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Relationship of Lumbar Postural Asymmetry, Functional Disability, and Pain in the Elderly Lumbar Radiculopathy

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Abstract
Introduction: *Lumbar radiculopathy is a common cause of low back pain in older adults and may affect postural alignment and functional capacity. Persistent pain can lead to biomechanical changes such as postural asymmetry, which may increase functional disability and pain intensity.* ***Objective:*** *To determine the relationship between lumbar postural asymmetry, functional disability, and pain intensity in older adults with lumbar radiculopathy.* ***Methods:*** *This study used a cross-sectional design involving older adults with lumbar radiculopathy at Hermina Pasteur Hospital. Postural asymmetry was measured using a flexible curve ruler, functional disability using the Oswestry Disability Index (ODI), and pain intensity using the Visual Analog Scale (VAS). Data were analyzed using Spearman Rank Correlation.* ***Results and Discussion:*** *The results showed a weak positive correlation between lumbar postural asymmetry and functional disability in older adults with lumbar radiculopathy, although the relationship was not statistically significant ($r = 0.256$; $p = 0.073$). In addition, a weak but statistically significant positive correlation was found between lumbar postural asymmetry and pain intensity ($r = 0.285$; $p = 0.045$). These findings highlight the importance of postural evaluation in physiotherapy assessment for determining appropriate interventions.* ***Conclusion:*** *there is a relationship between lumbar postural asymmetry and functional disability and pain intensity in older adults with lumbar radiculopathy, although the strength of the relationship is weak. Postural evaluation is important in physiotherapy assessment to determine appropriate interventions.*

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Introduction

Lumbar radiculopathy is one of the main causes of low back pain in the elderly which is characterized by compression or irritation of the nerve roots, causing radiating pain, sensory disturbances, and decreased function. This condition is often associated with degenerative changes of the spine such as herniated discs, thickening of ligaments, and changes in facet joints. As we age, the prevalence of low back pain increases and can have a significant impact on the quality of life and independence of the elderly. (Ferreira et al. 2023; WHO 2023) (Khairani et al. 2020) (Alexander et al., 2024)

According to data from the Ministry of Health, the prevalence *of Low back pain* in Indonesia reaches 18%, and increases with age. The causes of *Low back pain* are multifactorial; although most cases are non-specific (85%), specific causes such as fractures, infections, and tumors should still be considered. In addition, the prevalence of lumbar radiculopathy ranges from 3% to 5% in the population. At Hermina Pasteur in 2025-January 2026, there are 15% of patients with lumbar radiculopathy. (Aprilia et al.) (Ghasabmahaleh et al. 2021)

Persistent pain in lumbar radiculopathy can lead to biomechanical changes, including the occurrence of postural asymmetry in the lumbar and pelvic regions. This asymmetry has the potential to interfere with body load distribution and movement efficiency, which can ultimately increase mechanical stress on musculoskeletal tissue. The condition is often associated with increased pain intensity and limited functional activity in patients Clinically, lumbar postural asymmetry is defined as a deviation of the spinal curve from the vertical axis of the body that can be detected through visual assessment as well as quantitative measurements. In the context of this study, the degree of postural asymmetry was assessed using a flexible curve ruler by measuring the index of flexibility and deviation of the lumbar curve from the neutral position. Based on the measured values obtained, the severity of asymmetry is categorized into three degrees: mild, when the curve deviation is within the minimum physiological limits; while, if there is a significant deviation but is still within the body's compensatory capacity; and severe, when the deviation has exceeded the normal compensation range and has the potential to significantly interfere with function. This categorization is important to allow for a more structured clinical analysis in identifying the relationship between degrees of asymmetry and levels of pain and functional disability (Armon et al. 2025) (Sugavanam et al., 2025). (Ma et al., 2024).

Several previous studies have shown a link between postural disorders, pain, and functional disability in patients with low back pain. However, the results of the study still vary and have not specifically explained the relationship between the degree of lumbar postural asymmetry measured quantitatively with functional disability and pain levels, particularly in the elderly population with lumbar radiculopathy. In addition, the use of simple tools such as *flexible curve rulers* in assessing postural asymmetry is still rarely explored in this clinical context.

Based on this, there is limited evidence regarding the objective relationship between lumbar postural asymmetry, functional disability, and pain levels in the elderly with lumbar radiculopathy. Therefore, this study aims to analyze the relationship between the degree of postural asymmetry of the lumbar region with functional disability and pain levels in the population.

Based on the background of the problem and the results of research that has been carried out before, the researcher is interested in conducting research on it. The relationship between the degree of postural asymmetry using a flexible curve ruler and

functional disability with *the Oswestry Disability Index* (ODI) on pain levels using the Visual Analog Scale (VAS) in the elderly with lumbar radiculopathy. Because it has not yet been found, similar research. This needs to be researched because physiotherapists must know the relationship between these points in order to sharpen the analysis in the examination and the accuracy in the provision of interventions.

In another study, the reliability of the measurement used a flexible curve. The results show high reliability. This tool is considered practical, inexpensive, and easy to use in a clinical setting. However, the reliability of the inter-rater can be affected by the skill of palpation and marking of anatomical landmarks. Nonetheless, flexible curves can be a reliable alternative to assess postural deviations such as hyperkyphosis without the need to use radiation methods (Zanguie et al. 2023)

The Oswestry Disability Index (ODI) is a questionnaire developed to assess the level of functional disability due to low back pain and is considered the *gold standard* in measuring its impact on daily activities (Jenks et al. 2022). Based on the latest literature, the Visual Analog Scale (VAS) is a widely validated pain level measurement instrument and widely used in clinical practice and research. The application of VAS in the context of lumbar radiculopathy pain provides significant clinical benefits, particularly in evaluating the effectiveness of therapeutic interventions. In the latest guidance on the Management of Radicular Pain, the International Association for the Study of Pain recommends the use of VAS as the primary measuring tool for assessing the level of radicular pain before and after the administration of therapy. (Khorami et al. 2021)

Method

The type of research used in this study is Cross-Sectional. Where only observations will be made with variable measurements of the subject at one time. The main goal is to describe the condition of the population at any given time and analyze the relationships between variables at the same time. In this study, the researcher did not provide interventions, only observed the relationship between postural asymmetric risk factors/characteristics and pain outcomes and functional disabilities. The population in this study was all elderly patients with a diagnosis of lumbar radiculopathy who underwent physiotherapy services at Hermina Pasteur Hospital. The research sample was selected using purposive sampling techniques in accordance with the inclusion and exclusion criteria that have been set. Inclusion criteria include patients aged ≥55 years with a clinical diagnosis of lumbar radiculopathy who are willing to become respondents and sign an informed consent. Exclusion criteria include patients with a history of spinal trauma, severe structural abnormalities, or other neurological conditions that may affect posture and body function.

The independent variable in this study was the degree of postural asymmetry of the lumbar region, while the dependent variables were functional disability and pain level. The degree of postural asymmetry was measured using a flexible curve ruler, which is a flexible measuring device that is placed along the lumbar vertebrae spinosus process to follow the contour of the spine, then the result of the curve is transferred to millimeter paper to calculate the degree of curvature. Functional disability was measured using the Oswestry Disability Index (ODI) which consisted of 10 question items related to daily activities, while pain level was measured using the Visual Analog Scale (VAS) on a scale of 0–10.

The data collection procedure begins with the identification of respondents who meet the research criteria. After the respondents agreed to participate through informed consent, postural asymmetry measurements were carried out using a flexible curve ruler in an upright standing position. Next, respondents were asked to fill out the Oswestry Disability Index questionnaire to assess the level of functional disability and provide an assessment of pain intensity using the Visual Analog Scale. The data obtained were then statistically analyzed using the Spearman Rank correlation test to determine the relationship between the degree of postural asymmetry and functional disability as well as the relationship between the degree of postural asymmetry and the level of pain. The analysis was performed with a significance level of $p < 0.05$ using SPSS software

Result and Discussion

1. Results

Respondent Characteristics: this study involved 50 elderly respondents with lumbar radiculopathy. The average age of respondents was 63.82 ± 4.575 years, with an age range of 58–75 years. The majority of respondents were female as many as 42 people (84%), while men were 8 people (16%). This is in accordance with the theory that the elderly are more prone to postural and functional complaints than young age groups due to the presence of musculoskeletal degeneration over time (Tinnirello et al., 2021). Univariate Analysis: The mean values of lumbar postural postural asymmetry, functional disability score (ODI), and pain level (VAS) are presented in Table 1.

Table 1
Univariate Distribution of Research Variables

Variable	Red ±SD	Min-Max
Lumbar postural asymmetry	1.88 ± .799	1 (Light)-3 (Heavy)
Functional disability (ODI)	2.02 ± .795	1 (Light)-4 (Very Heavy)
Pain level (VAS)	5.48 ± 1.69	2.8-9

Bivariate Analysis: The relationship between postural asymmetry and functional disability and pain levels was analyzed using the Spearman Rank test.

Table 2
The Relationship of Postural Asymmetry with Functional Disabilities

Variable	r	Value
Postural asymmetry with ODI	0.256	0.073

The results showed a weak positive relationship and were not statistically significant.

Table 3
The Relationship of Postural Asymmetry to Pain Level

Variable	r	Value
Postural asymmetry with VAS	0.285	0.045

The results showed a weak but statistically significant positive relationship.

2. Discussion

The results of this study show that there is a positive relationship between lumbar postural asymmetry and functional disability, but it is not statistically significant. In contrast, a significant positive association was found between postural asymmetry and pain levels, albeit with weak correlation strength. These findings suggest that postural asymmetry contributes to pain, but is not the main factor determining functional disability in the elderly with lumbar radiculopathy.

The concept of neuromuscular adaptation also explains that the nervous system can adjust movement control through changes in muscle coordination, proprioception, and stabilization strategies. Recent research has shown the presence of neuromuscular control disorders in patients with low back pain, including changes in the timing of muscle activation and increased reliance on compensation strategies. These adaptations can maintain function in the short term, but have the potential to increase mechanical load and muscle fatigue. (Matheve et al. 2023)

A significant relationship between postural asymmetry and pain can be explained through the mechanism of pain modulation. Postureal imbalances can increase mechanical stress on the tissues and trigger sustained nociceptive input. Recent studies have shown that chronic pain in low back pain involves complex interactions between biomechanical factors and the central nervous system, including sensitization processes. This explains why postural changes are more likely to be reflected in increased pain than disability. (Ashar et al. 2022)

The results of this study are in line with recent studies showing that the relationship between postural parameters and low back pain tends to be weak to moderate, with high variation between individuals. In addition, functional disability in low back pain is known to be multifactorial and influenced by physical, psychological, and social factors. Thus, static posture is not the only determinant of disability. (Sugavanam et al. 2025)

This study has several strengths, namely the use of a simple and applicative measuring instrument (*flexible curve ruler*) and a focus on the elderly population with lumbar radiculopathy which is still limited in previous research. However, there are some limitations, including cross-sectional designs that cannot determine causal relationships, relatively small sample sizes, and non-analysis of other factors such as muscle strength, neuromuscular control, and psychosocial factors. In addition, posture measurements that are static do not fully reflect dynamic motion control.

Clinically, these findings suggest that physiotherapy interventions need to focus on a more comprehensive approach. Motor control-based exercises such as lumbopelvic stabilization and functional motion retraining are recommended to improve segmental control. In addition, neuromuscular re-education is important for improving coordination and efficiency of muscle activation. Given the association with pain, interventions also need to integrate pain modulation strategies such as *graded activity*, pain education, and function-based biopsychosocial approaches. This approach is expected to improve clinical outcomes more optimally than focusing only on static posture correction. (Kovačević et al. 2024)

Conclusion

This study showed that postural asymmetry of the lumbar region was associated with pain levels, but was not significantly associated with functional disability in the elderly with lumbar radiculopathy. The strength of the relationship found was relatively weak, suggesting that postural asymmetry was not the main factor determining the patient's clinical condition. These findings indicate that increased pain is more sensitive to changes in posture than functional ability, while functional disability is multifactorial and influenced by various other factors such as movement control, neuromuscular adaptation, and biopsychosocial factors. Clinically, the results of this study confirm that physiotherapy interventions are not enough to focus only on static posture correction, but need to integrate more comprehensive approaches, including *motor control exercises*, *neuromuscular re-education*, and *pain modulation* strategies to optimally improve therapy outcomes.

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