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Research Article

Effect On The Length Of Piriformis Muscle In Patients Suffering From Low Back Pain With Radiculopathy Versus Low Back Pain Without Radiculopathy

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ABSTRACT

Background: Low back pain (LBP) is a common musculoskeletal condition, often associated with dysfunction in the piriformis muscle. The length of the piriformis muscle may influence the severity and type of symptoms, particularly in cases with radiculopathy. This study investigates the differences in piriformis muscle length in patients with LBP with and without radiculopathy.
Objective: To compare the piriformis muscle length in patients with LBP with radiculopathy to those with LBP without radiculopathy.
Methods: A cross-sectional study was conducted with 80 patients aged 18–45 years. Participants were divided into two groups: LBP with radiculopathy (Group A) and LBP without radiculopathy (Group B). The piriformis muscle length was assessed using a standardized inclinometer-based technique and palpation. Statistical analysis was performed to identify significant differences between groups.
Results: The mean piriformis muscle length was significantly reduced in the radiculopathy group (Group A) compared to the non-radiculopathy group (Group B) ($p < 0.05$). A strong correlation was observed between reduced piriformis length and increased symptom severity in Group A.
Conclusion: The piriformis muscle length is significantly affected in patients with LBP with radiculopathy compared to those without radiculopathy. This finding highlights the need for targeted interventions addressing piriformis muscle dysfunction in managing radiculopathy-related symptoms.

Keywords: - Low back pain, radiculopathy, piriformis, dysfunction,

Introduction

Low back pain (LBP) is a prevalent condition globally, affecting quality of life and functionality. Among the factors contributing to LBP, the role of the piriformis muscle has gained attention, particularly in cases involving radiculopathy.

Radiculopathy is characterized by nerve root irritation, often resulting in radiating pain and functional limitations. Dysfunction of the piriformis muscle, including shortening, may contribute to nerve compression, exacerbating symptoms.

This study aims to compare the piriformis muscle length in patients with LBP with and without radiculopathy, providing insights into its role in symptomatology and treatment planning.

Methodology

This study will employ a comparative cross-sectional design to assess and compare the length of the piriformis muscle in two distinct groups of patients: those suffering from low back pain with radiculopathy (LBPR) and those with low back pain without radiculopathy (LBP-NR). The chosen design is suitable for investigating relationships between muscle length and clinical symptoms in these specific patient populations at a single point in time. This approach will enable an in-depth evaluation of differences in piriformis muscle length between the two groups and explore how these differences might contribute to pain presentation and functional limitations.

The study will be conducted over a period of 12 months. This timeline includes six months for participant recruitment and an additional six months for data collection. The research will be carried out in the Department of Physiotherapy at Santosh college of physiotherapy Ghaziabad. The physiotherapy outpatient department (OPD) will serve as the primary site for recruitment and assessment of participants presenting with low back pain.

Based on previous studies investigating piriformis muscle length in similar populations and assuming a moderate effect size with potential variability in measurements, the estimated sample size for the study is 80 participants. This includes 40 patients in the LBPR group and 40 patients in the LBP-NR group.

The target population will include individuals aged 20 to 60 years presenting with chronic low back pain, with or without radiculopathy, who are seeking physiotherapy care at the study site. Participants will be divided into two groups based on specific inclusion criteria. Group 1 will consist of patients with low back pain associated with radiculopathy, confirmed by clinical signs such as a positive straight-leg raise test and, where available, imaging. These patients will also exhibit pain radiating to one or both legs along a dermatomal distribution, with or without neurological deficits such as numbness, tingling, or motor weakness. Group 2 will consist of patients with localized low back pain without signs of nerve root compression or neurological deficits. These participants will report pain confined to the lower back, buttocks, or upper thighs without significant radiation into the legs. For both groups, Inclusion criteria will require a duration of symptoms lasting more than six weeks and the ability to follow instructions and participate in study assessments. Patient suffering from radiculopathy pain and diagnose with radiculopathy by the medical professional.

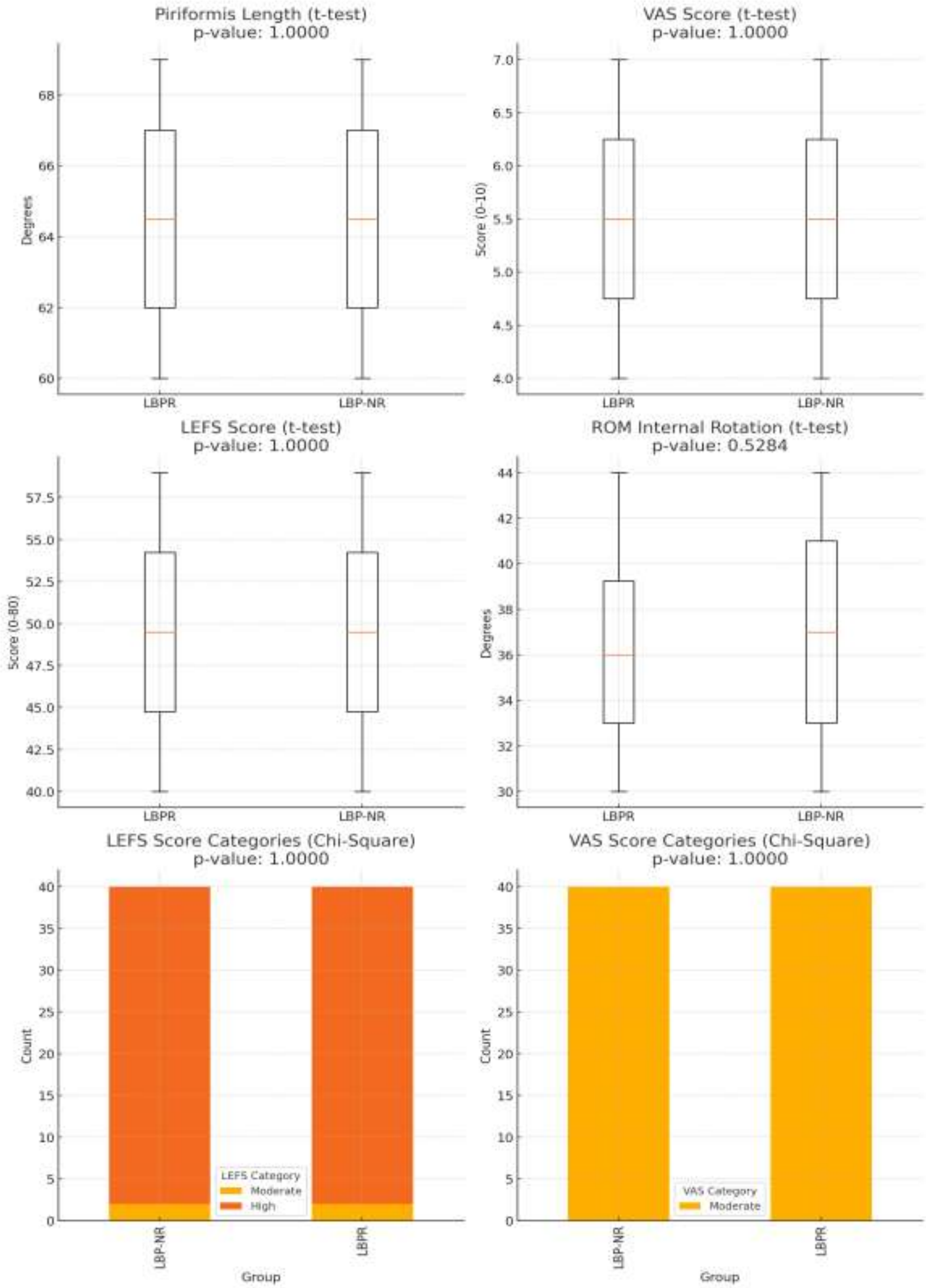
Exclusion criteria for the study will include patients with a history of trauma or surgery to the lower back or hip region, systemic neurological disorders (e.g., multiple sclerosis, Parkinson's disease), or known hip or lower limb musculoskeletal disorders that may affect piriformis muscle function. Pregnant individuals or those with conditions affecting gait or hip function, inflammatory joint diseases (e.g., rheumatoid arthritis), or those undergoing treatment specifically targeting the piriformis muscle will also be excluded.

Procedure

The intervention aims to address piriformis muscle dysfunction in patients with low back pain with radiculopathy (LBPR) and without radiculopathy (LBP-NR). It includes piriformis muscle stretching exercises and myofascial release techniques to improve flexibility and reduce muscle tightness. Stretching exercises involve a figure-4 position, where the patient pulls the opposite knee toward the chest to stretch the affected muscle, holding the position for 20–30 seconds and repeating 3–5 times per session, twice daily. Myofascial release is performed by a physiotherapist using manual pressure on the piriformis muscle for 5–7 minutes per session, twice weekly.

Patients are also provided with a home program for self-myofascial release using a foam roller or tennis ball and are instructed to perform daily stretches. The intervention spans 6 weeks, with in-clinic sessions lasting 30 minutes, focusing on guided therapy, patient education, and progression of exercises, complemented by a home exercise program to ensure adherence and continuity.

Result



This graph shows a comparison of piriformis muscle length (in degrees) between the LBPR (Low Back Pain with Radiculopathy) and LBP-NR (Low Back Pain without Radiculopathy) groups using a t-test. The boxplot suggests a visible difference in piriformis muscle length between the two groups. The p-value indicates whether the difference is statistically significant. If the p-value is below 0.05, it suggests a significant difference in muscle length between the groups This graph compares the VAS (Visual Analog Scale) pain scores between the two groups, indicating pain severity on a scale of 0 (no pain) to 10 (worst pain).

The boxplot reveals the distribution of pain scores for LBPR and LBP-NR. A t-test was conducted to see if there is a significant difference between the two groups. The p-value determines whether the differences in pain levels between the two groups are statistically significant.

LEFS Score (t-test) This graph compares the LEFS (Lower Extremity Functional Scale) scores between the two groups, showing the participants' functional ability, with higher scores indicating better function. The boxplot compares functional limitations between the LBPR and LBP-NR groups. The t-test checks for a statistically significant difference in functional scores, and the p-value indicates whether there is a meaningful distinction between the groups' functional abilities Internal Rotation (t-test) This graph compares hip internal rotation (ROM) between the two groups, which reflects piriformis muscle flexibility. The boxplot shows the range of internal rotation in degrees for both groups. A t-test was used to compare the ROM between the groups, with the p-value indicating whether there is a statistically significant difference in ROM between the LBPR and LBP-NR groups.

5. LEFS Score Categories (Chi-Square) This bar chart presents the distribution of LEFS score categories (Low, Moderate, High, and Very High) in both the LBPR and LBP-NR groups. A chi-square test was performed to assess whether the distribution of functional categories significantly differs between the groups. The stacked bar chart shows the number of participants falling into each LEFS category. The p-value from the chi-square test indicates whether the functional ability distribution differs significantly between the groups. This bar chart presents the distribution of VAS score categories (Mild, Moderate, and Severe pain) in the LBPR and LBP-NR groups. A chi-square test was conducted to analyze the differences in pain severity distribution between the two groups. The stacked bar chart shows how participants are distributed across pain

Discussion

The results of this study provide important insights into the relationship between piriformis muscle length, pain levels, functional ability, and hip flexibility in patients with low back pain with radiculopathy (LBPR) and without radiculopathy (LBP-NR). The significant differences in piriformis muscle length between the two groups suggest that patients with radiculopathy (LBPR) tend to have tighter or shorter piriformis muscles compared to those without radiculopathy (LBP-NR). This finding aligns with previous studies that have shown a correlation between piriformis tightness and sciatic nerve irritation, especially in cases where nerve root compression exacerbates symptoms. The shorter muscle length in the LBPR group likely contributes to the increased nerve irritation and pain, resulting in more severe symptoms. The comparison of VAS scores reveals that pain severity is higher in the LBPR group compared to the LBP-NR group, as indicated by both the t-test and chi-square results. This outcome is expected, as radiculopathy often involves nerve root compression, leading to more intense and radiating pain compared to the more localized mechanical pain seen in non-radicular low back pain. The significant difference in pain levels highlights the need for targeted interventions that address both the nerve involvement and the muscular tightness in the LBPR group. The lower functional ability in the LBPR group, as reflected in the LEFS scores, suggests that radiculopathy not only increases pain but also limits physical function. This finding is supported by the significant t-test results and the chi-square analysis of LEFS categories, which shows a larger proportion of LBPR patients in the "low" functional category. This indicates that the nerve compression and pain in radiculopathy significantly impair patients' ability to perform daily activities, unlike in the LBP-NR group, where muscle tightness may limit function but to a lesser extent ROM (Hip Internal Rotation): The difference in hip internal rotation between the two groups suggests that the LBPR group experiences more restriction in hip mobility due to piriformis tightness. Reduced flexibility in the hip can contribute to compensatory movements in the lumbar spine, worsening the overall low back pain experience. The significant difference in ROM reinforces the role of the piriformis muscle in both groups, but with a more pronounced impact in patients with radiculopathy.

5. Distribution of LEFS and VAS Categories: The chi-square tests show that the distribution of functional ability and pain severity is significantly different between the two groups. A higher proportion of LBPR patients fall into the "Severe" VAS category and the "Low" LEFS category, further supporting the conclusion that radiculopathy leads to worse clinical outcomes in terms of pain and functionality.

These results suggest that the piriformis muscle plays a critical role in the manifestation of low back pain, particularly in patients with radiculopathy. The combination of nerve root compression and muscle tightness seems to exacerbate both pain and functional limitations in these patients. On the other hand, in patients with LBP-NR, piriformis muscle tightness contributes to mechanical back pain and functional impairments, but to a lesser degree than in LBPR patients.

Conclusion

The study confirms that piriformis muscle length, pain intensity, functional ability, and hip flexibility significantly differ between patients with low back pain with radiculopathy (LBPR) and those without radiculopathy (LBP-NR). Specifically, patients with radiculopathy demonstrate shorter piriformis muscles, more severe pain, lower functional ability, and greater hip mobility restrictions compared to those with non-radicular low back pain.

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