figure 7. Comparison between types of surgeries and financial commitment.

technique (Mann-Whitney test; $p<0.001$; ES = 0.80; Power = 0.98). The time to return to work was MIS-TLIF M_d: 3 weeks (IQR = 2) versus TLIF M_d = 8 weeks (IQR = 4.25), with a large ES.

For the LL angle (Figure 5), the MIS-TLIF technique showed a statistically significant difference compared to the TLIF technique (Mann-Whitney test; $p<0.001$; ES = 0.25; Power = 0.31). The variation in LL angulation in the MIS-TLIF group was smaller (M_d = 49° [IQR = 13] to M_d = 50° [IQR = 12]) versus the TLIF group (M_d = 57° [IQR = 14] to M_d = 59° [IQR = 13]), with moderate ES.

For the use of the INSS (Figure 6), the MIS-TLIF technique showed a statistically significant reduction compared to the TLIF technique (Mann-Whitney test; $p<0.001$; ES = 0.53; Power = 0.81). The time taken to use MIS-TLIF in weeks was shorter (M_d = 0; IQR= 2) than TLIF (M_d = 6; IQR= 6.5), with a large ES.

Regarding financial commitment due to absenteeism from work, the MIS-TLIF technique showed a statistically significant reduction in financial commitment compared to the TLIF technique (Mann-Whitney test; $p<0.001$; ES = 0.77; Power = 0.98). The financial commitment of the MIS-TLIF technique was lower (M_d = R$ 5,434.00; IQR= 4,139.00) than that of the TLIF technique (M_d = R$ 17,354.00; IQR= 9,980.00), with a large ES (Figure 7).

DISCUSSION

This study aimed to compare the effects of two surgical techniques (MIS-TLIF vs. TLIF) in the intensity of low back pain, reported functional disability of the LS, time between hospital admission and discharge, time of return to work, LL angulation, use of INSS, and financial commitment resulting from the period of work-related leave. The results of this study are unprecedented in Brazil and provide additional evidence of the benefits of MIS-TLIF in the treatment of lumbar degenerative diseases. Although intra-group analysis showed significant improvements for both techniques, inter-group comparisons showed MIS-TLIF superiority over TLIF for short-term patient-reported outcomes.

Lumbar arthrodesis surgery is associated with extensive soft tissue dissection, and several authors have reported the negative consequences of this procedure, with a significant increase in morbidity.[21] As MIS-TLIF involves parasagittal access between the multifidus and the longus (erector spinae), it preserves the natural posterior tension band created by the interspinous and supraspinous ligaments, as well as the insertion, vascularization, and innervation of the paravertebral musculature.[22]

Regarding patient-reported outcomes, the MIS-TLIF group showed statistically superior reductions in NPR and ODI scores at three weeks of follow-up compared to TLIF. The results of this study are consistent with the recent retrospective findings of Quin et al., who showed that MIS-TLIF leads to shorter hospital stays and shorter return-to-work times. The authors argue that the reduction in soft tissue injuries and bleeding and faster postoperative recovery lead to improvements in NPR and ODI scores in favor of the MIS-TLIF for short-term follow-up assessments.[19]

In this study, the variation in LL angulation (12-month follow-up) in the MIS-TLIF group was lower ($M_{d=}$ 49º (IQR = 13) to $M_{d=}$ 50º (IQR = 12) compared to the TLIF group (57.9º (±8.9) to 60.2º (±8.72), with a moderate effect size. Although the difference between the groups has been demonstrated, LL corrections below < 10 o are considered minor and associated with fewer complications after spinal fusion. Furthermore, ⊗ of LL > 12º is associated with symptomatic disease of the adjacent segment.[23,24] Menezes et al. concluded that the standard MIS-TLIF technique had no therapeutic effect on lumbar lordosis, nor was it responsible for any loss of lordosis in the operated segments. There was no postoperative influence on the spinopelvic parameters, and the preoperative values were maintained.

Although a large number of investigations have shown that MIS--TLIF has improved patient-centered outcome scores (NPR and ODI) in short-term follow-up[25], the most prominent benefit demonstrated by the systematic review by Vazan et al.[26] is a significant reduction in length of hospital stay (LHOS). In this review, seven studies showed that LHOS was significantly lower in the MIS-TLIF cohorts, with mean LHOS values ranging from 3 to 9.3 days, compared to the TLIF groups, with mean LHOS values ranging from 4.2 to 12.5 days. In the present study, we demonstrated a median LHOS of 1.5 days for MIS-TLIF and four days for TLIF, with a large difference in effect size between the two techniques. Furthermore, when analyzing the time taken to return to work, Adogwa et al.[27] showed that the average time taken to return to work was 8.5 weeks for MIS-TLIF, a shorter period when compared to TLIF patients, who showed an average time taken to return to work of 17.1 weeks. The present study also demonstrated differences regarding return to work (median MIS--TLIF: 3 weeks vs. Median TLIF: 8 weeks) with a large effect size. The review by Parker et al.[28] supports our findings, suggesting that MIS-TLIF is associated with an accelerated return to work.

Regarding the cost-effectiveness of the techniques, a recent systematic review concluded that MIS-TLIF is more cost-effective than TLIF. In this review, the costs from the social perspective were described, with six studies that evaluated the loss of productivity according to the days of work lost. In summary, the costs from the social perspective ranged from US$ 5,584 to US$ 49,947 for TLIF and from US$ 11,649 to US$ 13,020 for MIS-TLIF. In the present study, considering productivity losses (indirect costs), the costs from the social perspective were US$ 25,653 for MIS-TLIF and US$ 81,928 for TLIF, with a large effect size between groups. The consequence of the loss of productivity according to absenteeism at work in the present study leads the INSS in Brazil to contribute to social security for a median of 0 weeks for MIS-TLIF and six weeks for TLIF, with a large difference in effect size between the two techniques. In Brazil, social security benefits are granted by the INSS system, which provides financial support to the adult population that contributes to social security and needs to take time off work temporarily or permanently.

From the point of view of strengths, an important issue to be addressed concerns the surgeon's experience with the MIS-TLIF technique, which requires solid anatomical knowledge and long practical experience. In this study, the surgeons were well-experienced with the MIS-TLIF technique. The sample size in each arm of this study was appropriate, with the power analysis and effect size difference between the two techniques demonstrated. However, this study has some limitations. Only a patient-centered short-term follow-up and the variation in the lumbar lordosis angle have been investigated between the groups (12 months). Considering this is a retrospective comparative study, there is an inherent methodological risk of bias, such as recruitment by convenience sampling. Convenience sampling should not be considered representative of the population, and due to the high possibility of self-selection in non--probability sampling, the effects of outliers can influence the results. Finally, since the aim of this study was to demonstrate clinical and radiological comparisons, length of hospital stay, time to return to work, and economic impact between patients undergoing MIS-TLIF and TLIF, variables such as blood loss, operating time, complication rate, and bone healing rate were not investigated and reported.

CONCLUSION

The MIS-TLIF showed efficacy in reducing the intensity of low back pain, functional disability, length of hospital stay, and time to return to work compared to the TLIF in short-term follow-up. MIS--TLIF also reduces the use of INSS and the financial loss compared to TLIF. About the LL, although statistical differences in angular variations were demonstrated between the groups, the level of each intra-group variation is considered clinically unimportant, suggesting that both surgeries stabilized the LL angle.

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