

Minimal Invasive Surgical Treatment of Piriformis Syndrome and the Results

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Abstract

Piriformis syndrome is a neuromuscular pain syndrome occurring as a result of compression on the underlying sciatic nerve due to various causes including the hypertrophy, inflammation, mass lesions or anatomical variations occurring in the deep gluteal space. Patients with piriformis syndrome often experience pain and numbness in the hip, thigh and leg, similar to those of sciatica. In addition to clinical findings, electrophysiological examinations and magnetic resonance imaging (MRI) is useful for diagnosis. Once diagnosed, the treatment approach is stepwise and conservative treatment is successful in majority of cases. Surgical treatment should be performed for the cases in whom conservative treatment methods fail and when the sciatic nerve should be decompressed. Surgery is an important treatment option for unresolved piriformis syndrome with its simplicity and low morbidity. Several surgical procedures have been described for the decompression of affected sciatic nerve. Due to excessive fibrosis tissue that may be developed around the sciatic nerve in classical surgical procedures, person's return to social and work life may be delayed. In the present study, we will evaluate the surgical indication criteria of our cases who underwent minimally invasive surgical treatment due to piriformis syndrome, the definition of the surgical procedure and the outcomes.

Keywords: Piriformis syndrome, Sialgia, Minimal invasive surgery

Introduction

Piriformis syndrome (PS) is a rare entrapment neuropathy occurring as a result of the compression of the sciatic nerve by various pathophysiologic etiologies such as hypertrophy, inflammation, injury or anatomical variations of the piriformis muscle and adjacent soft tissues. PS, which was described by Yeoman for the first time in 1928, is known to constitute about 6% of all sciatica. Its incidence was stated to be 0.33%. History of trauma is present in about 50% of cases. The distribution of PS is similar and not vary depending on age groups but there is 6/1 female predominance [1].

As a result of compression on the sciatic nerve, sciatica-like pain spreading from the back of the thigh to the entire lower extremity as well as dysesthesia in the calf and foot develop. Sciatic like pain that can be reproduced by adduction and internal rotation of the flexed hip is considered suggestive for the syndrome and sitting on hard surfaces for long periods of time, crouching for a long time, walking fast, running or climbing stairs can increase these symptoms [2].

Piriformis syndrome (PS) is an under recognized but is among common etiologies of posterior hip and sciatica pain in adult. Surgical procedures are considered for the patients who are diagnosed accurately and whose complaints do not resolve despite conservative treatments. Rest is needed for quite a long time in the postoperative period in classic surgical procedures due to the size of incision, resulting in prolonged time to return to social and work life. We present our minimally invasive surgical criteria, surgical incision type and outcomes of surgical treatment administered to our patients who were diagnosed with Piriformis syndrome (PS), and who did not recover despite conservative treatments.

Materials and Methods

Twelve patients who were diagnosed with Piriformis syndrome (PS) and whose complaints persisted for at least 6 months despite conservative treatments and thus who underwent surgical treatment, were included in the study (Table 1). Of the 12 cases, eight were female and four were male. The mean age was 32.5 years (25-46 years). The left side was affected in eight cases and right side was affected in four cases. The mean duration of symptoms was 11.5 months (6-24 months). Three cases had a minimal trauma history described as falling from the same level on the hip.

Table 1: Cases

Patient No	Age	Gender	Side	Symptom duration (month)	Trauma history:	Neurologic deficit	VAS score Pre/postop. Third month	Surgical method
1	26	F	left	24	-	+	9/1	R + N
2	40	M	left	8	-	+	10/2	R + N
3	28	F	Right	16	+	+	10/2	R + N
4	33	F	left	15	-	-	9/1	R
5	35	F	left	7	-	+	10/2	R + N
6	28	M	Right	13	-	-	8/1	R
7	41	M	left	9	-	-	9/1	R
8	46	F	left	12	-	-	9/1	R
9	25	M	left	9	+	-	10/2	R
10	32	F	left	8	-	-	9/1	R
11	42	F	left	10	-	-	9/2	R
12	39	F	left	12	+	-	10/2	R

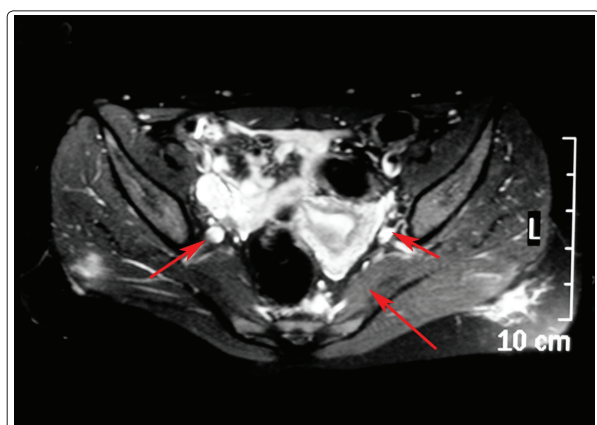


Figure 1: Increased signal intensity on left piriformis muscle and the flattening of the left sciatic nerve

One or some of the treatments including anti-inflammatory, myorelaxing, antidepressant drugs, medications for neuropathic pain such as gabapentin, pregabalin or duloxetine, physical therapy applications such as TENS, US, massage, hot application, local injection treatments (local anesthetic, corticosteroid or botulinum toxin) had been administered to all cases in various centers, however, no response could be attained.

We used a clinical scoring system in which the diagnosis of Piriformis syndrome (PS) is considered 'probable' when the score was greater or equal to 8 over total of 12 points (Table 2) [3]. FAIR test, Freiberg sign, Pace sign, Beatty maneuver and Lasque test were performed during the physical examination. Magnetic Resonance Imaging (MRI) and electromyography (EMG) of lumbosacral and pelvic region were performed to support the diagnosis and to make differential diagnosis in some of the patients. Distal latency and conduction velocity were assessed within the scope of motor conduction studies. The mean of normal sciatic nerve motor conduction velocity was taken as 56.0 ± 5.5 m/s and the lower limit of normal value was accepted to be 45 m/s. EMG control was performed at least twice in the preoperative and postoperative first month. A 0-10 scaled Visual Analog Scale (VAS) was used for pain assessment and the presence of pain spreading to the hip and/or

lower extremity with long sitting was evaluated. Steroid and local anesthetics were administered into the PM in a USG-guided manner in order to determine whether the cases were suitable for surgical treatment or not. In the interventional radiology unit under standard sterile conditions and the patients in the Sims position in which the affected gluteal region is in superior position, US probe was kept in transverse position and sacral hiatus was identified. Then, the probe was moved towards the major trochanter in the lateral direction. PM was visualized deep to the gluteus maximus muscle over the surface of the medial edge of the ilium. The patient's hip was brought into external rotation and the localization of PM was confirmed with muscle movement. Upon the visualization of 22 gauge needle that was inserted from medial to lateral along the longitudinal axis of the muscle at an angle of 45° within the muscle, the combination of 4 ml 1% Prilocaine and 1 ml Betamethasone was injected. Pain abated after 10 minutes of injection but without complete relief. The patients who developed pain at the same intensity again at least 24-72 hours after the injection, were considered as definitive surgical candidates. Other patients were continued to be followed up.

Table 2: Proposal for a Clinical Scoring System for the Diagnosis of Piriformis Muscle Syndrome

Criteria	Point
Unilateral or bilateral buttock pain with fluctuating periods without pain throughout the course of the day	1
No lowerback pain	1
Axial spinal palpation painless (L2 to S1)	1
Negative Laseque's maneuver	1
Seated position (often for a prolonged period) triggering buttock pain and/or sciatic pain	1
Sciatic pain with fluctuating periods without pain throughout the course of the day	1
Contraction resisted manoeuvres (Beatty)	1
Palpation	1
Sciatic pain (L5, S1, or truncal sciatic area) reproduced by the extension of clinical manoeuvres (several tens of seconds)	
Stretching	1

Resisted contraction	1
Absence of perineal irradiation	1
Total	12

FAIR: Flexion-adduction-internal rotation, **HCLK:** heel contralateral knee

Surgery

The cases who were planned to undergo surgery, premedication with a mild sedating agent and a first generation cephalosporin were administered via I.V. route following six hours of fasting. After spinal anesthesia achieved with lidocaine, surgical cushions were placed beneath both sides of the patient's chest and under ankles and the patient was positioned in the prone over the operation table. In order to identify the site of incision, a line extending from the lower end of the sacroiliac joint to the major trochanter was drawn with the aid of scopy. The oblique incision plane was made lateral to 1/3 of this line (Figure 2). A curvilinear skin incision lesser than 8 cm from the greater trochanter was made to the affected side following the sterilization of the skin (Figure 3). After passing the skin, subcutaneous tissue and muscle fascia, the muscle fibers of gluteus maximus were separated by blunt dissection and were ecarted to superomedial and inferolateral part (Figure 4). The fascia lata showing continuation on the trochanter was cut. The dissection was deepened slowly and meticulously and the piriformis and gemellus muscles were visualized. The hip was brought into internal rotation to facilitate the identification of PM. The PM was suspended with a Penrose drain (Figure 5). After evaluating the associations of PM with the sciatic nerve, the tendon of piriformis muscle was excised adjacent to attachment site on the greater trochanter and was ecarted medially (Figure 6 and 7). In cases with neurological deficits, it was proceeded medially with blunt dissection after the belly of PM and the sciatic nerve was visualized and external neurolysis was performed. After hemostasis was maintained, the opened layers were closed respectively by placing hemovac drain in the site. The wound dressing was performed on the next day and the drains were removed. Bed rest for one day was recommended and the patients were discharged. The stretching exercises of hip abductor and adductor muscle groups and range of motion exercises of the hip were recommended for the cases who was called for control visits one week later. Then they were called for control examinations once a month for 3 months.

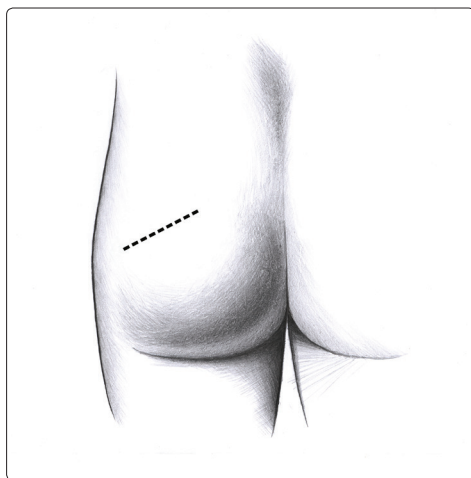


Figure 2: Incision plane

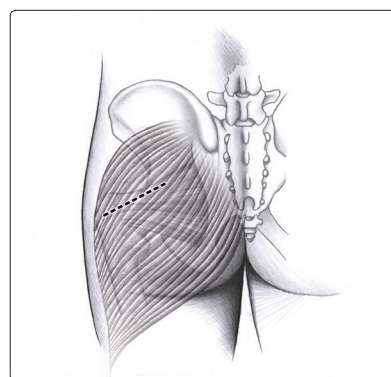


Figure 3: The place of skin incision relative to greater trochanter

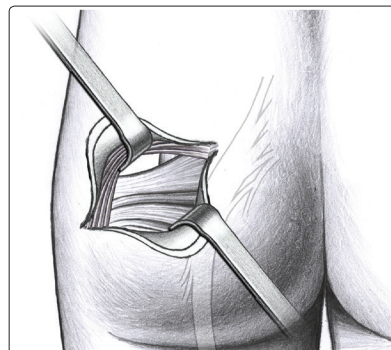


Figure 4: The muscle fibers of gluteus maximus were separated by blunt dissection

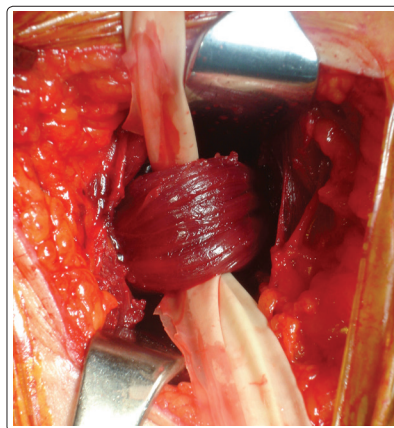


Figure 5: The PM was suspended with a Penrose drain

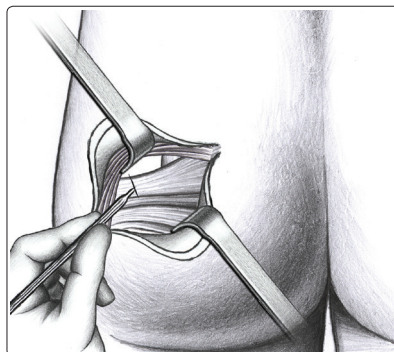


Figure 6: The tendon of piriformis muscle was excised

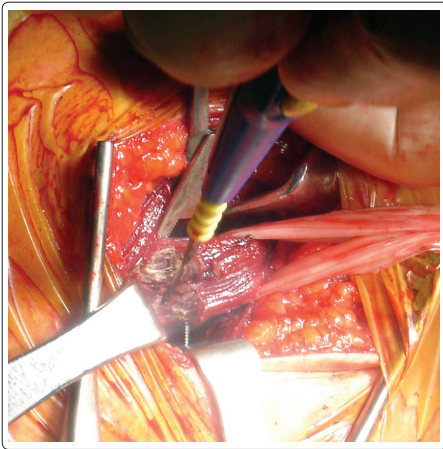


Figure 7: The tendon of piriformis muscle was excised with monopolar cautery

Results

At the end of one month, complete recovery was observed in nine cases and significant recovery in three cases. No deterioration was observed in any of the cases. Oral prophylactic antibiotic and Naproxen sodium tablet was given for one week in the postoperative period. Vitamin B complex was given for one month to all cases. The mean preoperative VAS value of our cases was 9.33 while it was found to be 1.50 in the postoperative first month.

Statistical Analysis

Descriptive statistics as well as dependent variables were assessed. As a result of the t-test comparison of the preoperative and postoperative VAS values, the differences between the preoperative and postoperative periods were 99% statistically significant ($p < 0.001$). Depending on the smallness of the incision made, no postoperative wound problem developed and early ambulation was provided. A statistically significant negativity occurred in the postoperative one week compared to the preoperative period at the ratio of 82% and in terms of the tenderness over piriformis muscle, at the ratio of 80% in Freiberg test, at the ratio of 86% in Pace sign and at the ratio of 82% in FAIR test ($p < 0.001$).

Discussion

PM is a flat, pyramidal shaped muscle originating from the sacroiliac joint capsule on the anterior surface of the sacrum, and attaches to the superior surface of the femur's greater trochanter. It is in close neighborhood with internal obturator and gemelli muscles. PM is innervated by the S1 and S2 spinal roots and rarely by the L5 spinal roots [4]. PM brings the hip into the external rotation when the hip is in the neutral position and into abduction when the hip is flexed. It also provides postural stability while standing and walking. The sciatic nerve in the vicinity of PM originates from the lumbosacral plexus (L4, L5, S1, S2, S3) and leaves the pelvis by passing underneath the piriformis muscle [5].

The most frequent entrapment site of the sciatic nerve in the lower extremity is underneath PM [1]. PS is a rare neuropathic entity occurring as a result of compression of the sciatic nerve by abnormal piriformis muscle. PS may be primary which is caused by anatomical variations and it is not very common. The sciatic nerve was underneath PM in all of our cases treated surgically and

no anatomic variation was encountered. Whereas secondary PS occurs as a consequence of macro or microtrauma or muscle spasm. It accounts for more than 50% of the syndromes [6,7]. There is usually a history of trauma to gluteal region [1]. Buttock and sciatic pain develop secondary to the inflammation and spasm occurring due to trauma in piriformis muscle. Our four cases had the history of minor trauma in the form of falling on the hip at the same level but there were no fracture.

Its incidence was reported to be 5-6% and female/male ratio was 6/1 [8]. Even though the distribution of PS was stated as not to vary according to the age group, it mostly occurs in the fourth and fifth decades [9]. The mean age of our cases was 32.5 years (25-46 years).

The symptoms are usually non-specific and generally it manifests itself with buttock pain spreading to the lower extremity and intensifying upon sitting for long periods. Local tenderness of buttock, palpation of fibrosis over the course of piriformis muscle, elicitation of pain upon forcing the hip to internal rotation and adduction (Fieberg test) are the principal signs of physical examinations. Also, making the patient sit and perform adduction and internal rotation against resistance (FAIR test) aggravates pain [10]. Gluteal atrophy may be observed [11]. Michel et al. proposed a clinical scoring system composed of clinical symptoms, signs and several provocation maneuver tests for the diagnosis of PS. A score of 8 or more on the scale ranging between 0 and 12 is predictive for the diagnosis of PS [12]. We used this scoring system for the clinical evaluation and diagnosis of our cases. Fieberg and FAIR tests were positive in all of our cases. We did not encounter gluteal atrophy in our cases.

Pelvic MRI and MR neurography are useful in diagnosis [13]. Since the nerve has a deep course, electrodiagnostic tests are hard to implement and thus diagnosis may not be made easily. Although the electrophysiological findings may be normal, it may also reveal H reflex abnormalities, abnormally prolonged segmental somatosensory evoked potentials [1]. With dynamic neurotransmission studies, prolonged H-reflexes may be detected in the hip flexion, adduction, and internal rotation positions (FADR) compared to the neutral position [14,15]. In our two cases MRI showed hypertrophy of PM and flattened sciatic nerve with perineural edema. All of our cases underwent dynamic nerve conduction study and prolonged H reflex was detected.

Once diagnosed, the treatment approach is stepwise and successful outcomes are attained in majority of cases. PS was reported to benefit from conservative treatment at the rate of 79% in the early period [16]. For patients without neurological deficits, physical activity modification, anti-inflammatory drugs, physical therapy, injection into or over the PM, or extracorporeal shock wave therapy (ESWT) should be performed for at least 3 months for positions triggering buttock and lower extremity pain [17]. Local anesthetic (LA), LA + steroid and botulinum toxin can be used as intramuscular injection [18]. Another study comparing LA or LA+ steroid injections for the treatment of PS demonstrated that both were clinically effective and that they were not superior to each other [19]. The combination of LA + steroid was administered to PM and its around, in order to be able to make accurate decision about surgical indication in the present study. Pain either did not resolve or recurred in a short time in all of our cases who underwent surgery.

Surgery to decompress the sciatic nerve should be performed for the cases in whom conservative treatment methods fail, and who experience difficulty to maintain social life due to pain and have to take analgesic medication every day. For the first time, Robinson argued that the sciatic nerve was compressed by PM and suggested that decompression should have been performed [20]. The following criteria were described for making surgical decision: spreading buttock pain felt with sitting, oversensitivity in PM, positive provocative tests (Freiberg and Pace tests), positive findings on CT and MRI, and persistent pain despite local anesthesia and/or steroids [17]. We performed surgical treatment after the mean duration of 11.5 months from the onset of their complaints.

Conservative piriformis surgery is a muscle weakening intervention, including a large incision over the gluteal muscle. In this method, an incision is made with a standard posterior approach to the buttock and the insertion of the piriformis tendon is isolated from the greater trochanter [21]. The outcome of this kind of surgeries ensue with hip and lower extremity weakness and pain lasting for weeks as well as walking with crutches for a long time. In addition to these, adverse factors such as delayed wound healing, excessive scarring, cosmetic problems, prolonged resting time and delayed rehabilitation emerged as well. Therefore, a limited success is achieved in the early period while attempting to treat the actual problem. Thus, several minimal surgical intervention types were described. Minimally invasive techniques came into the picture with the hope of less postoperative scar tissue formation and a lower relapse rate. Martin, et al. reported positive outcomes with endoscopic decompression in 35 cases [22]. Because of these reasons, we performed the minimally invasive surgical intervention in all of our cases. We used radiological parameters for determining incision site and performed the intervention with a small incision of approximately 7-8 cm.

Management after conservative operations includes giving partial weight with crutches for two weeks and a series of movement exercises [23]. Patients are ambulated with crutches postoperatively and they can give full weight after 5-10 days to the extent they tolerate. They are informed not to sit for a long time and not to drive for 4 to 6 weeks after surgery [7,16,24,25]. We achieved walking in a short time period, sitting and beginning to exercise with the minimally invasive surgical intervention. We ambulated our patients on postoperative day 1. We recommended them to give full weight to the extent they could tolerate after 3 days. The patients were informed not to sit for a long time and not to drive for a long time for three days postoperatively. Reoperation was not needed in any of the cases. The mean preoperative VAS value of our cases was 9.33 while it was found to be 1.50 in the postoperative first month.

Conclusion

PS has a nonspecific clinical findings and should be kept in mind in the differential diagnosis of sciatic like pain in order to avoid misdiagnosis, especially in terms of disc diseases and not to cause unnecessary surgical interventions since it is a rarely encountered disease. Surgical treatment should be definitely performed for cases in whom conservative treatment methods fail and the sciatic nerve should be decompressed. The injection test should be implemented for one last time before the surgical decision is made. Surgical intervention should be performed with minimally invasive methods to provide early mobilization.

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