Clinical Characteristics of Sciatica in Patients with Piriformis Syndrome Improved by Decompression Surgery

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Objective: To clearly identify the symptoms of sciatica in patients with piriformis syndrome, we retrospectively reviewed patients whose symptoms significantly improved over long-term postoperative follow-up.

Methods: Among patients who underwent sciatic nerve decompression for piriformis syndrome over the past 3 years, the preoperative sciatic pain symptoms of 32 patients whose symptoms were confirmed to have improved by more than 50% during more than 1 year of follow-up were analyzed. To identify the characteristics of sciatic pain in piriformis syndrome, we investigated pain when sitting, pain when resting, pain when standing or walking, and pain when resting at night. In addition, the distribution of sciatic pain in the lower back, buttocks, lower extremities, and feet was investigated.

Results: The most common symptom was pain when sitting, which was present in 25 patients (81%). Pain characteristically occurred even at rest, occurring in 62.5% of patients while lying down at night and in 53.1% of patients during daytime rest. Sciatic pain from piriformis syndrome was most commonly distributed in the buttock (90.6%) and also present in the lower back (37.5%). Pain was present in the posterior thigh in 23 patients (71.9%), in the calf in 68.8% of patients, and in the foot in 50% of patients.

Conclusion: Buttock pain exacerbated by sitting was the most common pattern of pain in patients with piriformis syndrome. However, the sciatic pain of this disease was also found to be characterized by pain that persisted even at rest.

Keywords: Pain; Piriformis muscle syndrome; Sciatic nerve

INTRODUCTION

Entrapment of the sciatic nerve at its exit from the greater sciatic foramen has long been known by the elusive name of “piriformis syndrome”⁹,¹⁰. Piriformis syndrome is defined simply as a non-discogenic cause of sciatica due to sciatic nerve impingement through or around the piriformis muscle⁹,¹⁰. Because it causes chronic sciatica along with buttock and lower back pain, it may be difficult to distinguish it from the degenerative lumbar lesions that commonly cause sciatica. The diagnosis of so-called piriformis syndrome is complicated by multiple differential diagnoses of low back
and buttock pain with many diagnoses associated with overlapping symptoms\(^{6,10,15}\).

The diagnosis of piriformis syndrome is based on findings of clinical history and evaluation, diagnostic blocks, and several physical examinations.\(^{5,6,10,13}\) Due to the lack of a definitive diagnostic method, it was strongly suggested to refer to the patient’s medical history and ascertain the infliction of blunt trauma to the buttock, such as a fall\(^{1,14}\). Therefore, multiple authors have sought to further characterize the symptoms unique to piriformis syndrome\(^ {5,7,16,23}\). Patients with piriformis syndrome often present with hip pain, buttock pain, dyspareunia (in female patients), and sciatica\(^ {7}\). The pain is often aggravated by prolonged sitting, such as driving, or by rising from a seated position\(^ {21}\). In the first systematic review of clinical features of the syndrome\(^ 6\), the most common features were: buttock pain, aggravation by sitting, external tenderness over the greater sciatic notch, and pain with maneuvers that increase tension in the piriformis muscle. In a recent, updated systematic review of clinical features of piriformis syndrome, these findings remained consistent\(^ {7}\).

If physicians do not recognize the characteristic symptoms of pelvic lesions that cause sciatica, there is a risk of misdiagnosing them as lumbar disc herniation or stenosis by magnetic resonance imaging (MRI) of the lumbar spine\(^ {16,17,18,20}\). The risk of misdiagnosis is reduced in patients presenting with so-called, lumbar spine MRI-negative sciatica, but it is elevated in cases of MRI-positive sciatica\(^ {16,17,18,20}\). With the increase in the frequency of degenerative lumbar spine disease due to aging, the frequency of spine surgery and the incidence of failed back surgery syndrome (FBSS) are increasing in the general population\(^ {16,17,18,20}\). There is a significant risk of developing FBSS due to undiagnosed refractory sciatica caused by piriformis syndrome\(^ {10}\). Of the 84 cases of sciatic nerve decompression due to piriformis syndrome experienced by the authors during the last 10 years, 28 cases (34.6%) were diagnosed during the evaluation of FBSS\(^ {10}\). We believe that knowledge of the characteristic symptoms of sciatica due to piriformis syndrome is important to prevent development of FBSS.

Accordingly, we analyzed the symptoms of patients who were diagnosed with piriformis syndrome and whose symptoms were significantly improved through sciatic nerve decompression surgery. We hope that identifying the characteristic symptoms of patients with surgically confirmed piriformis syndrome will help prevent chronic sciatica from being misdiagnosed as a lumbar spinal disease.

### MATERIALS AND METHODS

From 2021 to present, 89 patients with piriformis syndrome have undergone sciatic nerve decompression through the gluteal approach by the senior author (B.S.). Among these, 40 patients were followed for more than 1 year. To determine the exact symptoms of piriformis syndrome, we analyzed the symptoms of 32 patients whose preoperative symptoms improved by more than 50% after follow-up for more than one year. There were 18 women (56.3%), the affected area was on the right side in 14 patients (43.8%), and 8 patients (24%) had decompression on both sides. The duration of pain before surgery was 67.7 (± 64.3) months (mean ± standard deviation). Prior to sciatic nerve decompression, 17 of 32 patients (53%) had undergone spinal surgery (including 9 posterior lumbar interbody fusions), and 2 patients had even undergone spinal cord stimulation.

Our technique of transgluteal decompression of the sciatic nerve has already been reported in detail\(^ {18,21}\). The surgery was performed under general anesthesia with intraoperative neurophysiologic monitoring to confirm the localization of the sciatic nerve and its branches and prevent nerve damage\(^ {18,21}\). Circumferential dissection of the course of the sciatic nerve at the greater sciatic notch with dissection of the lateral margin of the sacrotuberous ligament was important in successful decompression\(^ {18,21}\). The postoperative course was followed for over a year (15.3 ± 11.0 months). The demographics of eligible patients are summarized in Table 1. The presence of pain when sitting, pain when resting, pain when standing or walking, and pain when resting at night was studied. The distribution of pain was identified in the lower back, buttocks, thighs, calves, and feet.

### RESULTS

Among the four symptoms analyzed, the most common symptom was pain when sitting, which was present in 25 patients (81%). Pain occurring even when lying down at night was found to be 62.5% and pain occurring during daytime rest was 53.1%. Pain occurred when standing or walking in 10 patients (31.3%). The pain was distributed in the buttock for 29 patients (90.6%), posterior thigh for 23 patients...
of patients. To improve understanding of the pattern and distribution of pain in piriformis syndrome, these results were also presented graphically (Fig. 1).

Of the 32 patients included in this study, 26 (81.3%) reported that their pain was reduced by more than 50% at 6-month follow-up after surgery. However, 5 of 32 (15.6%) patients underwent re-decompression surgery due to recurrence of pain during follow-up. They also reported pain relief of more than 50% at the last follow-up. There were no neurological deficits after surgery. Despite pain relief of more than 50%, 19 (60.2%) patients required medication such as gabapentinoid and nonsteroidal anti-inflammatory drugs. Drugs were not controlled in this study.

**DISCUSSION**

1. **Piriformis Syndrome as an Extraplinal Cause of Sciatica**

Sciatica is known by a range of terms in the literature, such as lumbosacral radicular syndrome, radiculopathy, nerve root pain, and nerve root entrapment or irritation\(^1\,^2\). The definition of sciatica vary, sciatica pain is generally defined

| Table 1. Demographic and clinical characteristics of the patients with piriformis syndrome |
|------------------------------------------|----------------------------------|
| Variables | Value |
| Number of patients | 32 |
| Age (years) | 51.3 ± 15.4 |
| Sex |  |
| Female | 18 (56.3) |
| Male | 14 (43.8) |
| Involved side |  |
| Right | 14 (43.8) |
| Left | 10 (31.3) |
| Both | 8 (25.0) |
| Duration of pain (months) | 67.7 ± 64.6 |
| Prior invasive treatment |  |
| Fusion | 9 (28.1) |
| Discectomy | 3 (9.4) |
| PEA | 2 (6.3) |
| Annuloplasty | 1 (3.1) |
| SCS | 2 (6.3) |
| Follow-up after PS decompression (months) | 15.3 ± 11.0 |

The data is presented as mean ± standard deviation or N (%).

PEA: percutaneous epidural adhesiolysis; SCS: spinal cord stimulation; PS: piriformis syndrome.

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**Fig. 1.** Pain pattern and distribution of piriformis syndrome. (A) A bar graph showing the characteristics of pain in patients with piriformis syndrome. As is already known, pain worsened by prolonged sitting was the most frequent pattern, but spontaneous pain that continued to occur even when resting without moving was also common. (B) A bar graph showing the distribution of pain in patients with piriformis syndrome. Pain was most commonly present in the buttock and radiated through the posterior thigh to the legs and feet. It should be noted that pain was also relatively common in the low back.
as pain radiating to the leg, normally below the knee and into the foot and toes\(^{11,22}\). It tends to approximate the dermatomal distribution of the nerve root affected (most often L5, S1) and is often associated with numbness or pins and needles in the same distribution\(^ {11}\). Sciatica is a symptom rather than a specific diagnosis, but lumbardisc herniation or foraminal stenosis are typical pathologies that may cause sciatic pain\(^ {11}\). However, there are some rare reasons for sciatica such as tumors, cysts, or other extraspinal reasons, such as piriformis syndrome\(^ {11}\). Although first described in 1928\(^ {5,6,10,15}\), the precise pathophysiology of piriformis syndrome is still not defined\(^ {11}\). It is still regarded as a controversial but potentially common, underdiagnosed cause of buttock pain and non-discogenic cause of sciatica\(^ {5,6,10,15}\), and even a cause of FBSS\(^ {10,17,18,20}\).

2. Piriformis Syndrome as a Cause of FBSS

FBSS is a term embracing a constellation of conditions that describes persistent or recurring low back pain, with or without sciatica, following one or more spinal surgeries\(^ {4,13,19}\). FBSS due to piriformis syndrome is a case where the symptoms of piriformis syndrome are not understood and are mistaken for the spinal cause of sciatica, that is, sciatica caused by lumbosacral radiculopathy\(^ {3,10}\). The risk of misdiagnosis is reduced in patients presenting with so-called, lumbar spine MRI-negative sciatica\(^ {5,10}\), but it is elevated in cases of MRI-positive sciatica\(^ {10,17,18,20}\).

The reason for reexamining the symptoms of piriformis syndrome in our cohort is that chronic sciatica in this condition is likely a common cause of FBSS\(^ {10,17,18,20}\). In fact, piriformis syndrome has long been identified as a cause of FBSS\(^ {11}\). However, piriformis syndrome was identified as a serious cause of FBSS in a report by Filler et al.\(^ {5}\) in 2005. Among their cohort of 239 patients with piriformis syndrome, 46 patients (19%) were classified as having FBSS due to previous spine surgery\(^ {5}\). In fact, only one-third of their cohort had a prior diagnosis of piriformis syndrome\(^ {5}\). According to a recent report by Son et al.\(^ {10}\), 28 (35%) of 81 patients with piriformis syndrome had FBSS. In his cohort, only 10% had a prior diagnosis of piriformis syndrome\(^ {10}\).

We reported the occurrence of FBSS in a patient with piriformis syndrome who underwent two spinal surgeries for mild lumbar stenosis detected on lumbar MRI\(^ {10}\). We also reported the case of a patient with piriformis syndrome who underwent two spinal surgeries due to a mild, asymptomatic L5/S1 disc herniation discovered on lumbar MRI\(^ {17}\). In fact, of the 32 patients included in current study, 17 (53%) underwent multiple spine surgeries, including lumbar posterior interbody fusion (Table 1). Considering these facts, it can be inferred that the symptoms of some patients with piriformis syndrome are chronic and difficult to control with conservative treatment, so the symptoms are severe enough to require surgery. In addition, the duration of preoperative symptoms for patients included in this study cohort was found to be significantly long, at 67.7 ± 64.6 months (Table 1). The long duration of symptoms means that the diagnosis of piriformis syndrome is usually delayed.

3. Symptoms of Piriformis Syndrome and FBSS

The diagnosis of piriformis syndrome is a clinical diagnosis\(^ {2,14,18}\). A diagnostic block of the ischial nerve is an adjunct to confirming this diagnosis\(^ {3,5,15}\). Additionally, imaging diagnosis, including MRI, is used as an adjunct to exclude mass lesions involving the ischial nerve\(^ {3,5,6,16,15}\). Due to the lack of a definitive diagnostic method, it was strongly suggested to refer to the patient’s medical history\(^ {3,5,6,10,14,15}\).

The typical symptoms of piriformis syndrome are known as buttock pain with or without ipsilateral radiation to the posterior thigh that sometimes extends below the knee to calf, resembling typical sciatica\(^ {3}\). Buttock pain or sciatica may be exacerbated by activity of lower extremities, such as hip adduction and internal rotation that stretches the piriformis muscle\(^ {4}\). However, these symptoms are difficult to distinguish from those of sciatica caused by lumbosacral radiculopathy. Therefore, studies were conducted on the typical clinical symptoms of sciatica caused by piriformis syndrome\(^ {4,5}\). Hopayan et al.\(^ {8}\) presented four common symptoms that can identify piriformis syndrome through a literature review in 2010. The four most common features were buttock pain, pain aggravated on sitting, external tenderness near the greater sciatic notch and pain on any maneuver that increases piriformis muscle tension, and limitation of straight leg raising (SLR)\(^ {9}\). In 2018, they again reported four symptoms that could define piriformis syndrome in an updated systematic review\(^ {9}\). These four symptoms were the same as in 2010. The straight leg raise test did not rule out a diagnosis of piriformis syndrome\(^ {2,8}\). Therefore, the symptoms of piriformis syndrome can be summarized as buttock pain and aggravation of pain on sitting, with the exception of two physical examination findings\(^ {8,9}\).
4. Symptoms of Piriformis Syndrome Identified in This Study

Based on our experience, we believe that the two symptoms of hip pain and increased pain when sitting alone are not sufficient to indicate symptoms of piriformis syndrome. So, we compiled a list of symptoms that patients with piriformis syndrome describe when they are interviewed. As we expected, pain that worsened when sitting was the most common symptom. In addition to pain caused by sitting, spontaneous persistent pain is also a symptom that we pay attention to. This category of persistent pain refers to pain at rest. The pain at rest we classified refers to spontaneous, persistent pain that occurs even when resting and not moving during the day.

Approximately 53% of patients complained that pain persisted even during rest during the day. In the same context, pain at night refers to spontaneous, persistent pain that occurs even when patients lie down at night and try to sleep. In 62.5% of patients, pain occurred spontaneously even while sleeping at night. In other words, it was confirmed that in about half of patients who undergo surgery due to severe pain in piriformis syndrome, the pain persists even when resting, along with the pain caused by sitting.

The most common location of pain in piriformis syndrome was the buttocks (90.6%). Pain in the posterior thigh and calf area was understood as the location from which pain in the sciatica radiates. One thing to note is that pain also commonly occurs in the lower back (37.5%). The presence of back pain along with hip pain makes the clinical diagnosis of piriformis syndrome difficult. In our opinion, the location of the pain did not show any other differences from sciatica caused by degenerative lumbar diseases.

5. Distinguishing Sciatica Symptoms Due to Lumbar Stenosis and Piriformis Syndrome

The most characteristic symptoms of degenerative spinal stenosis are back pain associated with sciatica and neurogenic intermittent claudication (NIC). Patients with NIC usually present with bilateral leg pain. However, pain of piriformis syndrome is usually unilateral. Unlike the buttock pain associated with sitting intolerance in piriformis syndrome, Pain associated with spinal stenosis improves with rest, such as sitting, bending, stooping, or lying down. Considering the pain of piriformis syndrome confirmed in this study, it is believed that the rare occurrence of NIC symptoms that appear even after walking for long periods of time and the persistent pain that does not improve with rest are symptoms that can be differentiated from lumbar stenosis.

However, sitting or lying down is less effective in relieving the pain associated with advanced lumbar stenosis. In addition, patients with lateral recess stenosis experience higher pain during rest and at night and may show greater walking intolerance than those with central stenosis. Therefore, it is difficult to distinguish piriformis syndrome from advanced central stenosis and lateral recess stenosis simply based on symptoms. Basically, the diagnosis of piriformis syndrome is a diagnosis of exclusion, so a sciatic nerve block is essential when the diagnosis is uncertain.

6. Limitations

The results of this study of symptoms of piriformis syndrome were obtained from a study conducted on a single cohort of patients by one researcher. This study is not a literature review or meta-analysis of existing results. Therefore, the researcher’s preconceptions and biases regarding the diagnosis of piriformis syndrome may be included. Therefore, we performed a retrospective analysis targeting only the patients we treated and had good results. We did not analyze the frequency and importance of the SLR test. This is because existing reports have already proven that it is not a unique symptom that can exclude piriformis syndrome. Additionally, our study did not include the flexion, adduction, and internal rotation test of the hip joint and antalgic position. The physical examination findings of buttock pain due to changes in hip posture were judged to be more related to lesions in the hip joint itself. Therefore, it was judged that this could not be considered a specific finding of sciatica caused by entrapment of the sciatic nerve.

CONCLUSION

Contrary to what was previously known, in some patients, buttock pain and sciatica caused by piriformis syndrome did not improve with conservative treatment, and in some cases, it was chronic and severe enough to require spinal surgery. In addition, it can be seen that many patients are undergoing unnecessary spinal surgery due to an incorrect diagnosis of lumbar radiculopathy instead of piriformis syndrome. If buttock pain and lower extremity neuralgia worsen when
sitting and persist even when resting at night, piriformis syndrome should be taken into consideration.

CONFLICTS OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES