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IMPACT OF OBESITY ON THE CLINICAL OUTCOMES OF SPINAL SURGERY BY TRANSPSOAS LATERAL FUSION

IMPACTO DA OBESIDADE SOBRE OS DESFECHOS CLÍNICOS DA CIRURGIA DA COLUNA POR ARTRODESE LATERAL VIA TRANSPSOAS

IMPACTO DE LA OBESIDAD EN LOS RESULTADOS CLÍNICOS DE LA CIRUGÍA DE COLUMNA MEDIANTE FUSIÓN LATERAL TRANSPSOAS

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ABSTRACT

Introduction: Obesity is a global phenomenon that affects the quality of life of the population. In addition to being a factor that can lead to cases of degeneration in the spine, it can also influence the clinical outcomes of spine surgeries. However, with the development of minimally invasive techniques, the impact of obesity has become uncertain. Methods: A single-center, non-randomized, comparative, observational study, here clinical and surgical outcomes and postoperative complications were analyzed between obese and non-obese patients undergoing LLIF surgery. Results: There was no difference between surgical times and blood loss between the groups; the number of postoperative complications was similar. Both groups showed significant improvement in clinical parameters, but there was no difference between the amount of improvement between the obese and non-obese groups. Conclusion: The present study demonstrated that LLIF is a safe and effective technique regardless of the patient's degree of obesity. ***Level of Evidence III; Retrospective study.***

Keywords: Observational Study; Obesity; Minimally Invasive Surgical Procedures.

RESUMO

Introdução: A obesidade é um fenômeno global que possui diversos sobre a qualidade de vida da população. Além de ser um fator que pode levar a casos de degeneração na coluna, como também pode influenciar nos desfechos clínicos das cirurgias de coluna. No entanto, com o desenvolvimento de técnicas minimamente invasivas o impacto da obesidade se tornou incerto. Métodos: Estudo de centro único, não-randomizado, comparativo, observacional, onde foram analisados os desfechos clínicos, cirúrgicos e complicações pós-operatórias entre pacientes obesos e não-obesos submetidos a cirurgia de LLIF. Resultados: Não houve diferença entre os tempos cirúrgicos e perda sanguínea entre os grupos, ademais o número de complicações pós-operatórias foi similar entre os grupos. Ambos os grupos apresentaram melhora significativa dos parâmetros clínicos, porém não houve diferença entre a quantidade de melhora entre os grupos obeso e não-obeso. Conclusão: O presente estudo demonstrou que o LLIF é uma técnica segura e eficaz independentemente do grau de obesidade do paciente. ***Nível de evidência III; Estudo retrospectivo.***

Descritores: *Estudo Observacional; Obesidade; Procedimentos Cirúrgicos Minimamente Invasivos.*

RESUMEN

Introducción: La obesidad es un fenómeno mundial que afecta la calidad de vida de la población. Además de ser un factor que puede conducir a casos de degeneración en la columna, también puede influir en los resultados clínicos de las cirugías de columna. Sin embargo, con el desarrollo de técnicas mínimamente invasivas, el impacto de la obesidad se ha vuelto incierto. Métodos: Estudio observacional, comparativo, no aleatorizado, unicéntrico, donde se analizaron los resultados clínicos, quirúrgicos y las complicaciones postoperatorias entre pacientes obesos y no obesos sometidos a cirugía LLIF. Resultados: No hubo diferencia entre los tiempos quirúrgicos y la pérdida de sangre entre los grupos, además, el número de complicaciones postoperatorias fue similar entre los grupos. Ambos grupos mostraron una mejora significativa en los parámetros clínicos, pero no hubo diferencia entre la cantidad de mejora entre los grupos obesos y no obesos. Conclusión: El presente estudio demostró que la LLIF es una técnica segura y eficaz independientemente del grado de obesidad del paciente. ***Nivel de Evidencia III; Estudio retrospectivo.***

Descriptores: *Estudio Observacional; Obesidad; Procedimientos Quirúrgicos Mínimamente Invasivos.*

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INTRODUCTION

Obesity is a health problem in the world. It is defined by calculating the body mass index (BMI), which consists of the ratio between the individual's mass in kilograms by the height in meters, squared. Obese individuals are those with values greater than 30 kg/m^2.[1]

An estimated two billion obese people worldwide in 2015.[2] And in the last 40 years, obesity levels have surpassed those of malnutrition. In Brazil, obesity affects 16.8% of men and 24.4% of women.[3]

In this subgroup of patients, spine surgery presents peculiarities. There are difficulties in positioning, exposure to the surgical site, and, in general, an complexity increase in the procedure and the risks involved in the anesthetic-surgical procedure.

Although there is no well-defined correlation between obesity and perioperative complications, the role of obesity in complications resulting from spinal surgery has been widely investigated in several studies.[4-6]

In recent years, spinal arthrodesis surgery, through minimally invasive procedures, has made it possible to reduce the risks that traditional procedures in spinal arthrodesis surgery provide.[7]

Thus, this paper aims to investigate the impact of patient BMI on the clinical outcomes of transpsoas lateral approach spine surgery (LLIF).

METHODS

A cohort, retrospective, single-center, comparative, non-randomized study.

Population Studied

Patients who have undergone lumbar spine arthrodesis surgery by the LLIF technique - at four or fewer levels, after filed on conservative treatment for at least 12 weeks. The procedures performed were the LLIF stand-alone technique - when only the inter somatic device is placed - or the technique with posterior supplementation - where pedicle screws are placed. Data were collected from 2008 to 2018, and patients were divided into three groups according to their BMI.

Inclusion Criteria

Adult patients, aged eighteen years or older, signed the informed consent form and received at least one level of LLIF. The research was conducted after approval by the Research Ethics Committee under number 35153220.9.0000.8847.

Exclusion Criteria

Cases undergoing inter somatic fusion other than LLIF; surgery in a spinal segment other than the lumbar spine; and lack of recording of clinical outcomes preoperatively.

Division of the Groups

The patients were divided into non-obese and obese, according to the BMI criteria, with values greater than 30 indicating obesity.

Analyzed Outcomes

Surgical outcomes: Surgery Time, Blood Loss, Hospital Length of Stay, ICU Length of Stay, and Complications

Clinical Outcomes: ODI

Statistical Analysis

All figures and statistical tests were performed in program R, version 4.0.

The normality test for continuous variables was done by the Shapiro-Francia method in the nortest package. For comparison of variance between continuous variables, Wilcox's test (two groups) and Kruskall-Wallis test (three or more groups) with *p-adjustment* by the Benjamin-Hocheberg method were used. For tests of qualitative variables, the chi-square method was used. *P-values* less than 0.05 were considered statistically significant.

RESULTS

A total of 302 patients were included in the study, 172 female and with a median age of 64 years [25-89 range]. The average weight of the patients was 77.2 kg, average height was 1.66 cm, and average BMI was 27.3 (Table 1).

In addition, 86 patients were in the normal BMI range, 132 in the overweight range, and 84 in the obese range, and there was no significant difference between the groups regarding the presence of comorbidities or gender.

Surgical Outcomes

There was no statistically significant difference when comparing the groups concerning blood loss. When the intergroup evaluation was performed, a higher bleeding rate was noted in obese patients in surgical procedures with three or more levels (Table 2).

Regarding surgical time, there was no difference between the groups. When comparing patients who underwent one or two surgery levels with those who underwent three or more levels, we found longer surgical time in the subgroup that underwent three or more surgery levels (Table 2).

There was also no difference in length of stay between the groups when comparing hospital admission ($p = 0.7$) and one-day ICU bed admission ($p = 0.33$), as well as no difference between the number of complications and the different BMI types (Table 3).

Clinical Outcomes

As for the post-surgical clinical improvement measured by the ODI, there was no statistical difference between the groups (Figure 1A). Both show significant improvement in postoperative clinical outcomes. (Figure 1B)

The behavior in patients with more than three levels was similar to those with one or two operating levels, where the results in the postoperative clinical segment were similar. (Figure 2A) It is interesting to point out in Figure 2B that in obese patients, there was more marked improvement postoperatively compared to non-obese patients. These only achieved the same pattern of improvement in the segment performed six months postoperatively.

DISCUSSION

Obesity is an increasingly prevalent phenomenon associated with several comorbidities.[4] Thus, for a long time, although its association with complications has not been completely elucidated, it has been considered a risk factor for spine surgery, especially major surgery.

Minimally Invasive Surgeries and Obesity

Several studies have verified the impact and advantages of minimally invasive surgeries for treating people with obesity. Othman et al. demonstrated that patients with the MIS-TLIF*(Minimally Invasive Surgery - Transforaminal Lumbar Interbody Fusion*) technique had similar clinical outcomes to patients with open TLIF. However, the first group had a lower rate of bleeding, fewer complications, and a shorter hospital stay.[8]

Table 1. Table containing the demographic data of the patients included in the study.

	Total	Obese	Non-Obese	p
Age Median [min-max]	64 [25-89]	61 [25-82]	63 [27-89]	0.46
Genre [F/M]	166/126	53/30	113/96	0.14
Comorbidities [No/Yes]	234/58	65/18	169/40	0.12
Levels operated [1-2/3]	250/42	72/11	178/31	0.45
BMI Mean(SD) [min-max]	NA	33.6 [30.0-41]	25.59 [19.1-29.9]	0.006

SD: Standard Deviation.

Table 2. Comparison of patients' intraoperative and perioperative variables between groups.

Variable	Group	Total	1-2 Levels	3 Levels	P (Intra group)
		Mean (SD) [95% CI]	Mean (SD) [95% CI]	Mean (SD) [95% CI]	
Blood Loss	Overweight	92 [71-112]	84 [66-102]	180 [0-365]	0.09
	Obese	166 [250-83]	99 [65-133]	503 [19-988]	0.02
p (Extra group)		0.16	0.44	0.26	
Surgery Time	Overweight	124 [114-134]	112 [102-121]	198 [231-165]	< 0.01
	Obese	125 [145-105]	114 [93-132]	188 [99-227]	0.02
p (Extra group)		0.48	0.66	0.26	
Hospitalization Time	Overweight	1 [1-6]	1 [1-5]	1 [1-6]	< 0.01
	Obese	1 [1-7]	1 [1-4]	2 [2-7]	0.04
p (Extra group)		0.7	0.6	0.13	
ICU time	Overweight	0 [0-2]	0 [0-1]	0 [0-2]	0.01
	Obese	0 [0-3]	0 [0-3]	1 [0-2]	0.03
p (Extra group)		0.33	0.23	0.38	

Table 3. Comparison of the number of complications between obese and non-obese patients.

	Complications	No Complications
Not Obese	49	160
Obese	15	68
p = 0.43		

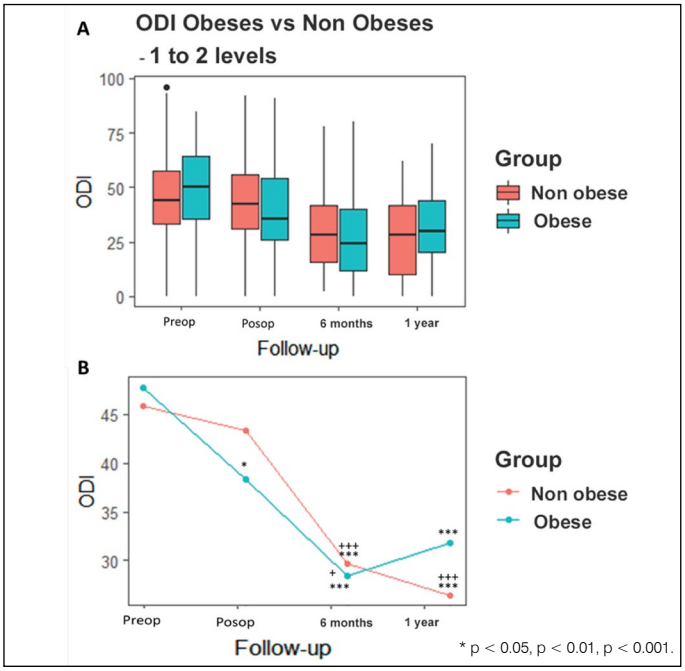

Figure 1. Comparison of intra- and extra-group clinical outcomes of patients receiving up to 1-2 levels of surgery.

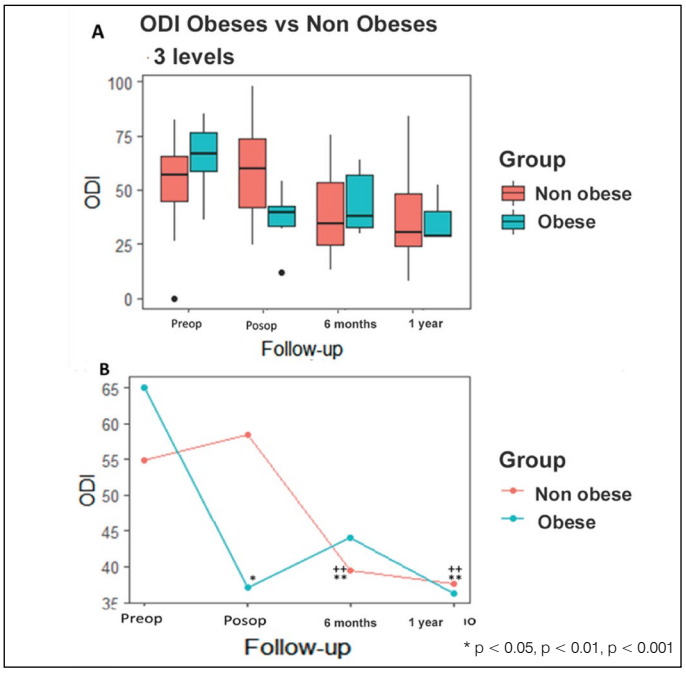

Figure 2. Comparison of intra- and extra-group clinical outcomes of patients receiving three or more surgery levels.

In the same theme, Goyal et al. observed a greater likelihood that patients with obesity would undergo more prolonged surgical procedures, greater blood loss, and greater complications without differences in clinical outcomes. The authors demonstrated that there were no significant differences between obese and non-obese patients who underwent minimally invasive surgery about the parameters mentioned above.[9]

Finally, in a meta-analysis study conducted in 2018, Wang and colleagues concluded: when using only minimally invasive surgery, obesity did not negatively impact clinical outcomes and complications, but obese patients had longer surgery times, greater blood loss, and longer hospital stays.[10]

Previous Surgeries and Obesity

In surgeries performed via the anterior or lateral approach, such as in ALIF*(Anterior Lumbar Interbody Fusion)*, OLIF*(Oblique* Lumbar Interbody Fusion), and LLIF*(Lateral L*umbar Interbody Fusion), there may be concern regarding the technical difficulty in accessing the spine in obese patients. Regarding this aspect, Xi and colleagues, in their study published in 2020, reported no such difficulty. They score a higher predisposition to risk in patients undergoing surgery at the L5/S1 level.[11] Also, in 2020, Safaee and colleagues showed similar clinical and surgical outcomes between obese and non-obese patients undergoing ALIF surgery. Here they made a caveat regarding patients with BMI greater than 31 kg/m^2. In these cases, BMI greater than 31 was the main risk factor associated with post-operative complications.[12]

In cases of LLIF surgeries, Rodgers and colleagues published in 2010 that obese patients did not have a higher risk of complications than non-obese patients.[10] Similar results in lateral approach LLIF surgeries were demonstrated in 2016 and 2021.[4,13] These findings corroborate the results presented in this study.

Limitations

One of the limitations of this study is its retrospective nature. Still, the data collection was done prospectively, and a clear protocol for data analysis was designed to mitigate many possible biases related to retrospective studies. However, the patient's BMI is not a

constant, linear variable, which is also a limitation of the study since only the BMI at the time of surgery was considered.

CONCLUSION

LLIF is safe and effective surgery, with obesity not being a risk or limiting factor, n the technique's ability to bring clinical benefit to patients.

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 the manuscript. GP and FMF were the main contributors to writing the manuscript. RA, FMF, and LP performed the surgery and followed up on the patients. GP and MR grouped the patient data. GP evaluated the data from the statistical analysis. GP, FMF, and RA performed the literature search and manuscript review and contributed to the intellectual concept of the study.

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