

RETROSPECTIVE ANALYSIS OF DEGENERATIVE LUMBAR SPONDYLOLISTHESIS: TRIGGERING OR AGGRAVATING FACTORS

ANÁLISE RETROSPECTIVA DA ESPONDILOLISTESE LOMBAR DEGENERATIVA:
FATORES DESENCADEANTES OU AGRAVANTES

ANÁLISIS RETROSPECTIVO DE LA ESPONDILOLISTESIS LUMBAR DEGENERATIVA:
FACTORES DESENCADENANTES O AGRAVANTES

RODRIGO ARNOLD TISOT¹ , JULIANO DA SILVEIRA VIEIRA¹ , MATHEUS BACKES SALLET¹ , DIEGO DA SILVA COLLARES¹ , MAYKON DE OLIVEIRA FELIPPE¹ ,
ARTHUR ASCENÇO CEOLIN¹ , FELIPE SEVERO LANZINI¹ , GABRIEL ORLANDI¹ , JOÃO GABRIEL DE SOUZA DO CANTO¹ , LEONARDO CECHINATO SCHIO¹ ,
LUCAS GABRIEL MENSCH DA LUZ¹ , LUÍS HENRIQUE ZAHNER¹ , MATEUS SEBEN PEREIRA¹ , MATHEUS FELIPE AQUINO OLIVEIRA¹ ,
PEDRO HENRIQUE DAL BOSCO ZAFFARI¹ , VALDO CUSTÓDIO TOLEDO FILHO¹ 

1. Faculdade de Medicina da Universidade de Passo Fundo (UPF), Orthopedic Hospital of Passo Fundo, Spine Surgery Service, Rio Grande do Sul, RS, Brazil.

ABSTRACT

Objective: Identify and measure probable triggering or aggravating factors of degenerative lumbar spondylolisthesis at the L3-L4 and L4-L5 levels. **Methods:** This is a cross-sectional study, analyzing medical records of patients surgically treated by a spine surgeon at the Hospital Ortopédico de Passo Fundo, from 2002 to 2020. **Results:** There was a statistically significant correlation between the degree ($p=0.041$) and percentage ($p=0.046$) of slippage with lumbar lordosis. There was also a statistically significant correlation between the percentage of slippage and the severity of disc degeneration ($p=0.032$). The other analyzed variables did not obtain statistical relevance. **Conclusions:** The degree and percentage of slippage of Degenerative Lumbar Spondylolisthesis were more pronounced in patients with greater lumbar lordosis. The percentage of slippage was also more pronounced in patients with greater disc degeneration. **Level of Evidence III; Retrospective Study.**

Keywords: Spondylolisthesis; Intervertebral Disc Degeneration; Facet Joint; Tropism.

RESUMO

Objetivo: Identificar e mensurar prováveis fatores desencadeantes ou agravantes da espondilolistese lombar degenerativa dos níveis L3-L4 e L4-L5. **Métodos:** Este é um estudo transversal, sob análise de prontuários médicos de pacientes tratados cirurgicamente por um cirurgião de coluna do Hospital Ortopédico de Passo Fundo, no período entre 2002 e 2020. **Resultados:** Houve correlação estatística significativa entre o grau ($p=0,041$) e porcentagem ($p=0,046$) de escorregamento com a lordose lombar. Também ocorreu correlação estatisticamente significativa entre a porcentagem de escorregamento e a gravidade da degeneração discal ($p=0,032$). As demais variáveis analisadas não obtiveram relevância estatística. **Conclusões:** O grau e a porcentagem de escorregamento da Espondilolistese Lombar Degenerativa mostraram-se mais acentuados em pacientes que possuíam lordose lombar maior. A porcentagem de escorregamento foi, também, mais acentuada, nos pacientes com maior degeneração discal. **Nível de Evidência III; Estudo Retrospectivo.**

Descritores: Espondilolistese; Degeneração do Disco Intervertebral; Articulação Facetária; Tropismo.

RESUMEN

Objetivo: Identificar y medir probables factores desencadenantes o agravantes de espondilolistesis lumbar degenerativa en los niveles L3-L4 y L4-L5. **Métodos:** Se trata de un estudio transversal, analizando historias clínicas de pacientes tratados quirúrgicamente por un cirujano de columna en el Hospital Ortopédico de Passo Fundo, entre 2002 y 2020. **Resultados:** Se observó una correlación estadísticamente significativa entre el grado ($p=0,041$) y el porcentaje ($p=0,046$) de deslizamiento y la lordosis lumbar. También hubo una correlación estadísticamente significativa entre el porcentaje de deslizamiento y la gravedad de la degeneración discal ($p=0,032$). Las demás variables analizadas no fueron estadísticamente significativas. **Conclusiones:** El grado y el porcentaje de deslizamiento en la espondilolistesis lumbar degenerativa fueron más pronunciados en los pacientes con mayor lordosis lumbar. El porcentaje de deslizamiento también fue mayor en los pacientes con mayor degeneración discal. **Nivel de Evidencia III; Estudio Retrospectivo.**

Descriptor: Espondilolistesis; Degeneración del Disco Intervertebral; Articulación Facetaria; Tropismo.

Study conducted by the Orthopedic Hospital of Passo Fundo, Av. Sete de Setembro, 817, Centro, Passo Fundo, Rio Grande do Sul, RS, Brazil. 99010-121.

Correspondence: Rodrigo Arnold Tisot. 817, Sete de Setembro Ave., Centro, Passo Fundo, RS, Brazil. 99010-121. rtisot@hotmail.com



INTRODUCTION

Spondylolisthesis is a disorder characterized by the anterior slippage of a vertebral body in relation to the subsequent caudal vertebra.^{1,2} Spondylolisthesis with intact *pars interarticularis* was initially described by Junghanns in 1930.³ In 1950, Macnab described spondylolisthesis with an intact neural arch, calling it pseudo-spondylolisthesis.⁴ The term “degenerative spondylolisthesis” was cited in 1955 by Newman and Stone, when observing the slippage of vertebrae resulting from degeneration of the lumbar facet joints.⁵

Degenerative lumbar spondylolisthesis (DLS) has, as its pathophysiology, the degenerative progression of the intervertebral disc and facet joints, leading to subsequent destabilization of one or more vertebral segments. It is most frequently observed at the L4-L5 level, followed by L3-L4,⁶ which can result in stenosis of the vertebral canal and lateral recesses that often generate neurological and axial symptoms.

The pathogenesis of DLS is not fully understood, being mainly related to advanced age, female sex, and the fourth lumbar vertebra.⁵ There are also other factors involved, such as genetic, hormonal, and mechanical factors.⁷ Recently, facet orientation and the relationship of pelvic incidence in DLS have emerged as potential risk factors,^{2,8-10} stimulating the need for studies seeking greater evidence.

It is known that with the increase in life expectancy, the prevalence of degenerative pathologies, such as DLS, increases. Although we know some determining factors for the development of degenerative pathologies,¹¹⁻¹³ the genesis of DLS, as well as its aggravating factors, requires more studies and documentation.

The objective of the present study is to analyze data from medical records and imaging exams of all patients surgically treated for DLS of L3-L4 and/or L4-L5, identifying the main triggering or aggravating factors.

METHODS

An observational cross-sectional study was conducted through the review and analysis of 49 medical records of patients with degenerative lumbar spondylolisthesis (DLS) who underwent decompressive surgeries, with or without associated arthrodesis. The collection and analysis of related factors were carried out through the database of the responsible spine surgeon for the procedures.

The authors of the present study signed the Free and Informed Consent Term (FICT) for the use of data, committing to do so anonymously. It should also be noted that the research project was approved by the Research Ethics Committee of the Universidade de Passo Fundo (CEP/UPF), after its submission via Plataforma Brasil, under number 6.038.833.

Patients with symptomatic degenerative lumbar spondylolisthesis of L3-L4 and L4-L5, surgically treated by a single responsible surgeon at the Orthopedic Hospital of Passo Fundo, from January 2002 to December 2020, were included. The medical records contained detailed anamnesis, surgical description, pre-operative examinations of lumbosacral radiography in anteroposterior and lateral incidence, as well as magnetic resonance imaging of the lumbosacral spine with axial and sagittal cuts.

The exclusion criteria considered were: patients with deformities, history of trauma to the spine, syndromes, infections, or rheumatological pathologies. Patients with incomplete medical records or who did not agree with the signed free informed consent term (FICT) would also be removed from the study.

In the described study, the degree and percentage of slippage of L3 over L4 or L4 over L5 were analyzed, with the following factors: sacral inclination; lumbar lordosis, measured by the Cobb method; disc and facet degeneration evaluated, respectively, through the Pfirrmann¹⁴ and Weishaupt classification;¹⁵ facet angulation, measured by the Karacan method;¹⁶ and facet tropism, classified by Vanharanta.¹⁷

The degree of slippage was determined according to the Meyerding classification. The percentage of slippage was calculated

based on the amount, in millimeters, of slippage of the affected vertebra, in relation to the upper vertebral plateau of the lower vertebra, measured with a millimeter ruler. The location of the posterior wall of the slipped vertebra, in relation to the upper plateau of the lower vertebra, allows the calculation of the percentage of slippage through a simple rule of three.

The statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 24.0 (SPSS Inc, Chicago, IL, USA). The t-test was used to analyze quantitative data in independent samples or analysis of variance (ANOVA), and the Mann-Whitney or Kruskal-Wallis tests for asymmetric data. In addition, Spearman and Kendall correlation tests were employed. We considered “p” significant when less than or equal to 0.05.

RESULTS

The results were obtained according to the relationship between degree and percentage of slippage with: (a) facet tropism; (b) severity of facet tropism; (c) lumbar lordosis; (d) sacral slope; (e) facet degeneration; (f) disc degeneration.

Regarding demographic data, 40 patients were female (81.6%) and 9 were male (18.4%). The age of these patients ranged from 43 to 80 years, with a mean of 63.10 ± 10.68 years. There were 42 patients (85.7%) with grade I spondylolisthesis and 7 (14.3%) with grade II. The average percentage of slippage was 14.92%, ranging from 3.00% to 35.00%.

Correlation between degree and percentage of slippage with facet tropism

The median of facet tropism was 6 (2-11) degrees, varying from 0 to 25 degrees. No statistically significant relationship was found between the degree of slippage of the affected vertebra and facet tropism ($p=0.356$). Furthermore, no statistically significant correlation was found between the percentage of slippage of the vertebra and the measured tropism ($p=0.070$).

Correlation between degree and percentage of slippage with severity of tropism

Facet tropism was absent in 27 cases (55.1%). It was considered moderate in 13 (26.5%) and severe in 9 (18.4%) of the analyzed cases. No statistically significant relationship was found between the degree ($p=0.428$) or percentage ($p=0.356$) of slippage of the affected vertebra and the aforementioned severity classification of tropism.

Lumbar lordosis

The average lumbar lordosis of the evaluated patients was 43.96 (SD=10.91) degrees, ranging from 25.00 to 71.00 degrees. There was a statistically significant correlation between the degree ($p=0.041$) and percentage ($p=0.046$) of slippage of the affected vertebra and the presented lumbar lordosis. It was found that a more pronounced lordosis predisposes to a greater possibility of slippage, as we can exemplify in the graph below. (Figure 1)

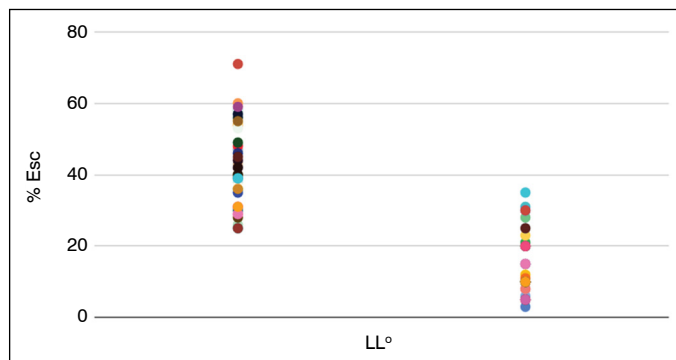


Figure 1. Relationship of the percentage of slippage with lumbar lordosis.

Slope sacral

The average sacral slope was 30.49 (SD=9.04) degrees, ranging from eight to 52 degrees. No statistically significant correlation was found between the degree ($p=0.433$) or percentage ($p=0.635$) of slippage with the measured sacral slope.

Facet degeneration

Facet degeneration was classified as absent in 0 cases (0.00%). There were 5 patients with mild degree (10.20%), 15 with moderate degree (30.61%), and 29 (59.18%) presenting severe degree. There was no statistically significant relationship between degree ($p=0.489$) or percentage ($p=0.372$) of slippage with the increase in severity of facet degeneration.

Disc degeneration

Disc degeneration was classified as grade I in zero cases (0.00%), grade II in 8 (16.33%), grade III in 25 (51.02%), grade IV in 13 (23.53%), and grade V in three (6.13%) cases. There was no statistically significant relationship between the severity of facet degeneration and the degree of slippage ($p=0.122$). On the other hand, there was a statistically significant association between the severity of disc degeneration and the percentage of slippage ($p=0.032$). It was found, therefore, that more degenerated discs presented a higher percentage of slippage.

DISCUSSION

The ELD and its incidence are well defined; however, its triggering and progression factors remain uncertain.

The average age and the incidence of sex of the patients found in this study are similar to those found in the literature. There are different opinions on which risk factor is most influential in the pathogenesis of LDD, but it is already established that female patients, those over 65 years old, and at the L4-L5 level, are the most affected by this pathology.^{1,2,5,12,13,18,19}

Tisot et al.¹³ identified a statistically significant relationship between facet tropism and disc degeneration in patients with degenerative lumbar stenosis, suggesting that the asymmetry of the articular facets would lead to an early degenerative disc process. This degenerative event could be considered one of the causes that support the possible progression of the affected segment to progressive instability, a fact that aligns with studies that evaluate the existing relationship between facet asymmetry facet and degenerative instability.^{6,8} However, there is no consensus in the literature on how to predict future instability that leads to symptomatic degenerative lumbar spondylolisthesis. In the present study, the correlation between the percentage of slippage and facet tropism was not positive ($p=0.070$), but it was very close to statistical validation. Perhaps, if there were a greater number of cases, with more varied slippage percentages, the result of this evaluation could have shown $p<0.050$.

Enyo, Yoshimura, Yamada, Hashizume, and Yoshida¹ suggested risk factors for LDD in the 15-year segment, in a Japanese population of similar age, finding a relationship of progression with female sex, facet sagittalization, and age under 60 years.

Rosenberg,² in 1975, already described the relationship between vertebral instability, resulting from the degenerative process, and the evolution of LDD towards surgical treatment. However, the existing relationship with spinopelvic angular parameters was not measured as in subsequent studies.

Yoshihara⁷ found that patients with increased pelvic incidence had a higher likelihood of slippage of the lumbar vertebrae.

In the present study, the degree of slippage, measured through the Meyerding Classification, showed a statistically significant correlation only with lumbar lordosis ($p=0.041$). The low correlation found with various other factors evaluated may be due to the fact that only grade I and II LDD were present in the study. We believed that the correlation of the percentage of slippage, which proved to be quite variable among patients, would allow for a more adequate statistical evaluation, generating statistically significant results regarding the various correlated factors. However, the percentage of slippage was statistically positive only with lumbar lordosis ($p=0.046$) and disc degeneration ($p=0.032$). Again, we emphasize that the fact that the study did not have pronounced slippage percentages or a very large number of cases may justify the little significant correlation with the related factors. It was believed that the research would demonstrate that people with greater facet asymmetry (greater tropism) would develop earlier discarthrosis and, when associated with pronounced lumbar lordosis and sacral inclination, would have a higher probability of developing LDD. However, this supposed correlation was not statistically confirmed in its entirety in the referred study.

It is therefore noted that facet asymmetry (tropism), throughout life, under axial loads and flexion-extension and shear forces, in a spine with hyperlordosis and pronounced sacral inclination, should be considered, along with facet sagittalization, as important risk factors for the appearance and worsening of LDD. However, more studies involving a large number of patients and varied degrees of slippage should be conducted, with the aim of statistically confirming these considerations. A better understanding of the causal and aggravating factors of LDD would help to outline prevention and treatment strategies for this degenerative disease.

CONCLUSION

The degree and percentage of slippage of Degenerative Lumbar Spondylolisthesis were more pronounced in patients with greater lumbar lordosis. The percentage of slippage was also more pronounced in patients with greater disc degeneration.

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

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