

Technical Report

Piriformis Muscle Injection Using Ultrasonography and Motor Stimulation – Report of a Technique

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The piriformis muscle syndrome has been described in the literature since 1947 and accounts for 6-8% of patients presenting with buttock pain, which may variably be associated with sciatica. Through the years, there have been attempts to find safe and effective ways of managing this condition, whether through conservative treatment or with the use of interventional procedures. Several authors have reported injection techniques using the following: nerve stimulation; fluoroscopy with electromyography; and fluoroscopy with muscle stimulation. We aim to describe an injection method which is effective, simple, reproducible, easily available, and safe. This is the first report on the combined use of ultrasonography and motor stimulation in performing piriformis muscle injection. Our technique offers advantages such as: markedly decreased radiation exposure for both patient and doctor; improved visualization of sciatic nerve and surrounding muscles; improved portability; the possibility of being performed as an office-based procedure; and allows for an accurate confirmation of pain in the piriformis muscle with stimulation.

Key words: Piriformis muscle, ultrasound, motor stimulation

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The piriformis muscle originates from the S2-S4 ventrolateral margin of the sacrum, runs through the greater sciatic notch, and inserts at the piriformis fossa of the greater trochanter. The muscle functions to externally rotate the leg when the hip is extended and abduct the hip when it is flexed.

Piriformis muscle syndrome is an important cause of buttock pain that may often be accompanied by sciatica (1,2). Hallin (3) reported that piriformis syndrome

is responsible for 6–8% of low back pain conditions associated with sciatica. It was first described by Robinson in 1947 (4). He identified 6 characteristics associated with it, namely: history of local trauma; pain localized to the sacroiliac joint, greater sciatic notch, and piriformis muscle extending along the distribution of the sciatic nerve; pain on stooping or lifting and relieved by traction; a palpable sausage-shaped mass at the anatomic location of the piriformis mus-

cle; a positive Laseague's sign (pain and tenderness to palpation in the greater sciatic notch with the hip passively flexed to 90° and a fully extended knee); and gluteal atrophy in chronic cases. True neurologic deficit is rare (4). Aside from a positive Laseague's sign, Friedberg's (pain on passive, forced internal rotation of hip) and Pace's (pain and weakness on resistance to active abduction and internal rotation of hip) signs may also be elicited.

Several techniques of piriformis injections have been described in the literature. Hanania (5) described a technique using anatomic landmarks and a nerve stimulator. After the sciatic nerve was identified via stimulation, the needle was pulled back by a few centimeters to lodge the tip within the piriformis muscle. The author, however, noted that in a small percentage of patients with an anomalous sciatic nerve and piriformis arrangement, this technique might not be accurate. Furthermore, because of the blind nature of the procedure, an inadvertent deep injection around the sciatic nerve may result in sensorimotor block. Fishman et al (6) described a technique using fluoroscopy and electromyography (EMG). The EMG helped confirm an intramuscular needle placement and allowed correlation with the fluoroscopic image. Although this technique was shown to be highly accurate, it would require expertise in the use of EMG. Betts (7) described the use of fluoroscopy with muscle stimulation. This technique involved the use of motor stimulation to better define the location of the piriformis muscle. Fluoroscopy helped to ensure precise needle placement for an accurate injection. However, the use of fluoroscopy is known to have disadvantages in terms of mobility, availability, and radiation exposure to both patients and doctors (8).

Because of such disadvantages, alternative modalities were sought. Smith et al (9) addressed this issue when they reported on an ultrasound-guided piriformis injection technique.

In our practice, we routinely employ motor stimulation in piriformis muscle injections. Its use has added value in that it corroborates the clinical suspicion of piriformis syndrome as muscle contractions evoked by stimulation simulates the patient's usual pain at the piriformis muscle.

To our knowledge, this is the first report on the use of ultrasound and muscle stimulation in piriformis muscle injection. This report aims to evaluate the usefulness of ultrasonography and motor stimulation in confirming the precise placement of the needle in patients undergoing piriformis muscle injections.

METHODS

The patient was placed in a prone position, cleaned, and draped. The method of locating the sciatic nerve as proposed by Smith et al was adopted in this case (9). A Micromaxx ultrasound machine (SonoSite, Inc. Bothell, WA, USA) and 5–10MHz, 38-mm broadband linear probe were used. The linear probe was initially positioned such that its lateral side was medial to the greater trochanter and the medial side was lateral to the ischial tuberosity. The sciatic nerve was identified as an oval, honeycomb structure with mixed echogenicity (Fig. 1). It was followed cephalad until it coursed beneath the piriformis muscle and medially towards the sacrum. An imaginary line (Line A), parallel to and approximately 3.5 inches from the spine, was drawn tracing the longitudinal course of the sciatic nerve as visualized with the ultrasound. Another imaginary line (Line B) was marked between the inferior border of the sacroiliac joint and greater trochanter. This marked the approximate location of the piriformis muscle. The needle entry point was 2 cm lateral to Line A and along Line B (Fig. 2). Before local anesthetic infiltration, the entry point identified via ultrasound was confirmed with fluoroscopy.

A 22-gauge, 10cm insulated needle was inserted perpendicular to the piriformis muscle. The motor stimulator was set at 0.8mA and distinct gluteal muscle twitching in a supero-medial direction with greater than 45° from the horizontal axis was noted. At this point, the linear probe was positioned parallel to the piriformis muscle fibers, such that the needle was in an in-plane orientation (P2). The gluteus maximus and piriformis muscles were visualized and demarcated by the sheath and appears as a hyperechoic band. The needle was advanced until ultrasound visualization showed it traversing the gluteus maximus and piercing the piriformis muscle. The twitching then changed in orientation to supero-medial with less than 45° angulation from the horizontal line. At this point, the patient was asked if she was having any buttock pain and if it coincided with her usual pain. After an affirmative response from the patient, one milliliter of contrast medium was injected and its spread into the belly of the piriformis muscle is seen real time via ultrasound (Fig. 3). Correct needle placement was confirmed with fluoroscopy, after which, the injectate containing the drugs were administered.

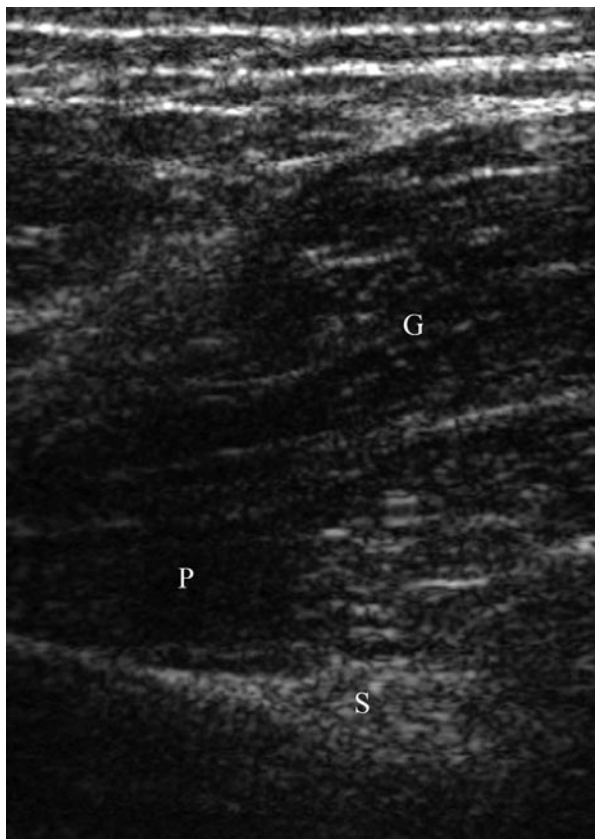


Fig. 1. An ultrasound image showing the gluteus muscle (G), the piriformis muscle (P), and the sciatic nerve (S)

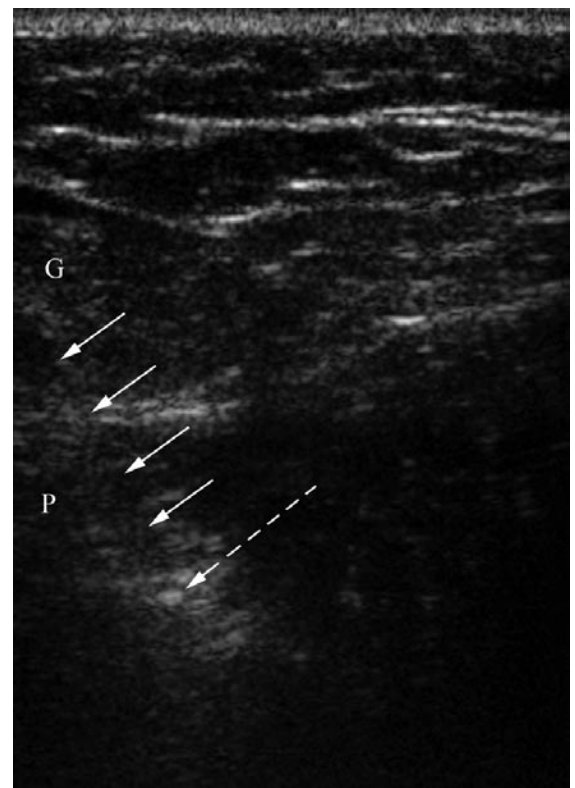
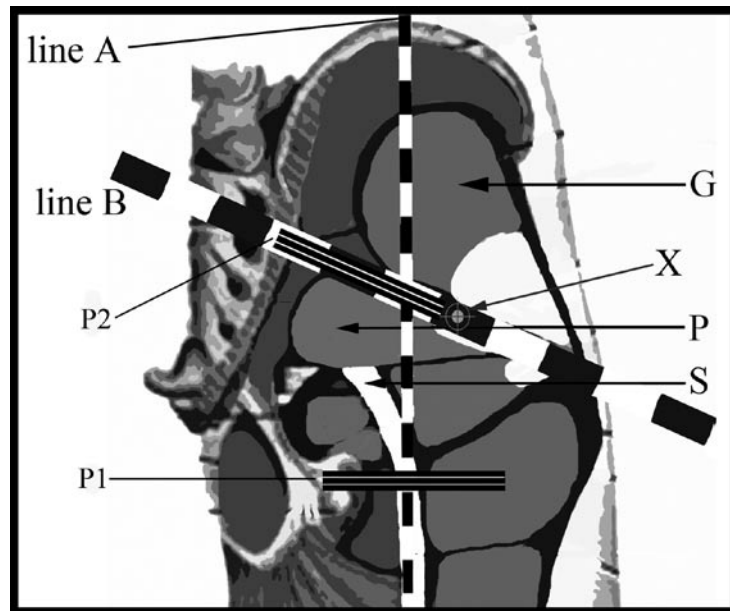


Fig. 3. Piriformis Injection. The solid arrows outline the shadow of the needle shaft. The needle pierced through the gluteus muscle (G) and into the belly of the piriformis muscle. The broken arrow points to the tip of the needle with the injectate visible around it.

Fig. 2. The needle entry point is depicted by Point X, which lies along Line B and is 2cm lateral to the longitudinal Line A. P1 is the initial position of the ultrasound probe such that its lateral side was medial to the greater trochanter and the medial side was lateral to the ischial tuberosity. P2 shows the position of the ultrasound probe parallel to the piriformis muscle fibers with an in-plane needle. The illustration also shows the gluteus maximus (G), piriformis muscle (P), and sciatic nerve (S).



DISCUSSION

Various techniques of piriformis injection have been described in the literature. Enhanced accuracy in performing such procedures has been made possible with the aid of fluoroscopy, computed tomography, magnetic resonance imaging, nerve stimulation, and EMG. Although no study has yet validated the value of motor stimulation in piriformis muscle injections, its use allows us to ascertain whether the pain generator is indeed the piriformis muscle. If the patient did not feel pain upon contraction of the piriformis muscle, the needle can then be redirected to seek out other adjacent muscles that can be the possible sources of pain. Furthermore, the direction of the muscle twitch helps differentiate the piriformis muscle from the gluteus maximus. As the needle advances through the muscle layers, the twitch noticeably changes from the steep angulation (> 45°) of the gluteus maximus to the more horizontal contraction of the piriformis muscle (< 45°).

Through the years, modern ultrasound machines have progressively improved in terms of image quality. It is portable and easily available, as it is standard equipment in most hospitals. Ultrasound is a reliable tool that allows real-time scanning of the piriformis muscle and adjacent anatomic landmarks, thus assuring reproducibility of technique and facilitating needle

insertion. It permits accurate localization of the sciatic nerve, avoiding inadvertent injury caused by the advancing needle. The needle entry point proposed in this report allows the operator to puncture into the piriformis muscle lateral to the sciatic nerve.

Aside from accuracy and reproducibility, ultrasound-guided injections avoid the risks of radiation exposure that come with fluoroscopy, computed tomography, or magnetic resonance imaging (9).

CONCLUSION

The technique of using ultrasonography and motor stimulation offers several distinct advantages such as: decreased radiation exposure; improved visualization of sciatic nerve and muscles; improved portability; the possibility of being performed as an office-based procedure; and it allows confirmation of pain in the piriformis muscle with stimulation. However, the technique has drawbacks as it would require an assistant and operation of the ultrasound machine would require expertise. In spite of these disadvantages, the combined application of muscle stimulation and ultrasound, in our experience, provides an accurate, safe, and reproducible alternative for piriformis muscle injection.

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