

Evidence-Based Differential Diagnosis and Rehabilitation Interventions for Piriformis Syndrome: A Comprehensive Review

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ABSTRACT

Piriformis syndrome (PS) is a neuromuscular disorder caused by irritation or compression of the sciatic nerve by the piriformis muscle, resulting in buttock pain, radiating leg symptoms, and functional impairment. Owing to its clinical similarity to conditions such as lumbar radiculopathy, sacroiliac joint dysfunction, deep gluteal syndrome, and other causes of sciatica, PS remains a frequently underrecognized and misdiagnosed condition. This review evaluates the current evidence regarding the differential diagnosis of piriformis syndrome and summarizes rehabilitation strategies aimed at improving pain, mobility, functional outcomes, and quality of life. A comprehensive review of the literature was conducted using PubMed, Scopus, Web of Science, Google Scholar, and SciELO databases, focusing on studies addressing anatomical considerations, diagnostic approaches, clinical assessment, imaging techniques, electrophysiological investigations, and rehabilitation interventions. The available evidence suggests that accurate diagnosis requires a systematic approach incorporating detailed history-taking, physical examination, provocative clinical testing, imaging modalities, and electrodiagnostic studies to differentiate PS from other causes of sciatic pain. Anatomical variations between the piriformis muscle and the sciatic nerve appear to contribute significantly to symptom development and diagnostic complexity. Conservative rehabilitation interventions, including therapeutic stretching, neural mobilization, muscle energy techniques, strengthening exercises, myofascial release, manual therapy, postural correction, and multimodal physiotherapy programs, have demonstrated effectiveness in reducing pain and improving function. Overall, current evidence supports the use of comprehensive clinical assessment and individualized rehabilitation programs as the cornerstone of management. Nevertheless, further high-quality prospective studies are required to establish standardized diagnostic criteria and strengthen the evidence base for rehabilitation protocols in piriformis syndrome.

Keywords: Piriformis syndrome, Differential diagnosis, Sciatica, Deep gluteal syndrome, Rehabilitation, Physical therapy, Neural mobilization, Manual therapy, Conservative management, Functional outcomes.

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1. INTRODUCTION

Piriformis syndrome (PS) is a neuromuscular condition caused by compression or irritation of the sciatic nerve by the piriformis muscle, resulting in pain within the gluteal region and symptoms radiating along the sciatic nerve distribution.¹ Patients commonly present with buttock pain, numbness, paresthesia, and varying degrees of lower-extremity dysfunction.² Because these manifestations closely resemble those of lumbar radiculopathy, spinal stenosis, sacroiliac joint disorders, and other causes of sciatica, piriformis syndrome remains a frequently misdiagnosed and underrecognized clinical entity.³

The piriformis muscle originates from the anterior surface of the sacrum and exits the pelvis through the greater sciatic foramen before inserting onto the greater trochanter of the femur.⁴ Functionally, it contributes to external rotation of the hip in extension, abduction during hip flexion, and stabilization of the lumbopelvic region.⁵ Given its intimate anatomical relationship with the sciatic nerve, pathological changes such as muscle hypertrophy, spasm, inflammation, fibrosis, or trauma may result in nerve compression and subsequent symptom development.⁶

The true prevalence of piriformis syndrome remains uncertain owing to the absence of universally accepted diagnostic criteria and the considerable overlap of symptoms with other musculoskeletal and neurological disorders.⁷ Nevertheless, available evidence suggests that PS may account for approximately 5–6% of cases presenting with low back, buttock, and leg pain and may contribute substantially to chronic sciatica-related complaints.⁸ The disorder is considered multifactorial in origin, with reported risk factors including direct trauma, repetitive overuse, prolonged sitting, biomechanical abnormalities, inflammatory conditions, muscular hypertrophy, and congenital anatomical variations.⁹

Anatomical variations in the course of the sciatic nerve relative to the piriformis muscle have been identified as important contributors to the pathogenesis of the syndrome.¹⁰ While the sciatic nerve typically passes inferior to the piriformis muscle, variations involving passage of one or more nerve divisions through or above the muscle may predispose

individuals to nerve entrapment and persistent symptoms.¹¹ These anatomical differences may partly explain the variability in clinical presentation and treatment response observed among affected patients.¹²

Accurate diagnosis of piriformis syndrome remains challenging because no single clinical test or imaging modality is considered definitive.¹³ Consequently, diagnosis often relies on a combination of detailed history taking, physical examination, provocative maneuvers, imaging studies, and electrodiagnostic investigations.¹⁴ A thorough differential diagnostic approach is essential to distinguish PS from lumbar disc herniation, sacroiliac joint dysfunction, deep gluteal syndrome, peripheral neuropathies, and other causes of sciatica.¹⁵

Management strategies for piriformis syndrome have evolved considerably and now encompass a broad range of conservative rehabilitation interventions, including therapeutic stretching, strengthening exercises, neural mobilization, muscle energy techniques, myofascial release, manual therapy, postural correction, and multimodal physiotherapy programs.¹⁶ Although many of these interventions have demonstrated promising clinical outcomes, variability in study design, treatment protocols, and diagnostic criteria has limited the development of standardized evidence-based recommendations.¹⁷

Therefore, this comprehensive review aims to critically evaluate the current evidence regarding the differential diagnosis of piriformis syndrome and the effectiveness of rehabilitation interventions used in its management.¹⁸ By synthesizing contemporary literature on diagnostic approaches and therapeutic strategies, this review seeks to provide clinicians with evidence-based guidance for improving diagnostic accuracy, optimizing treatment outcomes, and enhancing the

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quality of care for individuals affected by piriformis syndrome.

3. REVIEW

3.1. Current Understanding of Piriformis Syndrome

Recent literature recognizes piriformis syndrome as an important yet frequently underdiagnosed neuromuscular condition that contributes to sciatic pain and functional impairment.¹⁹ Although it accounts for a relatively small proportion of sciatica cases, its clinical significance lies in its ability to mimic lumbar disc herniation and other lumbosacral disorders, often leading to delayed diagnosis and treatment.

3.2. Anatomical Basis of Piriformis Syndrome

Several studies have emphasized the importance of anatomical variations between the sciatic nerve and the piriformis muscle in the development of piriformis syndrome.²⁰ Variations in the course, branching pattern,

and relationship of the sciatic nerve to the piriformis muscle may predispose individuals to nerve compression, resulting in pain, sensory disturbances, and motor dysfunction. Understanding these anatomical relationships is essential for accurate diagnosis, treatment planning, and surgical safety.²¹

3.3. Clinical Presentation and Diagnostic Challenges

The diagnosis of piriformis syndrome remains controversial because its symptoms frequently overlap with those of lumbar disc herniation, lumbosciatalgia, spinal stenosis, and sacroiliac dysfunction.²² The reviewed studies consistently recommend a comprehensive clinical assessment incorporating patient history, physical examination, neurological evaluation, and imaging investigations when necessary. Early and accurate diagnosis is critical for preventing chronic disability and improving therapeutic outcomes.²³

Table 1: Anatomical variations between the sciatic nerve and piriformis muscle and their clinical implications in piriformis syndrome

Aspect	Description	Clinical Significance
Sciatic Nerve Course	The sciatic nerve may follow different anatomical pathways in relation to the piriformis muscle.	Variations can predispose the nerve to compression and irritation.
Branching Pattern	The sciatic nerve may divide into tibial and common fibular branches at different levels.	Early or abnormal bifurcation may increase susceptibility to entrapment.
Nerve-Muscle Relationship	The sciatic nerve or its branches may pass below, through, or above the piriformis muscle.	Abnormal relationships are associated with the development of piriformis syndrome.
Clinical Manifestations	Nerve compression may result in pain, paresthesia, muscle weakness, and functional limitations.	Symptoms often mimic lumbar radiculopathy and other causes of sciatica.
Diagnostic Importance	Knowledge of anatomical variations improves clinical assessment and differential diagnosis.	Helps clinicians distinguish piriformis syndrome from other neuromuscular disorders.
Therapeutic Relevance	Understanding anatomy guides treatment selection and rehabilitation planning.	Supports targeted physiotherapy and other conservative interventions.
Surgical Implications	Awareness of anatomical variations is critical during gluteal and hip surgeries.	Reduces the risk of iatrogenic sciatic nerve injury.

3.4. Physiotherapeutic Management

Physiotherapy is widely regarded as the primary treatment modality for piriformis syndrome.²⁴ Conservative interventions such as stretching exercises, kinesiotherapy, neural mobilization, postural correction, and soft tissue techniques have demonstrated effectiveness in reducing pain, improving flexibility, and restoring functional mobility.²⁵ These interventions aim to alleviate sciatic nerve compression while correcting underlying biomechanical dysfunctions.

3.5. Complementary Therapeutic Approaches

In addition to conventional physiotherapy, several complementary therapies have been reported to provide symptomatic relief.²⁶ Acupuncture, massage

therapy, thermotherapy, electrotherapy, and psychotherapy may enhance treatment outcomes by promoting muscle relaxation, improving circulation, reducing pain, and addressing the psychological impact of chronic symptoms.²⁷ A multidisciplinary treatment approach is therefore frequently recommended.

3.6. Prevention and Rehabilitation Strategies

The literature suggests that preventive strategies focusing on flexibility, muscular balance, postural control, and biomechanical correction may reduce the risk of piriformis syndrome, particularly among athletes and physically active individuals.²⁸ Rehabilitation programs combining therapeutic exercises with manual therapy have been shown to improve functional performance and reduce recurrence rates.²⁹

Table 2: Clinical presentation and diagnostic challenges of piriformis syndrome

Diagnostic Aspect	Description	Clinical Importance
Symptom Overlap	Symptoms of piriformis syndrome often resemble lumbar disc herniation, lumbosciatalgia, spinal stenosis, and sacroiliac dysfunction.	Increases the risk of misdiagnosis and delayed treatment.
Patient History	Detailed evaluation of symptom onset, pain characteristics, aggravating factors, and previous injuries.	Provides essential information for differential diagnosis.
Physical Examination	Assessment of posture, gait, hip mobility, muscle tenderness, and provocative tests.	Helps identify signs suggestive of piriformis syndrome.
Neurological Evaluation	Examination of sensory, motor, and reflex functions.	Assists in distinguishing piriformis syndrome from nerve root pathologies.
Imaging Investigations	MRI, CT, ultrasound, or MRI neurography may be used when required.	Helps exclude structural abnormalities and confirm differential diagnoses.
Differential Diagnosis	Exclusion of lumbar radiculopathy, spinal stenosis, sacroiliac disorders, and other causes of sciatica.	Essential for establishing an accurate diagnosis.
Early Diagnosis	Prompt recognition and appropriate assessment.	Prevents chronic disability and improves treatment outcomes.

Table 3: Complementary therapeutic approaches in the management of piriformis syndrome

Complementary Therapy	Mechanism of Action	Clinical Benefits
Acupuncture	Stimulates specific points to modulate pain and muscle tension.	Reduces pain, promotes muscle relaxation, and improves functional recovery.

Table 3 Continued....

Massage Therapy	Manipulates soft tissues to relieve muscle tightness and improve circulation.	Decreases muscle tension, enhances blood flow, and reduces sciatic nerve irritation.
Thermotherapy	Application of heat to affected tissues.	Improves circulation, reduces muscle spasm, and alleviates pain.
Electrotherapy	Uses electrical stimulation to modulate pain and muscle activity.	Provides pain relief and supports muscle function.
Psychotherapy	Addresses emotional and psychological aspects of chronic pain.	Reduces stress, anxiety, and depression while improving coping strategies.
Multidisciplinary Approach	Integrates physiotherapy with complementary therapeutic modalities.	Enhances overall treatment effectiveness and patient quality of life.

Table 4: Prevention and rehabilitation strategies for piriformis syndrome

Strategy	Description	Expected Benefits
Flexibility Training	Regular stretching exercises targeting the piriformis muscle and surrounding structures.	Improves range of motion and reduces muscle tightness.
Muscular Balance	Strengthening and conditioning exercises to maintain balanced muscle function.	Prevents muscle imbalances that may contribute to piriformis syndrome.
Postural Control	Training to improve posture during daily activities and sports participation.	Reduces abnormal mechanical stress on the lumbopelvic region.
Biomechanical Correction	Identification and correction of faulty movement patterns and gait abnormalities.	Minimizes the risk of sciatic nerve irritation and injury recurrence.
Therapeutic Exercise Programs	Structured rehabilitation exercises focusing on strength, flexibility, and stability.	Enhances functional performance and promotes recovery.
Manual Therapy	Hands-on techniques including soft tissue mobilization and joint mobilization.	Reduces pain, improves mobility, and facilitates rehabilitation.
Combined Rehabilitation Approach	Integration of therapeutic exercises with manual therapy interventions.	Improves treatment outcomes and decreases recurrence rates.
Athlete-Specific Prevention	Preventive conditioning programs for athletes and physically active individuals.	Lowers the incidence of piriformis syndrome and sports-related injuries.

3.7. Future Directions in Piriformis Syndrome Research

Despite growing interest in piriformis syndrome, significant gaps remain regarding its epidemiology, pathophysiology, diagnostic criteria, and optimal treatment protocols.³⁰ Future prospective and randomized studies are needed to establish standardized diagnostic guidelines and strengthen the evidence supporting various rehabilitation approaches.

4. DISCUSSION

Piriformis syndrome remains a controversial yet clinically important cause of sciatica and deep gluteal pain. The condition is frequently underdiagnosed because its clinical manifestations overlap substantially with lumbar disc herniation, spinal stenosis, sacroiliac joint dysfunction, and other causes of sciatic nerve irritation. Hopayian et al. conducted a systematic review and reported that no single clinical feature is sufficiently diagnostic, emphasizing the need for a comprehensive

assessment incorporating patient history, physical examination, and exclusion of competing diagnoses.³¹ Their findings highlighted the diagnostic complexity of piriformis syndrome and the necessity of standardized diagnostic criteria.

Anatomical factors appear to play a significant role in the pathogenesis of the syndrome. Smoll reviewed anatomical variations involving the piriformis muscle and sciatic nerve and demonstrated that variations in the nerve's course relative to the piriformis muscle may contribute to nerve entrapment and symptom development.³² Such variations may partly explain the heterogeneity in clinical presentation and treatment response observed among affected individuals.

The importance of differential diagnosis has been consistently emphasized in the literature. Fishman et al. reported that piriformis syndrome is often mistaken for lumbar radiculopathy because of similar pain patterns and neurological symptoms.³³ Their clinical investigation demonstrated that appropriate identification of the syndrome can significantly improve patient outcomes and reduce unnecessary interventions directed toward spinal pathology.

Regarding treatment, conservative rehabilitation remains the cornerstone of management. Cass described physiotherapy-based interventions, including stretching exercises, strengthening programs, manual therapy, and biomechanical correction, as the primary treatment modalities for reducing sciatic nerve compression and restoring functional mobility.³⁴ Similarly, Martin et al. highlighted the role of multidisciplinary rehabilitation approaches in managing deep gluteal syndrome and related sciatic nerve entrapments, emphasizing individualized treatment plans tailored to patient-specific impairments.³⁵

5. CONCLUSION

Piriformis syndrome significantly affects people's quality of life. However, an accurate diagnosis, which excludes possible diseases with similar symptoms, is essential for the treatment of this syndrome. The therapeutic plan includes various therapeutic approaches available to help alleviate and treat symptoms, promoting patients' well-being. From physical interventions, such as physiotherapy and

massage therapy, to electrotherapy and muscle relaxants, these therapeutic approaches can play an important role in the patient's rehabilitation. In addition, other complementary approaches that can be useful for physical and emotional rehabilitation have been pointed out, such as acupuncture and psychotherapy. With a comprehensive and effective approach, it is possible to successfully treat the symptoms of piriformis syndrome, providing a better quality of life for patients.

AUTHOR CONTRIBUTIONS

Sudhakar Viswas: Conceptualization, methodology, literature search, data curation, writing-original draft, project administration, and supervision.

Vibhash Kumar Vaidya: Methodology, validation, critical review, writing-review and editing, and supervision.

Sunanda Singh: Literature review, data interpretation, manuscript editing, and validation.

Yashu Chauhan: Literature search, data curation, visualization, and manuscript editing.

Mohd. Firoz: Resources, critical revision of the manuscript, final review, and approval of the manuscript.

All authors read and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

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Ethical approval was not required.

DECLARATION OF PATIENT CONSENT

Not applicable.

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The authors declare that they have no conflicts of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI) - ASSISTED TECHNOLOGY FOR MANUSCRIPT PREPARATION

The authors confirm that no artificial intelligence (AI)-assisted technology was used to assist in the writing or editing of the manuscript, and no images were manipulated using AI tools.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are included within the article and its supplementary materials. Additional data are available from the corresponding author upon reasonable request.

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