# Ultrasound-Guided Versus Fluoroscopy-Guided Piriformis Injection: A Retrospective Comparative Case Series.

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*Abstract*—**Background**
**Piriformis syndrome is an underdiagnosed cause of chronic buttock pain and sciatica resulting from compression or irritation of the sciatic nerve by the piriformis muscle. Image-guided piriformis injections are increasingly being used for both diagnostic and therapeutic purposes. Ultrasound guidance offers real-time visualization without radiation exposure, whereas fluoroscopy remains a commonly practiced conventional technique. This study aimed to compare the clinical efficacy and procedural outcomes of ultrasound-guided versus fluoroscopy-guided piriformis injections in patients with piriformis syndrome.**

**Methods**
**A retrospective comparative analysis was conducted on 30 patients diagnosed clinically with piriformis syndrome who underwent image-guided piriformis injection at a tertiary care center. Patients were divided into two groups based on the intervention technique: ultrasound-guided group (n=15) and fluoroscopy-guided group (n=15). All patients received a standardized injectate containing local anesthetic and corticosteroid. Pain intensity was assessed using the Visual Analog Scale (VAS) before the procedure and at follow-up. Procedural duration, patient comfort, radiation exposure, and complications were also evaluated. Statistical analysis was performed using paired and unpaired t-tests, with $p < 0.05$ considered statistically significant.**

**Results**
**Both groups demonstrated significant reduction in post-procedural VAS scores compared to baseline ($p < 0.05$). However, the ultrasound-guided group showed superior procedural comfort, shorter procedure duration, and avoidance of radiation exposure. Real-time visualization of the sciatic nerve and surrounding soft tissue structures improved needle placement accuracy in the ultrasound group. No major complications were observed in either group.**

**Conclusion**
**Both ultrasound-guided and fluoroscopy-guided piriformis injections are effective interventions for piriformis syndrome. Ultrasound guidance appears to provide additional advantages including real-time soft tissue visualization, reduced procedure time, improved patient comfort, and elimination of radiation exposure. Ultrasound-guided piriformis injection may therefore be considered a preferred technique in routine pain management practice.**

*Index Terms*—**Piriformis syndrome; ultrasound-guided injection; fluoroscopy-guided injection; chronic buttock pain; retrospective study**

## I. INTRODUCTION

Piriformis syndrome is a neuromuscular condition characterized by buttock pain and radiating pain along the course of the sciatic nerve due to irritation or compression of the sciatic nerve by the piriformis muscle. The piriformis is a deep gluteal muscle located close to the sciatic nerve, and any inflammation, spasm, hypertrophy, or anatomical variation can lead to nerve entrapment, producing symptoms that often mimic lumbar radiculopathy.[1]

The diagnosis of Piriformis syndrome is primarily clinical and is often challenging because its symptoms overlap with other causes of low back pain and sciatica. Patients typically present with deep gluteal pain aggravated by prolonged sitting, walking, or hip movements. Physical examination tests such as the FAIR test, Freiberg maneuver, and Pace sign are commonly used to support the diagnosis. Conservative management including analgesics, physiotherapy, and stretching exercises remains the initial treatment approach; however, some patients continue to have persistent symptoms despite these measures.[2]

Image-guided piriformis injection is an established minimally invasive intervention for patients who do not respond adequately to conservative treatment. Injection of local anesthetic and corticosteroid into the piriformis muscle serves both diagnostic and therapeutic purposes. Accurate needle placement is essential for effective symptom relief and to avoid injury to adjacent structures.[3,4]

Fluoroscopy has traditionally been used for guidance during piriformis injections. It relies on bony landmarks and contrast spread for localization but does not provide direct visualization of soft tissues. In contrast, Ultrasonography allows real-time imaging of the piriformis muscle, sciatic nerve, and surrounding structures, enabling precise needle placement without radiation exposure.[5]

Recent studies suggest that ultrasound-guided piriformis injections may provide clinical outcomes comparable to fluoroscopy-guided injections while offering additional benefits such as shorter procedure time, portability, and improved safety. However, comparative clinical data remain limited.[6] Therefore, this study was conducted to compare the effectiveness, procedural characteristics, and safety of ultrasound-guided versus fluoroscopy-guided piriformis injections in patients with Piriformis syndrome.

## II. MATERIALS AND METHODS

Study design and setting

This retrospective comparative case series was conducted in the Department of Pain Medicine at a tertiary care hospital after approval from the Institutional Ethics Committee. Medical records of patients diagnosed with Piriformis syndrome and treated with image-guided piriformis injection.

Study population

A total of 30 patients with clinically diagnosed Piriformis syndrome who underwent piriformis injection were included in the study. Patients were divided into two groups based on the imaging modality used for guidance:

- Group U (Ultrasound-guided group): 15 patients
- Group F (Fluoroscopy-guided group): 15 patients

Inclusion criteria

- Patients aged 18 years and above
- Clinical diagnosis of piriformis syndrome based on history and physical examination
- Persistent buttock pain with or without radiating pain to the lower limb for more than 3 months
- Failure of conservative treatment including medications and physiotherapy
- Complete medical records with follow-up data available for at least 12 weeks

Exclusion criteria

- Lumbar disc herniation or confirmed spinal radiculopathy
- Previous hip or lumbar spine surgery
- Coagulopathy or anticoagulant therapy
- Local infection at injection site
- Incomplete clinical records
- Pregnancy

Procedure technique

All procedures were performed by experienced pain physicians under aseptic precautions in the prone position.

Ultrasound-guided piriformis injection

In the ultrasound-guided group, a low-frequency curvilinear transducer was placed over the gluteal region to identify the piriformis muscle beneath the gluteus maximus.[7] The sciatic nerve and adjacent soft tissue structures were visualized. Under real-time in-plane guidance, a 22-gauge spinal needle was advanced into the piriformis muscle. After confirming needle placement, 5 mL of 0.25% bupivacaine mixed with 40 mg triamcinolone was injected.

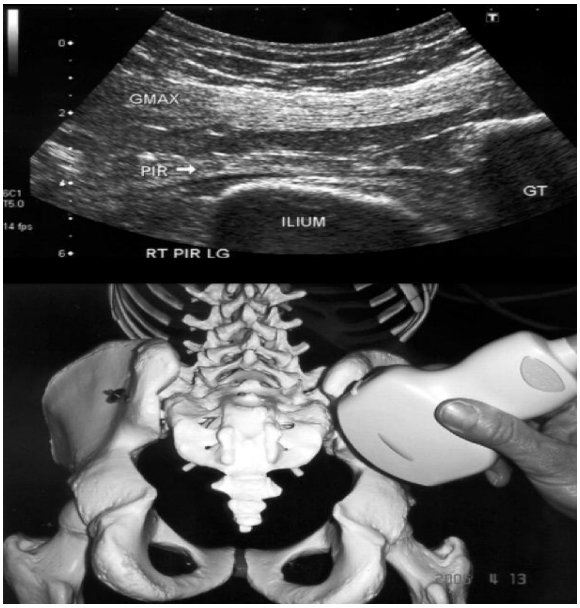



Figure 1: Usg Guided Pyriformis Injection

Fluoroscopy-guided piriformis injection

In the fluoroscopy-guided group, the sacrum and greater trochanter were identified under fluoroscopic guidance.[8] A 22-gauge spinal needle was advanced using bony landmarks to target the piriformis muscle. Contrast dye was injected to confirm appropriate spread, followed by administration of 5 mL of 0.25% bupivacaine mixed with 40 mg triamcinolone.

## III. OUTCOME MEASURES

The following variables were recorded from case records:

Primary outcome

- Pain intensity assessed using the Visual Analog Scale (VAS) before the procedure and at 4-week and 12-week follow-up

Secondary outcomes

- Functional disability assessed using the Oswestry Disability Index (ODI)
- Procedure duration (in minutes)
- Immediate and delayed complications
- Need for repeat intervention

## IV. DATA COLLECTION

Patient demographic data including age, sex, duration of symptoms, side affected, and baseline pain scores were collected from hospital records. Procedural details and follow-up assessments were extracted from follow-up visit notes.

Statistical analysis

Data were entered into Microsoft Excel and analyzed using IBM SPSS Statistics version 27. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The independent t-test was used to compare continuous variables between the two study groups. The paired t-test was applied to compare pre-procedure and post-procedure pain scores within each group. Categorical variables were analyzed using the chi-square test or Fisher's exact test, as appropriate. A p-value of less than 0.05 was considered statistically significant.

Ethical considerations

The study was approved by the Institutional Ethics Committee. Patient confidentiality was maintained by anonymizing all data during analysis. As this was a retrospective review of existing records, informed consent was waived by the ethics

## V. RESULTS

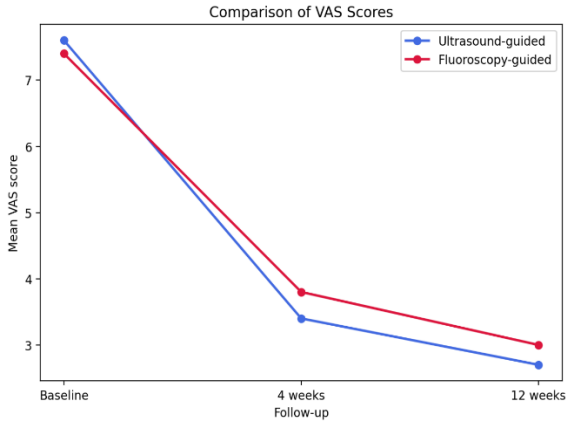
A total of 30 patients with piriformis syndrome were included in the study, with 15 patients each in the ultrasound-guided and fluoroscopy-guided groups. Baseline demographic and clinical characteristics were comparable between the two groups, with no statistically significant differences in age ($p = 0.69$), sex distribution ($p = 0.71$), or duration of symptoms ($p = 0.77$).

Both groups showed significant improvement in pain scores following injection. In the ultrasound-guided group, the mean Visual Analog Scale (VAS) score decreased from $7.5 \pm 0.9$ at baseline to $2.5 \pm 0.8$ at 12 weeks. In the fluoroscopy-guided group, the mean VAS score decreased from $7.6 \pm 1.1$ to $2.8 \pm 1.0$ at 12 weeks. The reduction in pain scores within both groups was statistically significant ($p < 0.001$), while the difference between groups at 12 weeks was not statistically significant ($p = 0.47$).

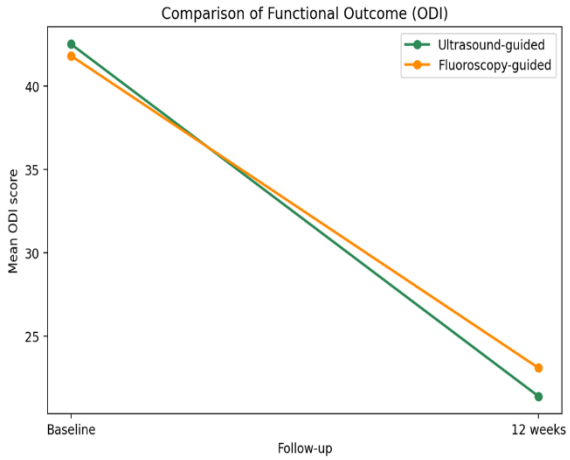
Functional outcomes assessed by Oswestry Disability Index (ODI) also improved significantly in both groups. In the ultrasound-guided group, the mean ODI score improved from $43.2 \pm 7.1$ at baseline to $20.6 \pm 5.2$ at 12 weeks. In the fluoroscopy-guided group, the mean ODI score improved from $42.8 \pm 6.9$ to $22.3 \pm 5.8$. The improvement within each group was statistically significant ($p < 0.001$), with no significant difference between groups at final follow-up ($p = 0.41$).

The mean procedure duration was significantly shorter in the ultrasound-guided group ($8.2 \pm 1.5$ minutes) compared to the fluoroscopy-guided group ($13.9 \pm 2.4$ minutes) ($p < 0.001$).

No major complications such as infection, nerve injury, or hematoma were observed in either group. Minor transient discomfort at the injection site was noted in two patients in the fluoroscopy-guided group and one patient in the ultrasound-guided group, which resolved spontaneously.




Graph 1: Comparison Of Vas Score




Graph 2: Comparison Of Functional Outcome

| Parameter | Ultrasound-guided (n = 15) | Fluoroscopy-guided (n = 15) | p-value |
|---|---|---|---|
| Procedure duration (minutes), mean ± SD | 8.2 ± 1.5 | 13.9 ± 2.4 | <0.001* |
| Technical success, n (%) | 15 (100%) | 15 (100%) | – |
| Needle attempts (number), mean ± SD | 1.2 ± 0.4 | 1.7 ± 0.6 | 0.01* |
| Contrast use, n (%) | 0 (0%) | 15 (100%) | <0.001* |
| Radiation exposure | None | Present | – |
| Total injectate volume (mL), mean ± SD | 5.6 ± 0.4 | 5.5 ± 0.5 | 0.59 |
| Immediate pain relief(≥50%VAS reduction), n (%) | 13 (86.7%) | 12 (80.0%) | 0.62 |

Values are presented as mean ± SD or number (%).

*Statistically significant ($p < 0.05$).

Table 1: Summary Of Results

## VI. DISCUSSION

The present study compared the clinical outcomes of ultrasound-guided and fluoroscopy-guided piriformis injections in 30 patients with piriformis syndrome, with 15 patients in each group. Both techniques resulted in significant improvement in pain and functional status over the 12-week follow-up period. However, ultrasound-guided injection was associated with a significantly shorter procedure duration while maintaining comparable efficacy and safety.

In the current study, both groups demonstrated substantial reduction in pain scores after intervention. The mean VAS score in the ultrasound-guided group decreased from 7.5 ± 0.9 to 2.5 ± 0.8, whereas in the fluoroscopy-guided group it decreased from 7.6 ± 1.1 to 2.8 ± 1.0 at 12 weeks. Although both groups showed statistically significant improvement ($p < 0.001$), the difference between groups was not significant ($p = 0.47$). These findings indicate that both techniques are effective for pain relief, and the choice of imaging modality may depend more on procedural factors than on therapeutic efficacy.

Our findings are consistent with the study by Jonathan T. Finnoff et al.[9], who compared ultrasound-guided and fluoroscopy-guided piriformis injections in a cadaveric model and reported significantly greater targeting accuracy with ultrasound guidance compared to fluoroscopy guidance. Although that study focused on anatomical accuracy rather than clinical outcomes, the superior visualization offered by ultrasound may explain the shorter procedure time and favorable outcomes observed in our study.

The functional outcome findings in the present study also support the effectiveness of both techniques. The ODI improved significantly in both groups, from 43.2 ± 7.1 to 20.6 ± 5.2 in the ultrasound-guided group and from 42.8 ± 6.9 to 22.3 ± 5.8 in the fluoroscopy-guided group. The absence of a significant difference between groups ($p = 0.41$) suggests that both modalities provide similar functional recovery when accurate injection is achieved.

A notable finding in our study was the significantly shorter procedure duration in the ultrasound-guided group (8.2 ± 1.5 minutes) compared with the fluoroscopy-guided group (13.9 ± 2.4 minutes; $p < 0.001$). This may be attributed to the ability of ultrasound to directly visualize the piriformis muscle, sciatic nerve, and adjacent soft tissues in real time,

allowing rapid needle placement without the need for contrast confirmation. Similar observations were reported in studies that demonstrated ultrasound-based interventions to be faster and less resource-intensive compared with fluoroscopy-guided procedures.[10]

The safety profile in the present study was favourable in both groups, with no major complications observed. Only minor transient soreness at the injection site was reported in a few patients and resolved spontaneously. This aligns with prior literature indicating that image-guided piriformis injections are generally safe when performed by experienced clinicians. Ultrasound may offer an additional safety advantage by allowing direct visualization of the sciatic nerve and surrounding vascular structures, thereby minimizing the risk of inadvertent neurovascular injury.[11]

The principal advantage of ultrasound guidance observed in our study was the absence of radiation exposure. Fluoroscopy exposes both patients and healthcare personnel to ionizing radiation and often requires a dedicated procedure suite. Ultrasound, on the other hand, is portable, cost-effective, and can be performed in outpatient settings. These practical advantages have contributed to its increasing acceptance in musculoskeletal and pain interventions.[12]

The results of the present study suggest that ultrasound-guided piriformis injection is at least as effective as fluoroscopy-guided injection for symptomatic improvement in piriformis syndrome, while offering procedural advantages such as reduced procedure time and elimination of radiation exposure. These findings are particularly relevant in resource-limited settings where access to fluoroscopy may be restricted.

However, this study has limitations. The small sample size may limit generalizability. In addition, follow-up was limited to 12 weeks, and long-term outcomes could not be assessed. Despite these limitations, the study provides clinically meaningful comparative data supporting the use of ultrasound as a practical alternative to fluoroscopy for piriformis injections.

Overall, the findings of this study are in agreement with previous literature and strengthen the growing evidence that ultrasound-guided piriformis injection is an effective, safe, and efficient technique for the management of piriformis syndrome.

## VII. CONCLUSION

The present study demonstrated that both ultrasound-guided and fluoroscopy-guided piriformis injections were effective in reducing pain and improving functional outcomes in patients with Piriformis syndrome. Significant improvement in VAS and ODI scores was observed in both groups over the 12-week follow-up period. Although the clinical outcomes were comparable between the two techniques, ultrasound-guided injection had the advantage of significantly shorter procedure duration and absence of radiation exposure. These findings suggest that ultrasound-guided piriformis injection is a safe, effective, and practical alternative to fluoroscopy-guided injection and may be preferred in routine clinical practice.

## VIII. LIMITATIONS

The present study has several limitations. First, the retrospective design may have introduced selection bias and limited control over confounding factors. Second, the sample size was small (n = 30), which may reduce the statistical power and generalizability of the findings. Third, the study was conducted at a single center, limiting external validity. Fourth, follow-up duration was limited to 12 weeks, preventing assessment of long-term outcomes and recurrence. Finally, procedural success and outcomes may have been influenced by operator experience, which was not independently analyzed in this study.

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