ORIGINAL ARTICLE
DEGENERATIVE
http://dx.doi.org/10.1590/S1808-185120222103249402

STUDY OF THE DIAMETER OF THE OBLIQUE CORRIDOR IN LATERAL DECUBITUS AND DORSAL DECUBITUS: RADIOLOGICAL STUDY

ESTUDO DO DIÂMETRO DO CORREDOR OBLÍQUO EM DECÚBITO LATERAL E DECÚBITO DORSAL: ESTUDO RADIOLÓGICO

ESTUDIO DEL DIÁMETRO DEL CORREDOR OBLICUO EN DECÚBITO LATERAL Y DORSAL: ESTUDIO RADIOLÓGICO

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ABSTRACT

Introduction: Degenerative intervertebral disc disease and its impact on quality of life when associated with sagittal misalignmentis a current topic in the literature. The technique known as OLIF derives from the need to use anterior cage stop romote stabilization of the affected segment, indirect decompression, restoration of segmental lordosis, and sagittal balance. Methods: Single-center, non-randomized, comparative, observational study. The following variables were measured using magnetic resonance imaging of the lumbar spine in dorsal and lateral decubitus, establishing a comparison between the size of the OLIF corridor in the L3L4 and L4L5 segments, as well as a comparison of corridor size between the different positions. Results:There was no difference incorridor size in the comparison between decubitus. However, when the L3L4 and L4L5 levels were compared, there was a significant difference in the size of the corridor in both the lateral and dorsal positions. Conclusion: The present study did not show any difference between the size of the OLIF corridor in L3L4 and L4L5 in the different decubitus, suggesting that thee valuation of the corridor in convention al magnetic resonance images appearstobe safe andreflects the actual size when positio ned for performing the OLIF technique. ***Level of evidence III; Retrospective study.***

Keywords: Intervertebral Disc Degeneration; Spinal Curvatures; Diagnostic Imaging; Magnetic Resonance Imaging; Spinal Fusion; Evaluation Study.

RESUMO

Introdução: A doença degenerativa do disco intervertebral e seu impacto sobre a qualidade de vida quando está associada a desalinhamento sagital é tema atual na literatura. A técnica conhecida como OLIF deriva da necessidade de uso de cages anteriores para promover estabilização do segmento afetado, descompressão indireta, restauração da lordose segmentar e equilíbrio sagital. Métodos: Estudo de centro único, não randomizado, comparativo, observacional. Foram medidas as seguintes variáveis por ressonância magnética de coluna lombar em decúbito dorsal e lateral, estabelecendo comparação entre o tamanho do corredor OLIF nos segmentos L3-L4 e L4-L5, assim como comparação entre o tamanho do corredor entre as diferentes posições. Resultados: Não houve diferença entre o tamanho do corredor na comparação entre os decúbitos. Entretanto, ao comparar os níveis L3-L4 e L4-L5 houve diferença significativa no tamanho do corredor, tanto na posição lateral quanto na posição dorsal. Conclusões: O presente estudo não demonstrou diferença detamanho do corredor OLIF em L3-L4 e L4-L5 em diferentes decúbitos, sugerindo que a avaliação do corredor em ressonância magnética convencional parece ser segura e reflete o tamanho real quando posicionado para execução da técnica OLIF. ***Nível de evidência III; Estudo retrospectivo.***

Descritores: *Degeneração do Disco Intervertebral; Curvaturas da Coluna Vertebral; Diagnóstico por Imagem; Tomografia por RM; Fusão Vertebral; Estudo de Avaliação.*

RESUMEN

Introducción: La enfermedad degenerativa del disco intervertebral y su impacto en lacalidad de vida cuando se asocia a una desalineación sagital es un tema actualenla literatura. La técnica conocida como OLIF deriva de la necesidad de utilizar cages anteriores para favorecer la estabilización del segmento afectado, la descompresión indirecta, la restauración de la lordosis segmentaria y el equilibrio sagital. Métodos: Estudio observacional comparativo unicéntrico, no aleatorizado. Se midieron las siguientes variables mediante resonancia magnética de la columna lumbar endecúbito dorsal y lateral, estableciendo la comparación entre el tamaño del corredor OLIF en los segmentos L3L4 y L4L5, así como la comparación entre el tamaño del corredor entre las diferentes posiciones. Resultados: No hubo diferencia entre el tamaño del corredor en la comparación entre decúbitos. Sin embargo, al comparar los niveles L3-L4 y L4-L5, hubo una diferencia

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Received on 03/05/2021 accepted on 05/20/2022
Reviewed by: Dr. Erasmo Abreu Zardo

significativa en el tamaño del corredor tanto en posición lateral como dorsal. Conclusiones: El presente estudio no mostró diferencias en el tamaño del corredor OLIF en L3-L4 y L4-L5, en diferentes posiciones de decúbito, lo que sugiere que la evaluación del corredor en la resonancia magnética convenciona lparece ser segura y refleja el tamaño real cuando se posiciona para realizar la técnica OLIF. ***Nivel de evidencia III; Estudio retrospectivo***

Descriptores: *Degeneración del Disco Intervertebral; Curvaturas de la Columna Vertebral; Diagnóstico por Imagen; Imagen por Resonancia Magnética; Fusión Vertebral; Estudio de Evaluación.*

INTRODUCTION

Degenerative intervertebral disc disease, lumbar facet disease, and sagittal misalignment in adults are pathologies that accompany the aging of the population.The reduction in the quality of life in patients with lumbar spondylosis and the fact that this decrease is strongly correlatedwith sagittal alignment is a consolidated theme in the literature. As a result, studies that address the theme stimulated the evolution of surgical treatments that exist today.The use of anterior cages is effective in promoting stabilization of the affected segment, indirect decompression, and the restoration of lumbar lordosis and sagittal balance.[1,2]

Among the existing surgical treatments, the retroperitoneal oblique corridor has gained popularity due to the possibility of accessing multiple lumbar levels and is currently characterized as suitable for levels L1 to S1. The technique was described by Michael Mayer in 1997. It consists of a retroperitoneal approach from an anterolateral access in the abdomen. Access to the intervertebral discoccurs through a space created between the psoas muscle and the peritoneum. According to the classic description, to perform it the patient should be positioned in right lateral decubitus. However, there is a description in the literature of performing the technique in left lateral decubitus, which tends to be contra indicated due to the presence of the vena cava and its ramifications.[3,4] Its main advantages are the ability to perform indirect compression, to access practically all levels of the lumbar spine, and to reduce neurological complications.[1]

However, performing lumbar fusion using the oblique corridor access technique is not free from risks. The main complications reported are peritoneal violation, large vessel injury, permanent motor neurological deficit, transient motor weakness of the psoas muscle, injury of the sympathetic plexus, and urological injuries.[5,6]

According to the original description of the procedure in right lateral decubitus, the oblique corridor for access to the intervertebral disc is defined by the medial edge of the psoas muscle and the left lateral border of the aorta, common iliac artery, or left common iliac vein, depending on the intervertebral segment under analysis.[7,8]

Analysis of the retroperitoneal oblique corridor in a magnetic resonance exam provides important information about the position of the psoas muscle and the vascular structures. In general, anatomical studies reveal that the retroperitoneal oblique corridoris especially narrow in the L4L5 topography, which makes analysis of the size of the corridor in imaging exams essential for a safe approach.[9–11]

Because of the scarcity of specific anatomical studies that allow an understanding of the possible free movement of the anatomical retroperitoneal structures and its impact on the size of the oblique corridor in different positionings, the objective of this study was to evaluatethe measurement of the corridor in the L3L4 and L4L5 segments in lateral and dorsal decubitus.

METHODS

This was a single-center, non-randomized, comparative, observational study. All the patients included in the study consented to the inclusion of the images by completing the informed consent form. This study was approved by the IRB (CAAE:40583620.7.0000.5515).

Inclusion and Exclusion Criteria

Patient images were obtained from a radiological clinic in Goiânia.

Only patients with a previous indicationofmagnetic resonance of the lumbar spine were invited consecutively to participate in the study.Of these, patients with a history of previous spinal surgery and those with anatomical variations or deformities that hindered visualization of the key structures for the study were excluded.

Image Acquisition

All examinations were performed on the same equipment (Siemens, Magnetom Spectra, 3T). For lateral positioning, the patient was placed in right lateral decubitus with the legs flexed, while for dorsal positioning the patient was placed in dorsal decubitus with the legs positioned on a cushion (Figure 1). Sagittals lices were used for localization and axial slices for taking measurements. The scans were performed with T2-weighting, with 4.5-millimeter slices, repetition time of 7800 milliseconds, and echo time of 91 milliseconds for the axial slices.

Findings

Two independent evaluators performed the measurements using the RadiAnt DICOM software (Pozán, Poland). To assist in the measurements, the evaluators received a guide containing details on how to take the measurements. The observers were blind to the positioning of the patients. A reference line centered on the spinous process was used for inclusion of vertebral rotation in the different measurements. Another line tangent to the edge of the vertebra and parallel to the first was also used (Figure 2). The measurements were taken from axial slices in the center of the disc whenever possible.

Figure 1. Photos showing the positioning of patients in the magnetic resonance equipment in dorsal and lateral decubitus.

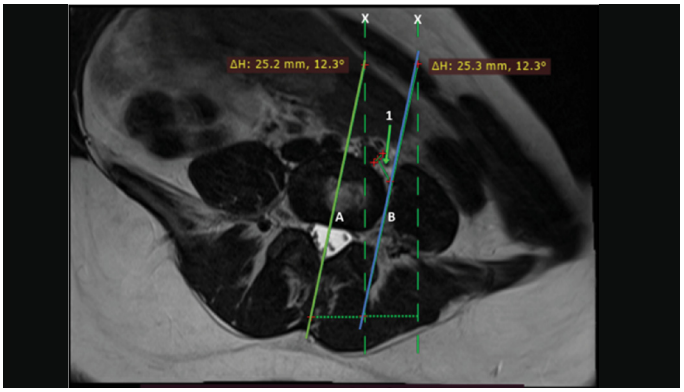

Figure 2. Image showing the stipulated measurements and reference lines used in the study. 1 – Least distance, X – 90°indication line, A – Spinous process reference line, B – Vertebral edge reference line.

When this was not possible, the measurement was performed using the lowest slice of that disc level.

The following measurement was performed in the axial images of both L3L4 and L4L5:

Least distance of the pre-psoas corridor, measured between the most lateralized blood vessel and the medial edge of the psoas muscle[12] (Figure 2).

Statistical Analysis

The Shapiro-Wilk test was used to analyze the distribution of the sample.To evaluate the difference between the two groups, the Wilcox test and the T-test were used, depending on the distribution of the variables analyzed. The summarized measurements were presented as means, medians, and quartiles. The statistics and images presented in the study were performed using R software (version 4.0.0, The R Foundation for Statistical Computing, Vienna, Austria). A p-value < 0.05 was considered as an indicator of statistical significance.

RESULTS

Twenty-five patients, 41% of them female, were included. They ranged in age from 21 to 78 years with a median age of 32 years (Table 1).

At the L3L4 level, the mean size of the corridor was 14.6 mm in the dorsal position and 14.3 mm in the lateral position. At the L4L5 level, the mean distances were 10.1 mm and 10.5 mm in the dorsal and lateral positions, respectively (Table 2).

There was no difference between the sizes of the corridorsof the two decubituspositions at each level (Figure 3A). However, there was a significant difference in the sizes of the corridors, both in the lateral and dorsal positions, when the L3L4 and L4L5 levels were compared (Figure 3B).

DISCUSSION

The oblique lateral interbody fusion technique (OLIF)

Oblique pre-psoas access was first described by Mayer et al.,[4] although the name OLIF by which it is currently known was coined in 2012.[13]

Development of the technique was motivated by the intention to prevent complications associated with manipulation of the abdominal wall, such as postoperative pain and incisional hernia, in addition to enabling a multilevel approach to the spine.[14] Moreover, the working channelpasses between the psoas muscle, the peritoneum, and vascular structures, avoiding the en bloc mobilization of the psoas muscle.[4,13,14] Thus, it is speculated that using the retroperitoneal oblique approach may lead to a reduction in the incidence of femoral plexus injuries.[8,15]

However, the OLIF technique is not risk-free. In the L1L2 segment, the ribs make the creation of a working channel difficult. In the L4L5 segment, the iliolumbar vein must often be dissected. In the L5S1 segment, the approach is easily hampered by the iliac crest and the iliac vessels need to be dissected.[8,16,17]

Table 1. Table containing the demographic data of the sample.

	Min	Median	Max	Standard deviation
age	21	32	78	16.93
Weight	50	74	98	13.29
Height	1.58	1.69	1.87	0.08
BMI	19.53	25.14	36.44	3.70

Table 2. Table containing the OLIF corridor size values, both at level L3L4 and level L4L5.

Position	Level	Min	Mean	Max	Standard deviation
Dorsal	L3L4	3.6	14.6	29.9	6.0
Dorsal	L4L5	2.2	10.1	22.8	4.6
Lateral	L3L4	3.7	14.3	30.7	6.1
Lateral	L4L5	2.0	10.5	19.8	4.5

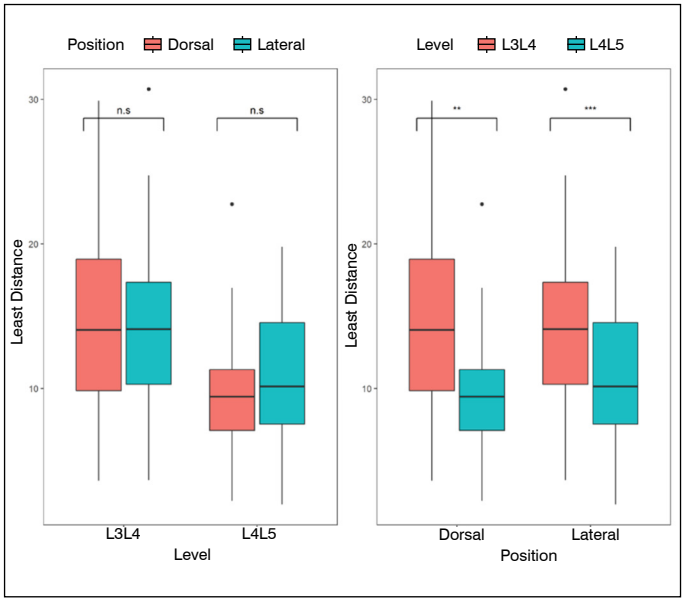

Figure 3. Box-plot graph showing the distribution of the shortest distances from the OLIF corridor. A) Shorter distance in L3-L4 and L4-L5 levels. B) Shorter distance between the lateral and dorsal decubitus.

Size of the retroperitoneal oblique corridor

Lie et al. studied the size of the oblique corridorbetween segments L1L2 and L4L5 in the dorsal-position magnetic resonance imagesof 200 patients. The authors demonstrated that the oblique corridor tends to be greater on the left side and that it gradually decreases in size the more caudal the level.[11,18] Results similar to those found in the present study, where we identified a significant difference between the size of the corridor in L3L4 and L4L5 in both positions.

Impact of positioning on the size of the retroperitoneal oblique corridor

Furthermore, Timothy T. Davis et al.[10] evaluated 20 cadavers in right lateral decubitus in both neutral and retracted positions. In that study, there was a significant difference in the size of the corridor between the retracted and neutral positions at all levels analyzed. This finding contrasts with what we observed in our study,in which no changes in the oblique corridor were detected between the two decubitus positions. Finally, Aqib et al.[19] identified an increase in the oblique corridor at all the levels from L2L2 to L4L5 when in the surgical position (lateral decubitus) as compared to dorsal decubitus. The greatest increase of 3.1 mm was in L1L2, followed by L4-L5 with 2.1 mm, in contrast to the results of our study, in which no significant differences were identified between the size of the oblique corridor in the dorsal and lateral positions.

Limitations

The limitations of the study include the small number of patients in the sample, which can make variations, whether anatomical or resulting from pathologies, have a greater impact on the averages. Another limitation lies in obtaining the mean between the two evaluators. To try to reduce the problem, the evaluators underwent prior training and received a booklet with a description and detailed visualization of the measurements. Finally, as the resonance is not usually performed in lateral decubitus, some variation in the positioning of the patients could occur and,to try to minimize these variations, the technicians involved in conducting these exams received detailed training on the positioning of the patients in each decubitus.

CONCLUSION

The present study did not observe any differencesin the size of the retroperitoneal oblique corridor in L3L4 or L4L5 in the different decubitus positions, suggesting that the evaluation of the corridor in conventional magnetic resonance is safe and reflects a size close to that which will be obtained in surgery with the patient in lateral decubitus.

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

CONTRIBUTIONS OF THE AUTHORS: All authors made significant individual contributions to this manuscript. GP, MB, DA, and RA were responsible for establishing the context of the research. MD was responsible for patient selection.RP,CFH, and LP were responsible for manuscript review. RM and FMF were responsible for performing the study measurements. MB, GP, and RR were responsible for writing the manuscript. MB and GP were responsible for the creation and elaboration of the figures and tables included in the manuscript.

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