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Manuel Reus
Juan de Dios Berná
Victoria Vázquez
Ma Victoria Redondo
José Alonso

Piriformis syndrome: a simple technique for US-guided infiltration of the perisciatic nerve. Preliminary results

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M. Reus (✉) · J. de Dios Berná · V. Vázquez · M. V. Redondo · J. Alonso
Department of Radiology, University Hospital Virgen de la Arrixaca, 30120 El Palmar, Murcia, Spain
e-mail: mreus@um.es
Tel.: +34-968-369498
Fax: +34-968-369498

Abstract The piriformis syndrome is an uncommon cause of sciatica, buttock or thigh pain. Because of the deep location of the muscle and sciatic nerve, infiltration has traditionally been guided by electromyography, fluoroscopy, computed tomography or magnetic resonance imaging. The aim of the present study is to describe a simple technique for ultrasound (US)-guided perisciatic infiltration of corticosteroids and anaesthetic using the inferior gluteal artery as a landmark. This technique was used satisfactorily in ten patients. Although the series in the study is limited, the procedure for US-guided infiltration of the perisciatic nerve is a quick, simple, economical and effective technique and can be considered an alternative in the percutaneous treatment of the piriformis syndrome.

Keywords Sciatica · Piriformis syndrome · Ultrasound · Ultrasound-guided · Myofascial syndrome · Pelvic pain

Introduction

The piriformis syndrome (PS) is an uncommon cause of sciatica, buttock or thigh pain. The pain normally increases on muscle contraction, palpation or after prolonged sitting. It is usually caused by alterations in the piriformis muscle such as hypertrophy, inflammation or anatomical variations, which lead to trapping of the sciatic nerve [1–3]. PS is an infrequent and often wrongly diagnosed syndrome, due to its rarity, lack of specific clinical symptoms, and definitive diagnostic tests [2]. In cases in which medical treatment [stretching exercises, massages, heat, ultrasound (US), non-steroid anti-inflammatories and myorelaxant medication] for PS is not effective, the piriformis muscle is injected with local anaesthesia and steroids or botulinum toxin [1, 4, 5]. Some authors [6] also inject diluted local anaesthetic and steroids into the perisciatic region. The traditional procedure consists of blind injection into the area of maximum pain. Techniques such as electromyography or computed tomography (CT) are currently used to identify the piriformis muscle, and a nerve stimulator to identify the sciatic nerve [1, 5, 7]. A limitation for further development of these techniques is due to the unavailability of muscle electromyography and CT in many hospitals. Recently [8], ultrasound-guided infiltration of the piriformis muscle has been described using bone references.

The purpose of our study is to describe a technique based on US-guide perisciatic infiltration of steroid and local anaesthetic. The inferior gluteal artery is used as a landmark to localise and identify the sciatic nerve, when it passes below the piriformis muscle.

Materials and methods

Patients

Between June 2005 and January 2007, ten patients (eight females and two males; age range: 19–60 years; mean age: 45 years) diagnosed with unilateral PS (seven right and three left) were referred from the Traumatology and Rheumatology Departments to our Ultrasonography Unit for treatment with US-guided percutaneous perisciatic injection of triamcinolone acetonide diluted with local anaesthetic.

The diagnosis of PS was established from the following: clinical history, physical exploration, EMG findings and by

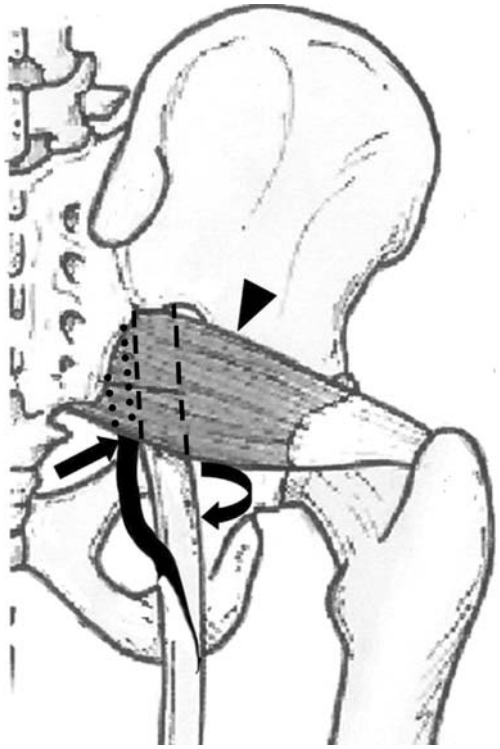

Fig. 1 Diagram of the posterior aspect of the pelvis showing the relationship between the piriformis muscle (*arrowhead*) and the inferior gluteal artery (*arrow*) and sciatic nerve (*curved arrow*). Trajectory below the piriformis muscle of the inferior gluteal artery (*dotted lines*) and sciatic nerve (*dashed lines*)

excluding other causes of sciatic pain. PS was suggested by pain on palpation of the sciatic notch and reproduction of pain with manoeuvres that stretch or contract the piriformis muscle over the sciatic nerve (Frieberg, Beatty and Pace manoeuvres) [9, 10].

The patients were given detailed information on the procedure and informed written consent was obtained from all of them. The present study was approved by our Hospital's Ethics and Research Commission.

Technique

The procedure in all cases was carried out by an ultrasonographer with expertise in infiltrations of the musculoskeletal system (MR) using an EnVisor device (Royal Philips, Eindhoven, Netherlands) equipped with a 7- to 12-MHz multifrequency transducer. The inferior gluteal artery is used as a landmark to identify the sciatic nerve, which is located just beside it and lateral to the exit of the greater sciatic notch (Fig. 1).

The perisciatic infiltration technique involves the following steps:

1. Location of the inferior gluteal artery.
   With the patient in the prone position, the transducer is placed over the pathological gluteal region at the level of the supero-internal quadrant, the inferior gluteal artery is located by transverse sections with colour power Doppler, and the sciatic nerve is observed lateral to the artery as an ovoid structure with hyperechogenic points inside similar to a honeycomb (Fig. 2).
2. Location of the puncture site.
   Longitudinal US sections are taken on the inferior gluteal artery, and once situated on the longitudinal axis of the inferior gluteal artery we move the transducer laterally a little to clearly identify the sciatic nerve as a fibrillar hyperechogenic structure below the piriformis muscle (Fig. 3). Once the position of the sciatic nerve is confirmed, the skin is marked with a permanent marker pen (Fig. 4).
3. Perisciatic infiltration.
   Under conditions of rigorous asepsis, the transducer is inserted into a sterile bag, and a sterile gel applied to the area of interest. We then perform percutaneous perisciatic injection of 1 ml of triamcinolone acetonide (1 ml = 40 mg of triamcinolone acetonide, Bristol-Myers Squibb) diluted in 1 ml of 2% mepivacaine using a 3.5-inch 22-gauge spinal needle (B/Braum) under US guidance. The direction of the needle is controlled by longitudinal sections of the sciatic nerve.

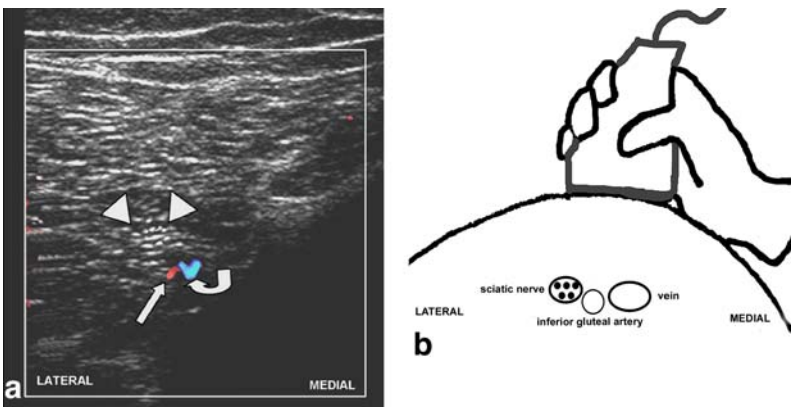

Fig. 2 **a** Transverse colour Doppler sonography in the supero-internal quadrant of the left buttock showing the inferior gluteal artery (*arrow*) and vein (*curved arrow*) and laterally the sciatic nerve (*arrowheads*). **b** Schematic illustration of **a** showing the transducer placement on the skin of the left buttock

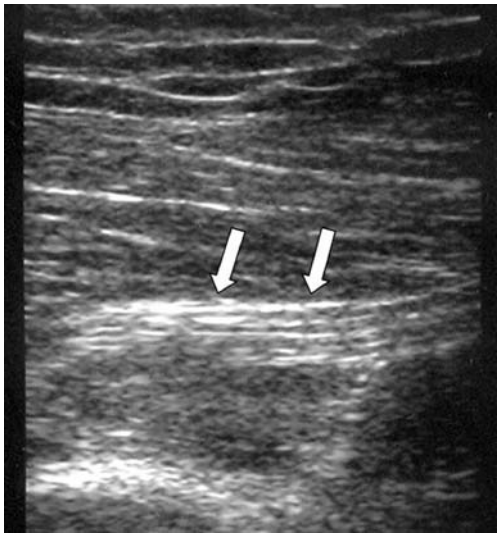

Fig. 3 Longitudinal sonography revealing the sciatic nerve as a fibrillar hyperechogenic structure (*arrows*)

The free-hand technique [11] was used for injection. With this method, one hand holds the transducer whilst the free hand pushes the needle towards the perisciatic region (Fig. 5), as perpendicular as possible to the US beam to identify the route of the needle (Fig. 6). This technique allows changes in needle direction during puncture.

All the patients were followed up weekly for the first two months by the specialists involved (traumatologists and rheumatologists).

Results

All the patients in this study received US-guided perisciatic infiltration satisfactorily. The average time of the procedure was 8 min (range: 5–10 min). Three patients felt a slight weakness in the lower limb after perisciatic injection, which disappeared spontaneously a few hours later. No local or general complications were observed after injection.

The symptoms in eight (80%) of the patients in this study diminished progressively after the first week. The two remaining cases (20%) required a further infiltration at 2 weeks because the pain had not remitted. The symptoms disappeared in all the patients 2 months after perisciatic infiltration.

Discussion

The piriformis muscle originates from the anterior part of the sacrum, exits the pelvis through the greater sciatic foramen and inserts distally on the upper border of the great trochanter; it is innervated by branches from S1 and S2 [12, 13].

PS is a form of myofascial pain syndrome caused by contracture of the piriformis muscle and characterised by pain in the buttocks, hip and posterior part of the thigh. These symptoms are aggravated by prolonged hip flexion, adduction and internal rotation. PS and the lumbar facet syndrome can occasionally coincide [5]. About 5–8% of all patients with low back pain and cases of sciatica may be caused by PS [1, 7, 12–14]. The diagnosis of PS is an exclusion diagnosis. All diagnostic techniques must rule out pathology of the spine, hip and sacroiliac joints [13, 14].

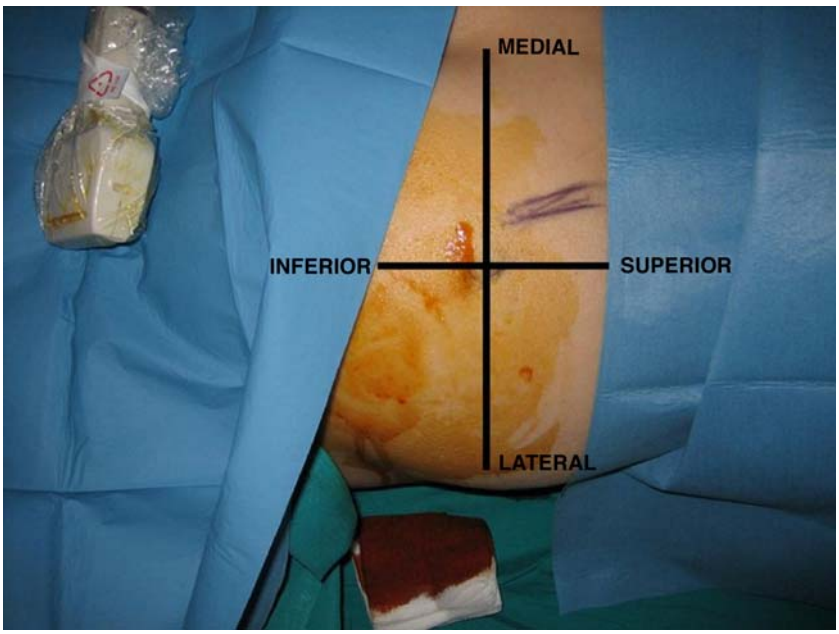

Fig. 4 Photograph of the patient's right buttock with the course of the sciatic nerve traced on the skin to its exit through the greater sciatic foramen. The buttock is divided into four quadrants (*black lines*)

Fig. 5 Photograph of the patient's left buttock shows the free-hand technique. One hand holds the transducer while the other one moves the 22-gauge spinal needle until the perisciatic region located below the piriformis muscle. The *crest* of ilium situation is drawn on the skin as a *curved black line*

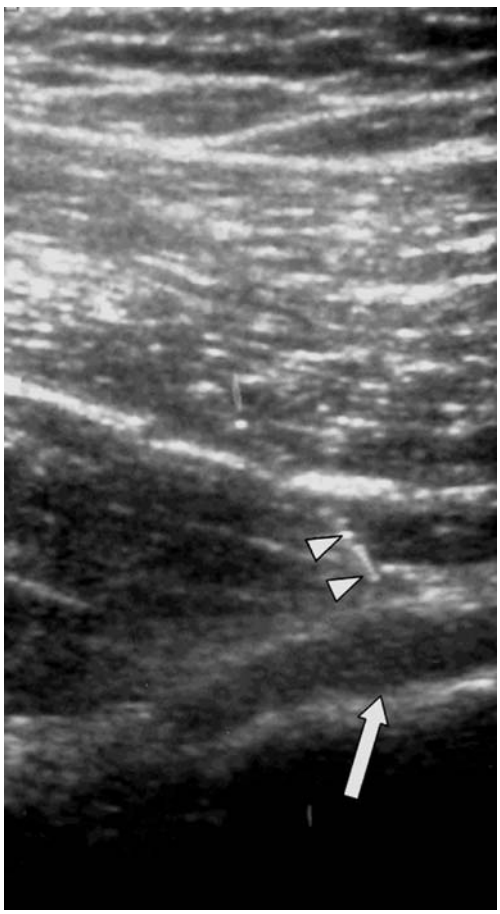

Fig. 6 Grey-scale longitudinal sonography revealing the echogenic course of the needle (*arrowheads*), through the piriformis muscle with the tip located posterior and nearby to the sciatic nerve (*arrow*)

PS should be included in the differential diagnoses of low-back pain and sciatica, specially when there is no pathology in the lumbar spine or in the hip joints. This syndrome is usually mistaken for a herniated disc. Spinal stenosis, trochanteric bursitis, sacroiliac joint pathology, pelvis tumor and endometriosis, should be considered in the differential diagnoses. These conditions can often be eliminated by means of a detailed medical history and a thorough physical examination. [1, 13, 14]. CT and magnetic resonance imaging (MRI) can be useful in some patients, in order to make a correct diagnosis [1, 2].

Traditional treatment for this myofascial syndrome includes stretching exercises, massages, heat, US, non-steroid anti-inflammatories and myorelaxant medication. Conservative treatment is sufficient in many cases. Patients who do not respond to a conservative therapy are candidates for local infiltration of anaesthetics and steroids [1]. Some authors suggest that the injection be given in the muscular stomach, whilst others prefer injecting in the medial aspect of the muscle or in the side [1, 14]. Botulinum toxin has also proved efficient for treating PS and to have a longer-lasting effect [15]. In a randomised study, Graboskiet al. [16] compared botulinum toxin injection with a local anaesthetic in the treatment of myofascial pain syndrome and found no statistically significant differences between either. The results of the study together with the high cost of botulinum toxin advise against using it as a first line of treatment.

Hypertrophy and inflammation of the piriformis muscle, leading to sciatic nerve compression, irritation, and swelling, are thought to be the causes of the radiating leg pain in piriformis syndrome. Perisciatic injection of steroid and local anaesthetic at the site of nerve compression was shown to reduce nerve swelling, reduce ectopic discharge,

and facilitate the recovery of nerve conduction following nerve injury. In our study, we have chosen the perisciatic nerve infiltration based on other authors' studies [6]. The perisciatic and the piriformis muscle infiltrations are two techniques useful to treat the PS, although, at the moment, there are no conclusive studies about the advantages of both techniques. It would be necessary to make a prospective randomised study to compare these techniques.

Hanania and Kitain [6] recommends using lower concentrations of local anaesthetics to prevent motor block in the sciatic nerve. Motor block associated with injection of a high concentration of local anaesthetic was minimal in our study.

Various authors have used electromyography, fluoroscopy, CT or MRI [5, 17] as a guide for infiltration of the piriformis muscle. However, the US-guided perisciatic infiltration technique described in this study in quick, simple, efficient and well tolerated by patients. The inferior gluteal artery used as a landmark is easily identifiable with colour power Doppler; we can also direct the needle towards the periphery of the sciatic nerve and control the advance of the needle at all times. Moreover, as there is no ionizing radiation exposure the procedure can be used in pregnant women. Smith et al. [8] also uses US to guide injection, but unlike us used bone structures as landmarks and the injection was given inside the piriformis muscle.

Surgery may be indicated in cases that resist medical treatment or when there is an anatomical alteration in the piriformis muscle. Proposed surgical treatment consists of reducing the volume of the muscle, dissecting it or excising it [1, 18].

In conclusion, although our study is limited to a few patients, we believe that the use of US to guide perisciatic injection, and using the inferior gluteal artery as a landmark, is a quick, simple, economical and effective technique. We consider this procedure to be an interesting option in the percutaneous treatment of PS.

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