

CURRENT RESULTS OF CONVENTIONAL LUMBAR ARTHRODESIS

RESULTADOS ATUAIS DA ARTRODESE LOMBAR CONVENCIONAL

RESULTADOS ACTUALES DE LA ARTRODESIS LUMBAR CONVENCIONAL

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ABSTRACT

Objective: To evaluate the peri- and postoperative results and clinical repercussions in patients undergoing decompression surgery and single-level lumbar arthrodesis using the traditional technique (OTLIF) and to compare with the results of minimally invasive techniques (MITLIF) described in the literature. **Methods:** Our sample consisted of 22 patients who underwent TLIF surgery using the open technique (OTLIF) in the period October 2019 to January 2021, in our hospital. We compared the patients' functional clinical results using the Oswestry scale in the preoperative period and 15 days after surgery, analyzed variables related to the perioperative period: surgery time, length of hospital stay, blood loss, use of a suction drain, and admission to the ICU, and compared these with the results reported in the literature for patients treated by the MITLIF technique. **Results:** The average age was 48.95 years and the most operated level was L4-L5 (55%). The average surgery time was 112.63 min. We did not use a suction drain in the postoperative period, there was no need for a blood transfusion in any patient, and no patient was admitted to the ICU. The average hospital stay was 1 day. Regarding the Oswestry Disability Index, the mean preoperative score was 44.73 and after 15 days, it was 24.05. **Conclusions:** surgical treatment using the OTLIF technique for single-level lumbar degenerative disease showed largely positive results, with improvement in disability scores, short hospital stay and low incidence of complications. When properly indicated, OTLIF is an excellent and safe option for the treatment of degenerative lumbar disease. **Level of evidence IV; Case series study.**

Keywords: Low Back Pain; Lumbosacral Region; Outcome Assessment, Health Care.

RESUMO

Objetivo: Avaliar resultados e repercussões clínicas precoces no peri e pós-operatório de pacientes submetidos à cirurgia de descompressão e artrodese lombar de um nível pela técnica tradicional (OTLIF) e comparar com resultados das técnicas minimamente invasivas (MITLIF) descritos na literatura. **Métodos:** Nossa amostra foi composta por 22 pacientes submetidos à cirurgia de TLIF pela técnica aberta (OTLIF) no período de outubro/2019 a janeiro/2021 em nosso hospital. Comparamos os resultados clínicos funcionais dos pacientes pela escala de Oswestry no pré-operatório e 15 dias de depois da cirurgia e analisamos variáveis relacionadas com o período perioperatório, a saber, tempo de cirurgia, tempo de internação hospitalar, perda de sangue, uso de dreno e internação em UTI, e comparamos com os resultados da literatura em pacientes tratados pela técnica MITLIF. **Resultados:** A média de idade foi de 48,95 anos e o nível mais abordado foi L4-L5 (55%). O tempo operatório médio foi de 112,63 minutos. Não utilizamos dreno no pós-operatório, não houve necessidade de transfusão de sangue em nenhum paciente e nenhum deles foi internado em UTI. O tempo médio de internação hospitalar foi de um (1) dia. Com relação ao Índice de Incapacidade de Oswestry, a pontuação pré-operatória média foi de 44,73 e depois de 15 dias foi de 24,05. **Conclusões:** O tratamento cirúrgico pela técnica OTLIF na doença degenerativa lombar de um nível apresentou resultados amplamente positivos, com melhora nos escores de incapacidade, baixo tempo de internação e baixa incidência de complicações. Quando bem indicada, a OTLIF é uma opção excelente e segura para o tratamento da doença degenerativa lombar. **Nível de evidência IV; Série de casos.**

Descritores: Dor Lombar; Região Lombossacral; Avaliação de Resultados em Cuidados de Saúde.

RESUMEN

Objetivo: Evaluar resultados y repercusiones clínicas precoces perioperatorias y postoperatorias de pacientes sometidos a cirugía de descompresión y artrodosis de un nivel por técnica tradicional (OTLIF); y compararlos con resultados de las técnicas mínimamente invasivas (MITLIF) descritos en la literatura. **Métodos:** Nuestra muestra fue formada por 22 pacientes sometidos a cirugía TLIF por técnica abierta (OTLIF), en el periodo comprendido entre octubre/2019 y enero/2021 en nuestro hospital. Se compararon los resultados clínicos funcionales de los pacientes mediante escala de Oswestry en preoperatorio y después de 15 días de cirugía y, analizaron las variables relacionadas al perioperatorio como tiempo de cirugía, tiempo de internación, pérdida de sangre, uso de drenaje e internación en UCI y se compararon con resultados de la literatura de pacientes tratados por la técnica MITLIF. **Resultados:** La media de edad fue de 48,95 años y nivel más abordado fue L4-L5 (55%). El tiempo promedio de operación fue 112,63 minutos. No se utilizó drenaje en el postoperatorio, no hubo necesidad de transfusión de sangre en ningún paciente y ninguno de ellos fue ingresado en la UCI. El tiempo promedio de internación fue 1 día. Con respecto al Índice de Discapacidad de Oswestry, la puntuación preoperatoria media fue 44,73 y

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después de 15 días, 24,05. Conclusiones: El tratamiento quirúrgico por técnica OTLIF en la enfermedad degenerativa lumbar de un nivel presentó resultados ampliamente positivos, con mejora en los escores de discapacidad, bajo tiempo de internación y baja incidencia de complicaciones. Bien indicada, OTLIF es una excelente y segura opción para el tratamiento de la enfermedad degenerativa lumbar. Nivel de evidencia IV; Serie de casos.

Descriptor: Dolor de la Región Lumbar; Región Lumbosacra; Evaluación de Resultado en la Atención de Salud.

INTRODUCTION

Low back pain has a point prevalence of approximately 11.9% in the global population.¹ Chronic low back pain is the main cause of disability in patients aged between 45 and 65 years and affects 70% to 85% of individuals during their lifetime.² It is associated with high direct costs with the use of health services, and indirect costs due to loss of productivity.^{1,3}

Intervertebral disc degeneration is the main suspect in the development of painful conditions of the spine and plays a contributory role in some clinical conditions such as lumbar spinal stenosis and spinal disc herniation.⁴

Intervertebral disc degeneration is a multifactorial process that mainly affects aging individuals,⁵ is among the main causes of chronic segmental spinal instability, and significantly affects quality of life.⁶ It is now known that disc degeneration results from cellular, biochemical and structural alterations, progressing to a reduction in the number of intervertebral disc cells and extracellular matrix components.⁵ Disc height decreases due to degeneration, changing the mechanics of the affected spinal segment.⁶ This process accelerates the degeneration of adjacent segments and other vertebral structures.⁶

Degenerative disc disease has been defined in many different ways and the term is often used without any additional definition being provided (30.1%).⁴ However, a range of clinical symptoms is attributed to this condition, including pain or paresthesia in the lower extremities, weakness, low back pain, neurogenic claudication and reduced mobility.⁷⁻⁹

Although conservative therapy is the first step in the treatment of low back pain, with resolution in 90% of cases, in some situations, such as persistent pain, neurogenic claudication and radiculopathy due to foraminal stenosis, surgical treatment may be indicated.^{1,8}

There are several techniques available for surgical treatment, including traditional open surgery and minimally invasive procedures.

Arthrodesis in combination with the use of intersomatic devices (cage) is an effective treatment option for segment stabilization and allows indirect decompression of the neural elements, restoration of lordosis and correction of deformity.⁹ By stabilizing the lumbar spine, it is possible to shorten hospitalization times and achieve earlier recovery than in lumbar arthrodesis without instrumentation.¹⁰

Fusion techniques through minimally invasive surgery (MIS) ensure faster recovery time with reduced intraoperative blood loss and muscle damage,^{11,12} as well as faster return to work and reduced dependence on opioids for the patient.¹¹ However, MIS also has several inherent negative factors, including higher levels of radiation exposure, a steeper learning curve for surgeons and complications also related to open surgeries, such as muscle retraction and rhabdomyolysis, damage to paravertebral muscle innervations, postoperative hematoma, malposition of implants, infection, dural fistulas¹² and a higher cost.⁸

There is no clear and definitive evidence that one approach is superior to another in terms of fusion or clinical outcomes,⁸ yet the most widely used technique for bone stabilization and decompression is standard transforaminal lumbar interbody fusion (TLIF),⁷ which has been performed with little bleeding, short surgical time and a low level of radiation, besides being more affordable for health services.

When properly indicated, single-level lumbar arthrodesis using the open transforaminal lumbar interbody fusion (OTLIF) technique is an excellent treatment option for lumbar degenerative disc disease, producing excellent results with low morbidity and a very low rate of complications.

The objective of this study is to evaluate perioperative and early postoperative clinical and surgical results in patients undergoing

single-level lumbar arthrodesis using the OTLIF technique, and to compare them with the published results of studies using the minimally invasive (MITLIF) technique.

METHODS

This is a cross-sectional study with a convenience sample consisting of 22 patients who underwent single-level lumbar arthrodesis and decompression surgery using the OTLIF technique between October/2019 and January/2021 at a tertiary hospital in Vitória/ES (state of Espírito Santo). All patients agreed to participate in the study and signed an Informed Consent Form. Through a protocol created by the attending staff for data collection purposes, patient-related variables such as age, sex and spinal level involved, and surgical variables such as duration of surgery, use of surgical drain, need for intraoperative or immediate postoperative blood transfusion, need for postoperative care in the ICU and length of hospital stay, were recorded for each individual surgery. The duration of surgery was recorded in minutes, from the moment of skin incision to the final dressing. For the purpose of determining the length of hospital stay, we considered the period of 1 day of hospitalization to be equivalent to a period of less than 24 hours from the time of admission to the time of hospital discharge, and 2 days for periods between 24 hours and 48 hours.

The disability assessment was performed using the Oswestry Index, applied by an attending physician, on the day of hospital admission and after 15 days, at the time of the first postoperative return appointment. Inclusion criteria: patients with lumbar degenerative disc disease (LDDD), without gender or age restrictions, undergoing surgical treatment involving decompression and single-level lumbar arthrodesis by the TLIF technique (OTLIF) at the HSCMV in the abovementioned period. Exclusion criteria: patients with diseases secondary to infectious processes, tumors, metabolic diseases and trauma, patients with degenerative spondylolisthesis, patients with LDDD undergoing multilevel surgeries, and those patients who did not agree to sign the informed consent form (ICF) were excluded.

Categorical variables were analyzed using frequencies and percentages, while numerical variables were analyzed using data summary measures such as mean \pm standard deviation and median (minimum – maximum).

Normality of numerical variables was determined using the Kolmogorov-Smirnov test. As the variables did not have normal distribution, the comparison between the L4-L5 and L5-S1 surgery groups was performed using the nonparametric Mann-Whitney test and the comparison between pre- and postoperative Oswestry scores was performed using the nonparametric Wilcoxon test (paired test).

Comparisons were considered significant in the case of p-value < 0.05 .

The data were tabulated in an EXCEL spreadsheet and analyzed using version 25 of the software program IBM SPSS Statistics (Statistical Package for the Social Sciences).

This study was approved by the Institutional Review Board of the institution where it was conducted (CAAE: 31567020.5.0000.5065) and data were collected after the study subjects had signed the informed consent form.

RESULTS

The sample group had a total of 22 patients, of whom 11 were male (50%). Patients undergoing surgery had a mean age of 49 years with standard deviation of 14.7 years, which indicates that the age variability is 30%.

Regarding the spinal level involved in the surgery, Table 1, most patients (54.5%) underwent surgery at level L4-L5 and 36.4% at level L5-S1. None of the patients used a surgical drain or were admitted to the ICU, and only one patient experienced a mild complication: a case of seroma requiring superficial drainage.

Table 2 shows the descriptive statistics for the surgery variables. The mean duration of surgery was approximately 108 min and the median was 106 min. The length of hospital stay was short at around 1.5 days. The mean pre- and post-surgical variation in the Oswestry score was 20.7, with high variability (the deviation is 53% of the mean). The mean variation was 22, ranging from 0 to 40.

Comparing the pre- and postsurgical Oswestry score, a significant difference ($p = 0.000$) is identified. The presurgical/post-surgical median was 45 and 21, respectively, Table 2.

Table 3 shows the comparison between levels L4-L5 and L5-S1. The test result indicated that no significant difference was identified between levels in any of the analyzed variables, $p > 0.05$.

DISCUSSION

Since the introduction of minimally invasive TLIF (MITLIF) by Foley et al. as an alternative to traditional TLIF (OTLIF), several studies have compared both techniques for perioperative, postoperative, clinical and radiological outcomes. The parameters most frequently compared were operative time, blood loss, rate of complications, time of exposure to radiation and various pain scores.¹³

Operative time is a relevant factor when comparing MITLIF and OTLIF techniques. In our study, the mean duration of surgery was 108 min. According to Lau et al., the mean duration of surgery for MITLIF cases was 389.67 min, while for OTLIF it was 365.30 min.¹⁴ In his meta-analysis, Hammad evaluated 27 studies comparing the duration of surgery of MITLIF and OTLIF; 13 of the studies showed longer operative time for MITLIF.¹³ Although the duration of surgery was longer for MITLIF in general, there was a statistically significant

difference in duration of surgery between the initial 15 MITLIF patients (mean time, 3.2 h) and the last 15 patients (mean time, 1.8 h), which confirms that MITLIF requires a learning curve, but once adequate experience is gained, the operative time significantly decreases.¹⁵

In relation to intraoperative bleeding, in a meta-analysis published by Hammad, the mean volume of blood loss was 247.82 mL in the MITLIF group vs. 568.18 mL in the OTLIF group, with a significant difference ($p < 0.00001$).¹³ In our study, we did not quantify estimated blood loss, but none of our patients required a perioperative blood transfusion.

Sulaiman et al.,¹⁶ did not observe a significant difference in the length of hospital stay (LHS) between MITLIF and OTLIF patients, with a mean length of stay for MITLIF cases of 3.6 days, compared to 3.2 days for OTLIF. However, unlike our study, most patients had 2 spinal levels operated on, and patients with spondylolysis and spondylolisthesis were also included, which may have contribute to the longer hospitalization times. In our study, all patients were walking on the first postoperative day and were considered fit enough for early discharge, with a mean hospital stay of 1.5 days.

The Oswestry (ODI) index classifies patients as follows: minimal disability (0 to 20%), moderate disability (21 to 40%), severe disability (41 to 60%), crippling back pain (61 to 80%), and bedridden (81 to 100%).¹⁷

Comparing the pre- and postoperative Oswestry scores in our study, we found a significant difference ($p = 0.000$). The median in the preoperative period was 45 while the postoperative median was 21, with a mean variation of 20.7 points. According to Ghizoni et al., patients undergoing lumbar arthrodesis had a significant difference between mean pre- and postoperative ODI scores, evolving from a mean preoperative ODI of 72.3% to a mean value of 51% after the surgical procedure, an average reduction of 21.3% after 30 days.¹⁸ A similar result was described by Glassman et al., who reported ODI improvements of 22.9% and 22.8% at 1 year and 2 years of follow-up, respectively, for a group of 152 patients undergoing open TLIF (OTLIF) and/or open PLIF (posterior lumbar interbody fusion).¹⁹

Regarding the outcomes of minimally invasive techniques, data from the literature indicate similar results. Perez-Cruet et al. evaluated 318 MITLIF procedures, including diagnoses of spondylolisthesis (66%), central canal stenosis (47%), foraminal stenosis (34%), degenerative disc disease (23%), retrolisthesis (1%) and other diagnoses (10%), and demonstrated that the mean ODI score was 43.1 points preoperatively, exhibiting significant improvement, with means of 31.6 points and 28.7 points after 3 and 6 months, respectively.²⁰

CONCLUSION

Surgical treatment of degenerative lumbar disease using the OTLIF technique, when properly indicated, offers improved quality of life in the early postoperative period of patients with a significant difference in pre- and postoperative ODI scores, short hospital stay, and low rate of complications.

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

Table 1. Frequency distribution of patient characteristics.

| Characteristics | | Count | % |
|-----------------|--------|-------|-------|
| LEVEL | L3-L4 | 2 | 9.1 |
| | L4-L5 | 12 | 54.5 |
| | L5-S1 | 8 | 36.4 |
| DRAIN | No | 22 | 100.0 |
| ICU | No | 22 | 100.0 |
| COMPLICATIONS | None | 21 | 95.4 |
| | Seroma | 1 | 4.5 |

Table 2. Descriptive statistics for surgery characteristics (n = 22).

| Surgery | Mean ± Standard deviation | Median (Minimum - Maximum) |
|--|---------------------------|----------------------------|
| Duration of surgery (min) | 108.8 ± 28.1 | 106.5 (40 - 150) |
| Length of hospital stay (days) | 1.6 ± 0.7 | 1.5 (1.0 - 3.0) |
| Oswestry pre- | 44.7 ± 9.8 | 45.0 (25.0 - 57.0) |
| Oswestry post- | 24.0 ± 9.6 | 21.0 (12.0 - 45.0) |
| Variation between pre- and postoperative | 20.7 ± 11.0 | 22.0 (0.0 - 40.0) |

Table 3. Comparison of L4-L5 and L5-S1 surgery groups.

| | L4-L5 (n = 12) | | L5-S1 (n = 8) | | p ^a |
|--|---------------------------|----------------------------|---------------------------|----------------------------|----------------|
| | Mean ± Standard deviation | Median (Minimum - Maximum) | Mean ± Standard Deviation | Median (Minimum - Maximum) | |
| Duration of surgery | 108.6 ± 30.2 | 107.5 (40 - 150) | 116.3 ± 26.9 | 114 (75 - 150) | 0.616 |
| Length of hospital stay (days) | 1.7 ± 0.8 | 1.5 (1 - 3) | 1.6 ± 0.7 | 1.5 (1 - 3) | 0.970 |
| Oswestry pre- | 43.1 ± 9.6 | 43.5 (25 - 56) | 46.9 ± 11 | 50.5 (26 - 57) | 0.305 |
| Oswestry post- | 24 ± 9.6 | 21.5 (13 - 45) | 22.5 ± 9.6 | 19 (12 - 36) | 0.678 |
| Variation between pre- and postoperative | 19.1 ± 9.5 | 22.5 (3 - 32) | 24.4 ± 11.2 | 21.5 (9 - 40) | 0.521 |

a nonparametric Mann-Whitney test.

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