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Interprofessional Care Pathways for Suspected Piriformis Syndrome

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Abstract

Background

Piriformis syndrome (PS) is a clinically diagnosed cause of buttock and sciatic-like pain within the deep gluteal syndrome spectrum. Management is typically stepwise, beginning with conservative rehabilitation and progressing to pharmacologic or interventional therapies. Care is interprofessional, commonly involving orthopedic surgeons and physical therapists; however, real-world referral pathways remain poorly defined.

Methods

A comparative cross-sectional survey was conducted among orthopedic surgeons and physical therapists in governmental and private facilities in the Tabuk region, Saudi Arabia. The questionnaire assessed demographics, conservative practices, pharmacologic management, and referral patterns, including escalation to pain medicine for image-guided injections. Data from 88 respondents were analyzed using descriptive statistics and χ^2 or Fisher's exact tests. Odds ratios (ORs) with 95% confidence intervals (CIs) were calculated.

Results

All orthopedic surgeons routinely referred suspected PS cases to physical therapy. Physical therapists frequently used manual therapy (95.9%), stretching (91.8%), and patient education (91.8%). Surgeons commonly prescribed NSAIDs (69.2%) and muscle relaxants (76.9%), with neuropathic agents typically initiated via neurology referral. Compared with physical therapists, surgeons were more likely to refer patients for corticosteroid injections (69.2% vs 16.3%; OR 11.6) and botulinum toxin injections (51.3% vs 12.2%; OR 7.6; both $p < 0.001$).

Conclusions

PS care follows a hierarchical pathway: physiotherapy first, pharmacologic escalation by surgeons, and physician-led referral for interventional treatment. Differences in referral reflect professional scope rather than clinical disagreement. Enhanced shared referral criteria may improve care coordination and access to advanced therapies.

1. Introduction:

Piriformis syndrome (PS) is a neuromuscular condition resulting from irritation or compression of the sciatic nerve within the deep gluteal region. Clinically, it presents with buttock pain that may radiate to the posterior thigh or lower limb and frequently mimics lumbosacral radiculopathy or other causes of sciatica-like symptoms. Accordingly, PS occupies a diagnostically challenging position within the broader spectrum of low back pain (LBP) and radicular disorders commonly encountered in musculoskeletal practice.

The epidemiology of PS remains incompletely defined, with widely variable prevalence estimates reported in the literature. Some authors describe PS as an uncommon but clinically relevant cause of sciatica, typically characterized by deep gluteal pain exacerbated by sitting and positive provocation tests. Others report that the prevalence ranges from rare to relatively common among patients with radiating LBP. These discrepancies likely reflect differences in diagnostic criteria, study designs, and clinical settings and highlight the lack of standardized definitions and assessment pathways.

The broader term deep gluteal syndrome (DGS) has been introduced to encompass PS and other nondiscogenic causes of sciatic nerve entrapment in the deep gluteal space, including gemelli–obturator internus syndrome, ischiofemoral impingement, and proximal hamstring disorders. This terminology aims to unify diverse etiologies presenting with posterior hip pain and sciatica-like symptoms and to reduce diagnostic confusion with spinal pathology.

Despite increasing recognition, both PS and DGS remain controversial because universally accepted diagnostic criteria are lacking, and diagnosis relies predominantly on clinical assessment. Structured diagnostic algorithms incorporating the exclusion of spinal causes, targeted imaging when appropriate, and response to image-guided injections have been proposed, but their application is inconsistent across clinical settings.

Imaging modalities play a supportive—but not definitive—diagnostic role. Conventional MRI may demonstrate nonspecific findings, whereas MR neurography and musculoskeletal ultrasound can assist in identifying sciatic neuritis or compressive pathology and may guide targeted injections. However, objective imaging criteria remain incompletely validated.

Management typically follows a stepwise escalation model. First-line therapy consists of conservative rehabilitation, including stretching, manual therapy, exercise-based programs, and patient education. In patients who fail to improve, escalation strategies may include pharmacologic treatment and image-guided interventional procedures such as corticosteroid or botulinum toxin injections, which are usually delivered within pain medicine services. Surgical decompression is considered only for severe, refractory cases.

Clinical decision-making in this context is strongly influenced by the professional scope of practice and referral authority. In referral-based systems, orthopedic surgeons frequently act as initial evaluators and coordinators of escalation, whereas physical therapists (PTs) deliver the mainstay of conservative care. The effectiveness of patient management therefore depends on clear role delineation and efficient interprofessional referral pathways.

Barriers reported in the literature include the following:

- lack of clinician familiarity with PS/DGS terminology
- Overlap with spinal pathology
- inconsistent use of diagnostic algorithms

- variability in access to advanced imaging and interventional care

However, empirical data describing how patients actually move through real-world care systems remain limited.

In Saudi Arabia, particularly in regions such as Tabuk, where subspecialty pain medicine services may be centralized, effective interprofessional coordination is essential to prevent diagnostic delays and prolonged symptoms.

STUDY AIM:

This study aimed to characterize real-world interprofessional management pathways for patients with suspected piriformis syndrome and low back pain in the Tabuk region of Saudi Arabia. Specifically, it examined routine referral patterns, quantified conservative physiotherapy practices, characterized pharmacologic management strategies, and evaluated escalation to pain medicine services for interventional procedures. The focus was on care pathways rather than isolated treatments, providing practice-based insight into how patients transition across disciplines in routine clinical settings.

2. Methods:

2.1 STUDY DESIGN:

This study employed a comparative cross-sectional observational survey design to characterize interprofessional care pathways for patients with suspected piriformis syndrome and/or low back pain in the Tabuk region of Saudi Arabia.

2.2 STUDY SETTING AND POPULATION:

The study was conducted in the Tabuk region of Saudi Arabia across outpatient musculoskeletal care settings, including governmental hospitals and private-sector facilities such as hospitals and rehabilitation/physiotherapy centers. The study population comprised licensed physical therapists and orthopedic surgeons (specialists and consultants) involved in the evaluation and management of patients with suspected piriformis syndrome and/or low back pain.

2.3 INCULSION CRITERIA:

Participants were eligible if they:

- were orthopedic surgeons or licensed physical therapists
- were currently practicing in governmental or private healthcare institutions in the Tabuk region
- provided informed consent to participate

2.4 EXCUSION CRITEIA:

Participants were excluded if they:

- were orthopedic surgeons still in residency training or physical therapists in internship
- were not currently engaged in active clinical practice
- were practicing outside the Tabuk region
- submitted incomplete questionnaires

2.5 SAMPLING STRATEGY AND RECRUITMENT:

A stratified sampling strategy was adopted based on the following:

- professional group (orthopedic surgeons vs PTs)
- healthcare sector (governmental vs private)

Eligible clinicians were invited via email, written invitations, and institutional professional networks. One reminder message was sent after one week. Participation was voluntary following the provision of study information and electronic informed consent.

2.6 DATA COLLECTION:

Data were collected via a structured questionnaire administered either electronically or in paper format. The participants were given two weeks to complete the survey. The responses were anonymous and coded with unique identifiers to ensure confidentiality.

2.7 QUESTIONNAIRE DOMAINS:

The questionnaire included the following domains:

1. demographic and professional characteristics
2. Clinical exposure and training background
3. referral patterns and care pathway structure
4. Conservative physiotherapy practices (PTs only)
5. pharmacologic management strategies (orthopedic surgeons only)
6. escalation of care to pain medicine services

2.8 OUTCOMES:

PRIMARY OUTCOMES:

- interprofessional referral patterns and escalation of care, including the following:
    - orthopedic referral to physiotherapy as first-line management
    - referral to pain medicine for image-guided corticosteroid or botulinum toxin injections

SECONDARY OUTCOMES:

- utilization of conservative physiotherapy strategies
- pharmacologic management approaches
- Integrated escalation pathways across disciplines

2.9 SAMPLE SIZE AND RECRUIMENT YIELD:

An a priori target sample of approximately 100 PTs and 50 orthopedic surgeons was established to reflect the regional workforce distribution and ensure adequate representation.

A total of 88 fully completed questionnaires were analyzed:

- 49 physical therapists
- 39 orthopedic surgeons

The achieved sample size was sufficient to estimate effect measures for the primary outcomes, particularly interprofessional differences in referral patterns to pain medicine services. Precision for less frequent practices was limited in some subgroups; however, the direction and magnitude of the observed associations were consistent.

2.10 Statistical analysis:

The data were analyzed via IBM SPSS Statistics (version 27).

- Categorical variables are summarized as frequencies and percentages.
- Between-group comparisons were performed via χ^2 or Fisher's exact tests, as appropriate.
- Effect sizes are reported as odds ratios (ORs) with 95% confidence intervals (CIs).

Domains applicable to only one profession were analyzed descriptively without between-group comparisons. Variables with no variability were reported descriptively. All the statistical tests were two-sided, with $p < 0.05$ considered statistically significant. The findings were interpreted as associative in accordance with the cross-sectional design.

2.11 Ethical approval:

The study was reviewed and approved by the University of Tabuk Institutional Review Board (Approval No. UT-649-401-2025) prior to commencement. All study procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki. Participation was voluntary, informed consent was obtained from all respondents before enrollment, and strict measures were implemented to ensure confidentiality and anonymity of the collected data.

3. Results:

Participant characteristics:

A total of 88 clinicians, comprising 39 orthopedic surgeons and 49 physical therapists, were included in the final analysis. All respondents reported active involvement in the management of patients with LBP and/or suspected PS.

Demographic and professional characteristics:

The participant characteristics are presented in Table 1.

The age distribution differed significantly between the groups (χ^2, $p < 0.001$). The physical therapists were predominantly younger, with most aged ≤ 35 years, whereas the orthopedic surgeons showed a broader age spectrum, with 30.8% aged > 50 years. No physical therapist was older than 50 years.

Gender also differed significantly ($p = 0.001$). The orthopedic surgeons were almost exclusively male (97.4%), whereas the physical therapists remained male-dominant but included a substantially greater proportion of female clinicians (30.6%).

Nationality differed significantly ($p < 0.001$). Most physical therapists were Saudi nationals (93.9%), whereas orthopedic surgeons included a larger proportion of non-Saudi clinicians (35.9%).

The workplace sector did not differ significantly between groups ($p = 0.435$), indicating comparable representation from governmental and private institutions.

Table 1
Demographic and professional characteristics of the participants

Characteristic	Category	Orthopedic surgeons (n = 39)	Physical therapists (n = 49)	p value
Age (years)	20–25	1 (2.6%)	11 (22.4%)	< 0.001
	25–30	8 (20.5%)	15 (30.6%)	
	30–35	7 (17.9%)	18 (36.7%)	
	35–40	6 (15.4%)	4 (8.2%)	
	40–50	5 (12.8%)	1 (2.0%)	
	> 50	12 (30.8%)	0 (0.0%)	
Gender	Female	1 (2.6%)	15 (30.6%)	0.001
	Male	38 (97.4%)	34 (69.4%)	
Workplace setting	Governmental	20 (51.3%)	21 (42.9%)	0.435
	Private	19 (48.7%)	28 (57.1%)	
Nationality	Saudi	25 (64.1%)	46 (93.9%)	< 0.001
	Non-Saudi	14 (35.9%)	3 (6.1%)	

Interprofessional Referral Patterns:

All orthopedic surgeons reported routine referral to physical therapy as first-line management for suspected PS/LBP (100%).

The use of pain medicine for interventional procedures differed significantly between the groups (Table 2). Compared with physical therapists, orthopedic surgeons were more likely to refer patients for image-guided corticosteroid injection (69.2% vs 16.3%; OR 11.6; 95% CI 4.1–33.1; $p < 0.001$) and image-guided botulinum toxin injection (51.3% vs 12.2%; OR 7.6; 95% CI 2.7–21.9; $p < 0.001$). These referral patterns are illustrated in Fig. 1, highlighting the physician-led nature of escalation to interventional pain medicine services.

Table 2
Primary interprofessional referral patterns (primary outcome)

Referral action	Orthopedic surgeons n (%)	Physical therapists n (%)	Test	OR (95% CI)	p value
Routine referral to PT	39/39 (100%)	—	Not applicable	—	—
Pain Medicine referral — corticosteroid injection	27 (69.2%)	8 (16.3%)	χ^2	11.6 (4.1–33.1)	< 0.001
Pain Medicine referral — botulinum toxin injection	20 (51.3%)	6 (12.2%)	χ^2	7.6 (2.7–21.9)	< 0.001

Conservative Physiotherapy Practice:

The integrated findings are summarized in Table 3. Conservative physiotherapy interventions were widely implemented among physical therapists. Manual therapy was the most frequently used modality (47/49; 95.9%). Stretching programs (45/49; 91.8%) and patient education and self-management strategies (45/49; 91.8%) were also highly utilized. Physical modalities such as ultrasound or TENS were reported by 38/49 therapists (77.6%), and dry needling or trigger-point therapy was used by 34/49 therapists (69.4%). Collectively, these findings indicate a consistent preference for multimodal, conservative rehabilitation strategies in routine clinical practice.

Table 3
Conservative physiotherapy practices (PT only)

Intervention	n (%)
Manual therapy	47 (95.9%)
Stretching program	45 (91.8%)
Patient education/self-management	45 (91.8%)
Physical modalities	38 (77.6%)
Dry needling/trigger point therapy	34 (69.4%)

Pharmacologic Management by Orthopedic Surgeons:

Pharmacologic management among orthopedic surgeons focused primarily on non-opioid therapy (Table 4**).** Nonsteroidal anti-inflammatory drugs were prescribed by 27/39 (69.2%) respondents, and muscle relaxants by 30/39 (76.9%). Escalation to neuropathic pain agents generally occurred via referral rather than direct prescription, with 20/39 (51.3%) referring to Neurology for gabapentinoids and 19/39 (48.7%) for tricyclic antidepressants. Short-term opioid prescribing or referral was uncommon (6/39;

15.4%). These prescribing and referral patterns, illustrated in Fig. 2, indicate a structured, stepwise, and conservative pharmacologic escalation strategy.

Table 4
.Pharmacologic strategies (orthopedic surgeons only)

Strategy	n (%)
NSAIDs prescribed	27 (69.2%)
Muscle relaxants prescribed	30 (76.9%)
Referral for gabapentinoids	20 (51.3%)
Referral for TCAs	19 (48.7%)
Short-term opioids	6 (15.4%)

Integrated Interprofessional Care Pathway:

The integrated care pathway is summarized in Table 5. Management followed a stepwise, scope-aligned structure beginning with universal referral from orthopedic surgeons to physical therapy as first-line treatment (100%). This was followed by high-intensity conservative rehabilitation, with more than 90% of therapists using key modalities such as manual therapy, stretching, and patient education. Pharmacologic escalation was coordinated primarily by orthopedic surgeons, who most commonly prescribed NSAIDs and muscle relaxants, whereas initiation of neuropathic medications generally occurred via specialist referral. Access to interventional Pain Medicine services—such as corticosteroid or botulinum toxin injections—was almost exclusively physician-initiated, with statistically significant between-group differences indicating odds ratios greater than 7 ($p < 0.001$). Overall, care progressed in a hierarchical manner from conservative therapy to pharmacologic management and then to interventional procedures when required.

Table 5
Integrated interprofessional pathway

Stage of care	Responsible discipline	Quantitative summary
First-line management	Orthopedic surgeons → PT	100% referral
Conservative therapy	Physical therapists	> 90% use of key modalities
Pharmacologic escalation	Orthopedic surgeons	NSAIDs 69.2%, muscle relaxants 76.9%
Neuropathic escalation	Neurology (via referral)	~ 50% gabapentinoids/TCAs
Interventional escalation	Pain Medicine (via referral)	OR > 7 vs PTs, $p < 0.001$

4. Discussion:

This practice-based cross-sectional study characterized interprofessional management pathways for suspected piriformis syndrome (PS) and low back pain (LBP) in routine clinical practice in the Tabuk region of Saudi Arabia. In line with the STROBE recommendations, the findings are interpreted in the context of the study design, participant characteristics, and healthcare setting. The results demonstrate a clearly structured, scope-aligned pathway in which conservative physiotherapy constitutes universal first-line care, pharmacologic escalation is coordinated primarily by orthopedic surgeons, and access to interventional pain medicine services is determined almost exclusively by physician-initiated referrals. These patterns were supported by both descriptive statistics and statistically significant between-group differences, particularly in interventional referral behavior.

A central finding was the universal referral of patients with suspected PS/LBP from orthopedic surgeons to physical therapy (100%). The absence of variability precluded inferential testing; however, this uniformity is itself highly informative, indicating a system-level pathway rather than discretionary individual practice. Within this framework, physical therapists reported consistently high use of conservative modalities, with manual therapy employed by 95.9% of respondents, structured stretching programs by 91.8%, and patient education and self-management strategies by 91.8%. The narrow dispersion of these estimates suggests highly standardized practice patterns.

These observations align with international clinical guidelines that recommend conservative rehabilitation as first-line management for nonspecific LBP and deep gluteal pain syndromes [1, 8, 13]. Hopayian and colleagues reported that targeted physiotherapy and activity modification are recommended as initial management methods for DGS, supported by case series and limited controlled data [13]. Similarly, Hu and colleagues emphasized conservative multimodal therapy as the preferred initial approach [8]. Nambi demonstrated in a small randomized study that post isometric relaxation and reciprocal inhibition improved pain, hip range of motion, and function over short-term follow-up in PS patients [14].

Taken together, our findings and the literature underscore the central role of physiotherapy in initial management. The high frequency of conservative strategies in this cohort should be interpreted as role-concordant practices within a structured pathway rather than a reluctance to escalate care.

The data also indicate that orthopedic surgeons act as primary gatekeepers for pharmacologic escalation. In this cohort, 69.2% of the patients were prescribed NSAIDs, and 76.9% were prescribed muscle relaxants. Escalation to neuropathic pain agents typically occurs through referral to neurology rather than direct prescription, with approximately half of the patients being referred for gabapentinoids (51.3%) or TCAs (48.7%).

Reviews consistently list NSAIDs and muscle relaxants as commonly used adjuncts in PS/DGS management but note a lack of high-quality PS-specific randomized trials [13, 15]. Vij and colleagues highlighted the frequent use of these agents in clinical practice and the limited evidence base [15]. Hopayian and colleagues similarly reported that pharmacologic regimens are largely extrapolated from broader pain literature rather than from PS-specific trials [13].

Short-term opioid prescriptions or referrals were reported by only 15.4% of orthopedic surgeons. Although this estimate is based on descriptive data, it is clinically relevant given the global emphasis on opioid stewardship. The pattern observed—nonopioid pharmacologic strategies with cautious, referral-based initiation of neuropathic agents—is consistent with contemporary pain management principles emphasizing multimodal and conservative escalation.

The most statistically robust findings related to referrals for interventional procedures. Compared with physical therapists, orthopedic surgeons were significantly more likely to initiate referrals to pain medicine for image-guided corticosteroid injection (69.2% vs 16.3%; OR 11.6; 95% CI 4.1–33.1; $p < 0.001$) and botulinum toxin injection (51.3% vs 12.2%; OR 7.6; 95% CI 2.7–21.9; $p < 0.001$). These large effect sizes, with confidence intervals that clearly exclude unity, indicate strong and clinically meaningful differences.

The literature supports the role of image-guided injections as diagnostic and therapeutic interventions in refractory PS/DGS, despite limited randomized evidence [13, 17]. Barbero and others described ultrasound- or CT-guided techniques to target the piriformis and surrounding structures, reporting symptom relief of variable duration [17]. Probst and Vij both highlight intramuscular botulinum toxin injections as an adjunct for patients unresponsive to conservative measures, but evidence is largely derived from case series and nonrandomized studies [1, 15].

Our findings reflect professional scope rather than divergent therapeutic beliefs. Physical therapists generally lack independent authority to request interventional procedures, whereas orthopedic surgeons are positioned to coordinate referrals. Thus, escalation to pain medicine appears to be role-dependent rather than preference dependent, reinforcing the importance of clearly defined interprofessional pathways.

Synthesizing findings across domains reveals a sequential and hierarchical model of care. Conservative physiotherapy is universally initiated; orthopedic surgeons then direct pharmacologic therapy and, when indicated, referrals for neuropathic agents and interventional procedures. The authority to transition patients between stages rests predominantly with orthopedic surgeons.

This configuration is consistent with the regulatory scope and may support appropriate patient selection for advanced interventions. However, reliance on physician-initiated referrals also carries a risk of delays for patients who do not respond to high-quality conservative care. Reviews and editorials have repeatedly linked diagnostic delay and variable referral practices to clinician unfamiliarity with DGS, overlapping spinal pathology, and inconsistent imaging yields [4, 6, 9, 20]. Our findings provide quantitative evidence of this hierarchical structure, which may represent both a necessary safeguard and a potential bottleneck in care progression.

The care pathway identified in this study aligns with frameworks described internationally, where rehabilitation professionals deliver conservative therapy and specialist physicians control access to advanced interventions [4, 8, 13]. Our work extends this literature by explicitly quantifying

interprofessional differences in referral behavior via ORs and CIs and by distinguishing between treatment delivery and authority to escalate care—dimensions that are seldom examined in PS-specific studies.

Recent systematic reviews by Kizaki, Hopayian, and others have highlighted the need for standardized diagnostic algorithms and structured care pathways to reduce misdiagnosis and delays [6, 13, 21]. The present study contributes practice-based data from a Middle Eastern context, illustrating how PS care is operationalized in a real-world health system where subspecialty pain services are centralized.

4.6 Strengths and Limitations:

This study has several strengths that are consistent with the STROBE recommendations. The questionnaire was explicitly aligned with professional scope, minimizing bias from hypothetical or nonapplicable items. Both descriptive statistics and appropriate χ^2/Fisher's exact tests were used, and interprofessional differences were quantified via ORs with 95% CIs rather than p values alone. The integrated pathway table and figures enhance clinical interpretability by linking quantitative findings to a visually coherent model of care.

Limitations:

This study should also be interpreted in light of important limitations. First, the cross-sectional design captures clinician-reported practice at a single time point and does not allow assessment of temporal relationships, pathway sequencing, or changes in practice over time. Second, the data were derived from self-reported behaviors rather than audited clinical records, introducing the possibility of recall bias and misclassification of actual practice patterns.

Third, the study was conducted in a single geographic region and included only orthopedic surgeons and physical therapists; therefore, the findings may not be generalizable to other regions or to additional disciplines involved in PS management, such as neurologists, pain medicine specialists, or primary care physicians. Fourth, some estimates—particularly those reflecting less frequent practices—were based on modest cell counts, limiting statistical precision.

Importantly, several clinically relevant pathway elements could not be evaluated. We were unable to determine the time to diagnosis; extent of repeated imaging; use of electrodiagnostic testing (EMG/nerve conduction studies); number and duration of physiotherapy sessions; duration and number of pharmacologic treatment cycles (e.g., NSAIDs); or dose, number of cycles, and durability of response following corticosteroid or botulinum toxin injections. Finally, patient-level outcomes such as pain reduction, functional improvement, or quality of life were not assessed; therefore, the clinical effectiveness of the identified pathways cannot be inferred from these data.

4.7 Implications for Practice and Policy:

The findings underscore the central role of physiotherapy in conservative management and highlight orthopedic surgery as the principal coordinator of escalation. The development of standardized interdisciplinary referral protocols may enhance the timeliness and consistency of access to pain medicine services while maintaining clear scope-of-practice boundaries. Strengthening physiotherapy capacity and streamlining interprofessional communication could reduce delays for patients who do not respond adequately to conservative management.

Systematic reviews have called for clearer disease definitions and structured diagnostic pathways for DGS to reduce misdiagnosis and referral delays [6, 9, 13]. The present study provides empirical data on current practice patterns in the Saudi Arabian context, which can inform the design of standardized PS/DGS pathways and interprofessional education initiatives.

4.8 Future Research Directions:

Future research should directly address the methodological and contextual limitations identified in this study and strengthen both external validity and causal inference. The priority directions include the following:

- Multicenter studies across heterogeneous healthcare systems are needed to examine regional variation in practice patterns and improve generalizability.
- Prospective cohort studies capture pathway timing and diagnostic delay, including the number of imaging studies, electrodiagnostic tests, physiotherapy sessions, medication courses, interventional cycles, and patient-reported outcomes (pain, function, QoL).
- Longitudinal designs to clarify temporal sequencing across pathway stages and assess durability of treatment response over time.
- Comparative effectiveness research evaluating alternative interprofessional referral models and standardized clinical pathways.
- Implementation studies assessing the feasibility, fidelity, and clinical impact of structured diagnostic criteria and escalation thresholds in routine practice.
- Qualitative research exploring clinician and patient perspectives on referral barriers, delays, and interdisciplinary communication.
- Health economic evaluations examining costs, resource utilization, and value associated with different management pathways.
- Randomized controlled trials, where feasible, evaluating conservative, pharmacologic, and interventional strategies embedded within clearly defined PS–DGS care pathways.

5. Conclusion:

Care for patients with suspected piriformis syndrome and low back pain in the Tabuk region follows a structured, stepwise pathway. Conservative physiotherapy represents the universal first-line approach, whereas pharmacologic escalation is coordinated predominantly by orthopedic surgeons. Access to

interventional pain medicine is largely dependent on physician-initiated referrals, as demonstrated by large and statistically significant differences in referral behavior between professional groups.

These findings delineate a clearly defined but physician-dependent escalation structure. Strengthening interprofessional referral pathways and establishing explicit escalation criteria may reduce delays for patients who do not improve with conservative management. Future work linking pathway structure to patient-level outcomes is warranted to determine whether this model optimally supports timely and effective care.

This study contributes empirical data on real-world interprofessional care pathways for piriformis syndrome in the Saudi Arabian context, addressing a gap in the literature identified by multiple systematic reviews .These findings have implications for service organization, professional education, and the development of standardized clinical pathways aimed at improving care quality and patient outcomes.

Abbreviations:

- PS–Piriformis Syndrome
- LBP — low back pain
- PT — physical therapist/physical therapy
- NSAIDs—Anti-Inflammatory Agents, Nonsteroidal
- TCA — Antidepressive agents, tricyclic
- OR — odds ratio
- CI — Confidence interval
- MRI — magnetic resonance imaging
- QoL — Quality of Life
- US — Ultrasonography
- TENS — Transcutaneous electric nerve stimulation
- BoNT— Botulinum Toxins
- Gabapentinoids —Gabapentin and Pregabalin
- DGS — Deep Gluteal Syndrome

Declarations:

Conflicts of interest

The authors declare that they have no conflicts of interest.

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Author Contribution

Mishari Mohammad Beragdar: Conceptualization; Methodology; Data collection; Formal analysis; Writing – original draft; Writing – review and editing; Project administration.Amirah M. Alatawi: Methodology; Data interpretation; Writing – review and editing.Hassan A. Moria: Conceptualization; Clinical supervision; Writing – review and editing.Yasir M. Alhusayni, Thikra Ali M. Alwadai, Hossam Mouffed Albrahimi, Ibrahim Alfaifi: Data collection; Data curation; Writing – review and editing. All authors reviewed and approved the final version of the manuscript and agree to be accountable for all aspects of the work.

Data Availability

The data supporting the findings of this study are included within the manuscript.

References:

1. Probst, D., Stout, A. & Hunt, D. Piriformis syndrome: a narrative review of the anatomy, diagnosis, and treatment. *PM&R* **11** (10), 1–11. https://doi.org/10.1002/PMRJ.12189 (2019).
2. Siddiq, M. A. B. et al. Piriformis Syndrome: Epidemiology, Clinical features, Diagnosis, and Treatment. In *Medical Radiology* (pp. 1–15). Springer. (2023). https://doi.org/10.1007/978-3-031-40736-9_15
3. Akhaddar, A. Deep Gluteal Syndrome (Including Piriformis Syndrome). In *Peripheral Nerve Disorders* (pp. 1–10). Springer. (2023). https://doi.org/10.1007/978-3-031-44984-0_95
4. Park, J. W. et al. Deep gluteal syndrome as a cause of posterior hip pain and sciatica-like pain. *The Bone Joint Journal*. **102-B** (5), 556–567. https://doi.org/10.1302/0301-620X.102B5.BJJ-2019-1212.R1 (2020).
5. Siddiq, M. A. B. et al. Piriformis syndrome: a case series of 31 Bangladeshi people with literature review. *European J. Orthop. Surg. Traumatology*. **27** (2), 193–203. https://doi.org/10.1007/S00590-016-1853-0 (2017).
6. Kizaki, K. et al. Deep gluteal syndrome is defined as a non-discogenic sciatic nerve disorder with entrapment in the deep gluteal space: a systematic review. *Knee Surg. Sports Traumatol. Arthroscopy*. **28** (10), 3354–3364. https://doi.org/10.1007/s00167-020-05966-x (2020).
7. Schmidt, M. H., Burchiel, K. J. & Dailey, A. T. 365 Sciatica of Non-Disc Origin. *Neurosurgery*, 69(CN_suppl_1), 1–2. (2022). https://doi.org/10.1227/neu.0000000000001880_365

8. Hu, Y. W. E., Cass, S. P. & Burks, R. T. Deep gluteal syndrome: a pain in the buttock. *Current Sports Med. Reports*. **20** (5), 218–224. https://doi.org/10.1249/JSR.0000000000000848 (2021).
9. Hopayian, K. & Heathcote, J. Deep gluteal syndrome: an overlooked cause of sciatica. *British J. Gen. Practice*. **69** (688), 520–521. https://doi.org/10.3399/BJGP19X705653 (2019).
10. Vassalou, E. E. et al. Piriformis muscle syndrome: MR imaging findings and treatment outcome in 23 patients. *Hellenic J. Radiology*. **2** (4), 22–30. https://doi.org/10.36162/HJR.V2I4.182 (2017).
11. Manske, R. C., Silvis, M. L., Meyers, W. C. & Prather, H. Use of Diagnostic Musculoskeletal Ultrasound in the Evaluation of Piriformis Syndrome: A Review for Rehabilitation Providers. *The Int. J. Sports Phys. Therapy*. **19** (7), 1–12. https://doi.org/10.26603/001c.118145 (2024).
12. Kanumuri, S. R. R., Petchprapa, C. & Chhabra, A. Piriformis Syndrome and Deep Gluteal Syndrome: Presentation, Diagnostic Imaging, and Management. *Medical Radiology*, 1–20. (2024). https://doi.org/10.1007/174_2024_481
13. Hopayian, K., Danielyan, A. & Heathcote, J. A systematic review of conservative and surgical treatments for deep gluteal syndrome. *Journal Bodyw. Mov. Therapies*. **32**, 1–10. https://doi.org/10.1016/j.jbmt.2022.12.003 (2022).
14. Nambi, G. Effect of Reciprocal inhibition and Post Isometric relaxation; types of muscle energy technique in Piriformis syndrome – A Comparative study. *Physical Med. Rehabilitation Research*. **3** (1), 1–6. https://doi.org/10.15761/PMRR.1000162 (2018).
15. Vij, N. et al. Surgical and non-surgical treatment options for piriformis syndrome: A literature review. *Anesthesiology Pain Medicine*. **11** (1), e112825. https://doi.org/10.5812/AAPM.112825 (2021).
16. Adiyatma, A., Setyopranoto, I. & Haryanto, H. Piriformis syndrome. *Journal of Pain. *Headache Vertigo*. **3** (1), 29–34. https://doi.org/10.21776/ub.jphv.2022.003.01.5 (2022).
17. Barbero, R. A. C0104 Deep gluteal syndrome. *British J. Sports Medicine*. **52** (Suppl 1), A44. https://doi.org/10.1136/BJSPORTS-2018-099763.44 (2018).
18. Metikala, S. & Sharma, V. Endoscopic Sciatic Neurolysis for Deep Gluteal Syndrome. *Syst. Rev. *Cureus*. **14** (3), e23153. https://doi.org/10.7759/cureus.23153 (2022).
19. Park, E., Kim, Y., Choi, S., Kim, D. & Kim, K. Comparison of Pulsed Radiofrequency and Endoscopic Piriformis Release for Refractory Piriformis Syndrome: A Propensity Score-Matched Retrospective Cohort Study. *Journal Clin. Medicine*. **14** (16), 5908. https://doi.org/10.3390/jcm14165908 (2025).
20. Külcü, D. G. Deep Gluteal syndrome: An underestimated cause of posterior hip pain. *Turkish J. Phys. Med. Rehabilitation*. **70** (2), 1–8. https://doi.org/10.5606/tftrd.2024.14668 (2024).
21. Monteleone, A. et al. Piriformis syndrome: a systematic review of case reports. *BMC Surgery*. **25** (1), 1–15. https://doi.org/10.1186/s12893-025-03202-2 (2025).
22. Hogan, K. J., Tao, M. & Miller, A. N. A minimally invasive surgical approach for the treatment of piriformis syndrome: a case series. *Journal Hip Preservation Surgery*. **7** (1), 37–42. https://doi.org/10.1186/S41016-020-00189-Y (2020).

23. Haghnegahdar, A., Sedighi, M. & Khazaei, M. Piriformis muscle syndrome: a recurrent case after surgical release. *Journal Surg. Case Reports*. **2015** (8), rjv105. https://doi.org/10.1093/JSCR/RJV105 (2015).

Figures

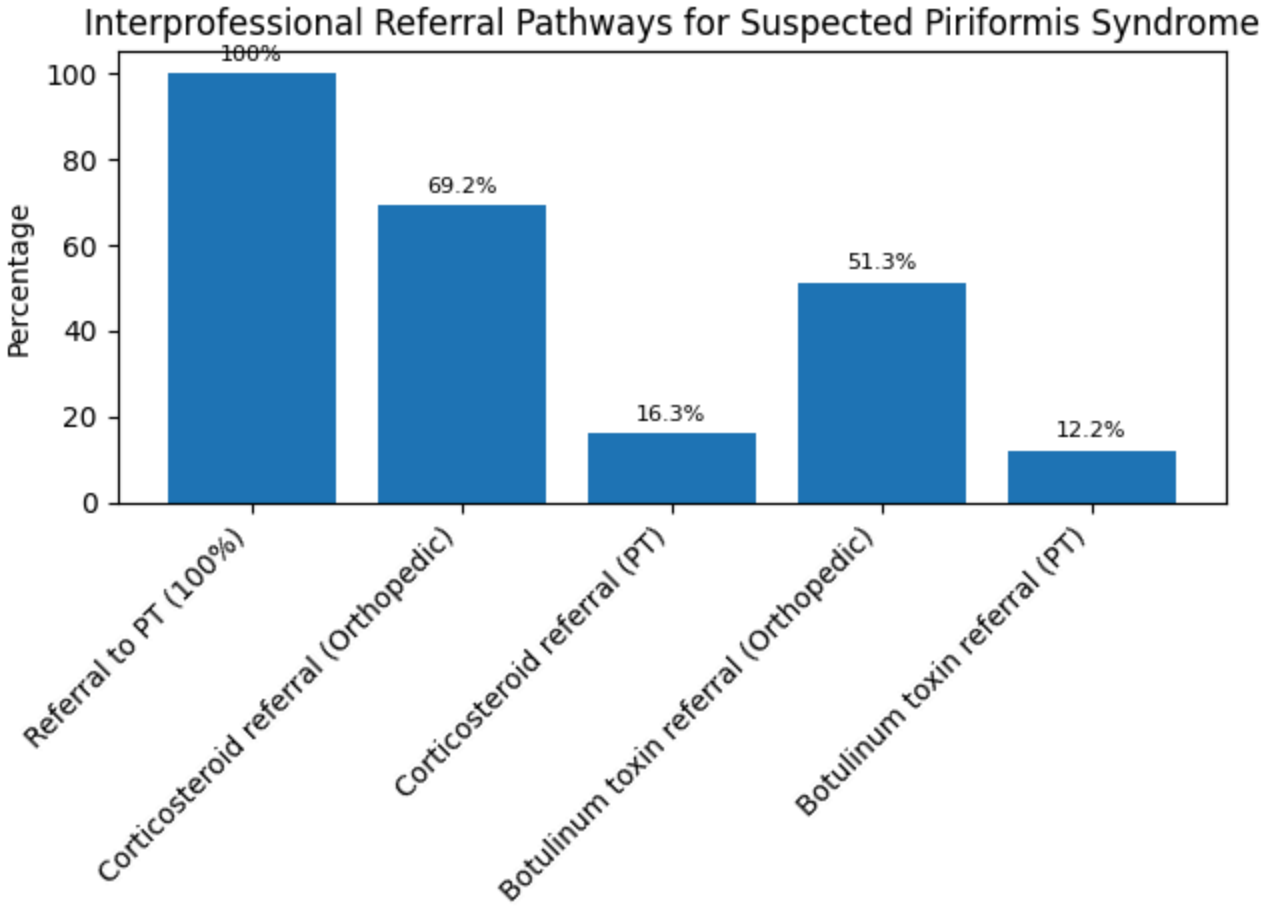


Figure 1

Interprofessional referral pathways for suspected piriformis syndrome . illustrates interprofessional referral pathways for patients with suspected piriformis syndrome or low back pain. All orthopedic surgeons reported routine referral to physical therapy as first-line management (100%). Referral to pain medicine services differed between professional groups, with orthopedic surgeons referring patients for image-guided corticosteroid injections (69.2% vs 16.3%) and botulinum toxin injections (51.3% vs 12.2%) more frequently than physical therapists did. The figure highlights a stepwise, physician-led escalation pattern in which access to interventional pain medicine is initiated primarily by orthopedic surgeons.

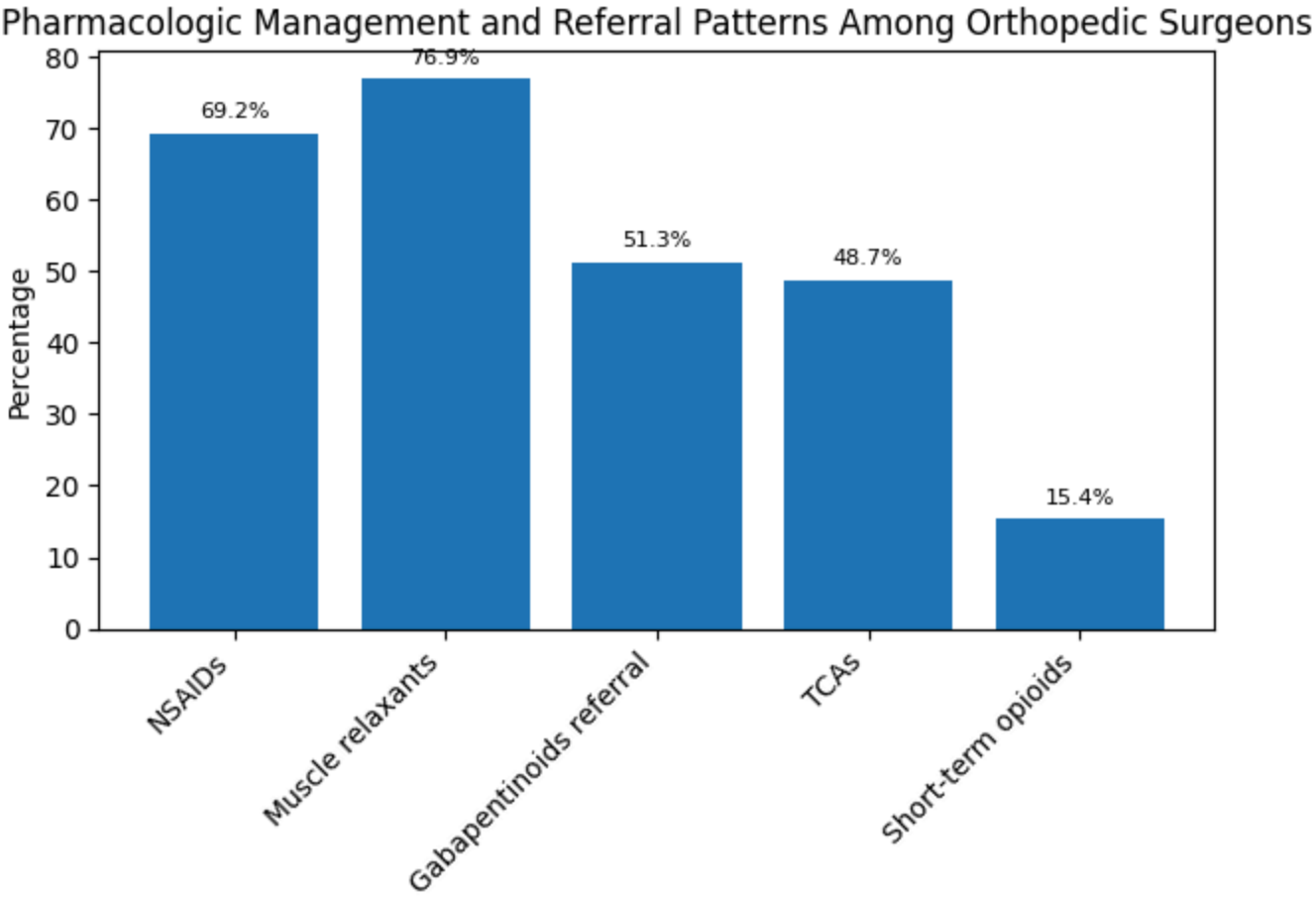


Figure 2

Pharmacologic management and referral patterns among orthopedic surgeons. displays the distribution of pharmacologic management strategies reported by orthopedic surgeons for patients with suspected piriformis syndrome or low back pain. Nonopioid medications, including muscle relaxants (76.9%) and NSAIDs (69.2%), constituted the mainstay of treatment. Approximately half of the respondents reported being referred for the initiation of neuropathic pain agents, including gabapentinoids (51.3%) and tricyclic antidepressants (48.7%). Short-term opioid prescription or referral was uncommon (15.4%).