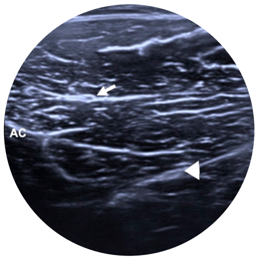

Ultrasound of the peripheral nerves of the lower extremity

Ultrasonido de los nervios periféricos de la extremidad inferior

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Summary

Recent advances in ultrasound technology and the development of high-resolution ultrasound transducers have enabled detailed depiction of superficial musculoskeletal structures, tendons and nerves, allowing the method to become more competitive, positioning it as the first choice over other imaging modalities in the assessment of tendon and nerve diseases. While in the past considered as complementary to magnetic resonance (MR) imaging, modern ultrasound has clearly become competitive. It is now the imaging modality of choice for evaluating tendon and neural pathology. The major advantages of ultrasound include dynamic evaluation of structures, low cost and wide availability. The main disadvantage is a high degree of operator dependency and the experience of the operator is essential for its acquisition and interpretation. This article reviews the technique and anatomical markers in the ultrasound appearance of the most common peripheral nerves of the lower limb.

Resumen

Los recientes avances en los equipos de ultrasonido y de sus transductores han permitido la mayor competitividad del método, posicionándose como la primera opción sobre otras modalidades de imagen en la valoración de las enfermedades de los tendones y nervios, gracias al incremento en la resolución para visualizar y explorar los tendones y los nervios periféricos. El ultrasonido (US) se consideraba un complemento de la resonancia magnética (RM); sin embargo, con los equipos modernos, se ha convertido en la mejor modalidad diagnóstica para la revisión de los nervios periféricos, aceptada cada día más, debido a la rapidez, disponibilidad y la característica dinámica del método ecográfico. La desventaja principal es que depende del operador y que la experiencia de quien lo realiza es fundamental para su adquisición e interpretación. Este trabajo muestra una breve revisión de la técnica y de los marcadores anatómicos en la valoración de los nervios periféricos más comunes de la extremidad inferior.

1. Introduction

The latest technological advances - specifically, the technical improvement of transducers with a frequency greater than 12 MHz - have facilitated the choice of ultrasound (US) as a complementary imaging method for the evaluation of peripheral nerves, which benefits the care of patients with disorders in the small nerve branches of the extremities, difficult to assess due to the complexity of their anatomy, and for which magnetic resonance imaging (MRI) does not provide additional information. This, together with the other advantages of US, allow it to be considered the first diagnostic option (1-4).

The known advantages of this method are: safety, good patient tolerance, low cost, wide availability; it is a complementary modality with superior quality in the dynamic evaluation of peripheral nerves.

The disadvantages depend on the availability of equipment with high resolution and on the skill and knowledge of the person performing it. Hence the importance of knowledge of the sonoanatomy of peripheral nerves.

Previous reports have pointed out the convenience of the comparative study when performing ultrasound examination of the healthy side, particularly in the upper extremity (5, 6).

It is important to remember that the complete musculoskeletal US includes the review of the nerve structures, exploration of the muscles, tendons and vascular structures in the routine examination (7). In the image, qualitative and quantitative parameters of the structure are evaluated: morphology, echotexture and others, such as vascularity with the color Doppler tool (the normal nerve does not show signal in the Doppler). Quantitative ones comprise the measurement of the cross-sectional area of the nerve and, in more recent years, the measurement of hardness by the different elastography modalities, with some drawbacks due to the lack of standardization of criteria (3, 7-9).

Recently, Martinoli and Tagliafico have introduced the term nerve density, as the ratio between hypoechoic and echogenic areas of the nerve. That quantitative

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measurement describes the internal fascicular echotexture of peripheral nerves and is another feature that allows US to be considered a quantitative imaging biomarker technique. Additional information published by Carlo Martinoli and Alberto Tagliafico (3, 10-12) is suggested to the reader.

In summary, US is an effective technique in the evaluation of tendons and nerves (4).

As a general concept, the complete evaluation of the thicker nerves, such as the femoral and sciatic nerves, in their intrapelvic course and in the proximal plexus, is performed with MR imaging. While US is the best imaging method in the review of medium and small nerves, as well as superficial nerves: lateral femoral cutaneous nerve, pudendal nerve, iliohypogastric nerve, ilioinguinal nerve, genitofemoral nerve, posterior femoral cutaneous nerve, superior gluteal nerve and obturator nerve (13).

2. Examination technique

Examination of these nerve structures usually involves the use of a soft tissue transducer with a frequency between 10-18 MHz, although more superficial nerves are not identified unless a frequency of 18-24 MHz is used.

The preferred and simplest slice plane for nerve demonstration, in the proximal to distal scan, is the short or transverse axis.

When the ultrasound approach is for therapeutic purposes, in plane scanning is preferred, with the nerve in the transverse cutting plane and the needle or marking oriented perpendicular to it.

For the figures illustrating this article, ultrasound equipment with linear transducers with a frequency range of 10-18 MHz was used. In the exploration of the ankle and foot, the use of small transducers is suggested, such as the one commonly called "golf club". The ideal bone marker was taken as an anatomical reference, as in the osteofibrous tunnels, or the anatomical muscular or vascular structures of interest, in relation to the nerve in question.

The simplest way to search for a nerve is by means of anatomical markers, whether it is a muscle, an artery, a vein or a bone structure. The approach in the short axis or axial plane is used to recognize this anatomical marker and look for the follicular pattern of the nerve and, finally, use the "elevator up" technique, described by Martinoli, by sweeping proximally to distally, in such a way that the nerve can be visualized from the brachial plexus to the finger or from the groin to the foot, depending on the upper or lower extremity, respectively (14).

3. Ultrasound appearance

3.1. Normal

The normal ultrasound pattern of the nerve is fascicular. The "honeycombed" description is due to the sum of the individual hypoechoic nerve fascicles, surrounded by echogenic connective tissue (epineurium) (Figure 1).

In the short axis or transverse plane, the peripheral nerve shows a "honeycombed" appearance or stippled pattern which facilitates its identification, as it can be differentiated from the fibrillar, linear pattern of the tendon. Tendons in the short or transverse axis scan plane show a punctate pattern of thin, compact echoes surrounded by the paratendon or tendon sheath. Characteristically, the tendon presents anisotropy as there is loss of the angle of incidence of the transducer with the perpendicular axis of the tendon, which occurs with angulation from 5 degrees, a phenomenon that does not occur when evaluating the nerve fascicles (15-17).

Nerve fascicles are composed of axons, Schwann cells, collagen and endoneural fluid, surrounded by epineurium. This characteristic is what produces the palisaded or "honeycombed" appearance in the short-axis plane, where the hypoechoic bundles are surrounded by echogenicity due to connective tissue and collagen. In the long axis plane, the nerves have predominance of hypoechoic fascicles surrounded by echogenic lines, the epineurium (2, 16, 18).

3.2. The sciatic nerve

The sciatic nerve is the longest nerve in the body, formed from the nerve roots L4 to S3. It provides motor innervation to the posterior thigh, leg and foot muscles and sensory innervation to the leg. It emerges from the pelvis through the sciatic foramen, anterior to the piriformis muscle, has a deep course to the gluteus maximus, lateral to the ischial tuberosity which at the level of the gluteal crease, are used as anatomical markers such as bones or constant neighboring structures to facilitate identification of this nerve. In the proximal thigh, the sciatic nerve is located lateral to the hamstrings, deep to the biceps femoris and lateral to the semimembranosus; in the middle third of the thigh the nerve is surrounded by fat, with a follicular pattern easy to identify and its bifurcation is identified in the apex of the popliteal space to originate the anterior branch or tibial nerve and the posterior branch or common peroneal nerve (16) (figure 2).

3.3. The lateral femoral cutaneous nerve

The lateral femoral cutaneous nerve, also known as the lateral cutaneous nerve of the thigh or femorocutaneous nerve, originates from the dorsal divisions of L2 and L3. It is a purely sensory nerve that emerges from the external border of the psoas major, pierces the fascia as it courses toward the anterosuperior iliac spine. Normally, it exits the pelvis as it passes under the inguinal ligament. Subsequently, in the anterolateral thigh, it divides into anterior and posterior branches, superficial to the sartorius in approximately 60% of cases. It is difficult to evaluate by MRI, so US is the modality of choice for both diagnostic and therapeutic purposes (13, 16).

Anatomical variants are common. The distance of the lateral femoral cutaneous nerve to the anterosuperior iliac spine can range from 3 mm to 7.3 cm in the exploration of the inguinal ligament (19, 20).

The technical approach is that described by authors such as Tagliafico and Martinoli. In the transverse or oblique axial plane, the reference is the anterosuperior iliac spine, located in the lateral end of the image, it is shown as an echogenic line with posterior acoustic shadow; the lateral femoral cutaneous nerve is medial to the anterosuperior iliac spine; in the image invariably appear the sartorius muscles, medial and anterior, and the tensor of the fascia lata, the largest muscular mass, with lateral situation (14) (figure 3).

3.4. Pudendal nerve

The pudendal nerve originates from the ventral divisions of S2, S3 and S4. It enters the gluteal region by crossing the greater sciatic foramen, between the piriformis and coccygeus muscles. It enters the pelvis through the lesser sciatic foramen near the sacrotuberous and sacrospinous ligaments; it then divides into small branches, some smaller than 1 mm in diameter, sometimes visible by ultrasound. The most constant branches visible by US are the dorsal penile or dorsal clitoral nerve, the perineal nerve and the inferior anal nerves.

Martinoli and Tagliafico have described the posterior, medial and anterior approach planes and may require additional review with convex transducer (21).

This difficult to explore nerve can be approached in the posterior approach, with the patient in prone position, in which the transducer is

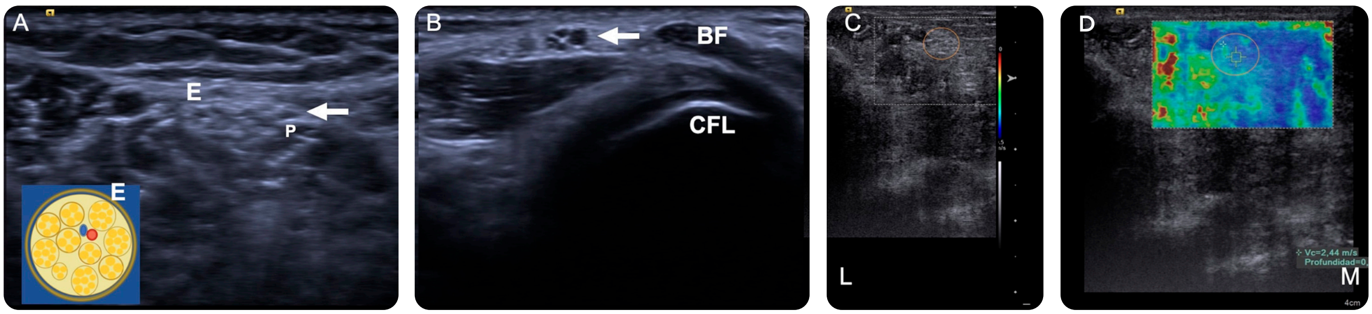

Figure 1. a) Axial image obtained with 18 MHz transducer in the posteromedial aspect of the distal leg with the tibial nerve (arrow). Echotexture shows fascicular pattern of hypoechoic nerve fibers surrounded by echogenicity the perineurium (p); the epineurium (E) is intermingled with fat. b) Transverse image in the posterolateral region of the knee with the fibular nerve (arrow), shows hypoechoic multifascicular pattern surrounded by fat. (LFC: lateral femoral condyle, BF: biceps femoris, L: lateral and M: medial). c) Axial image of the distal leg with the tibial nerve (arrow), acquisition image with 9 MHz transducer and preset program with depth of 4 cm prior to quantitative elastography measurement. d) Transverse image with shear wave elastography and value of 2.44 m/s with 9 MHz transducer.

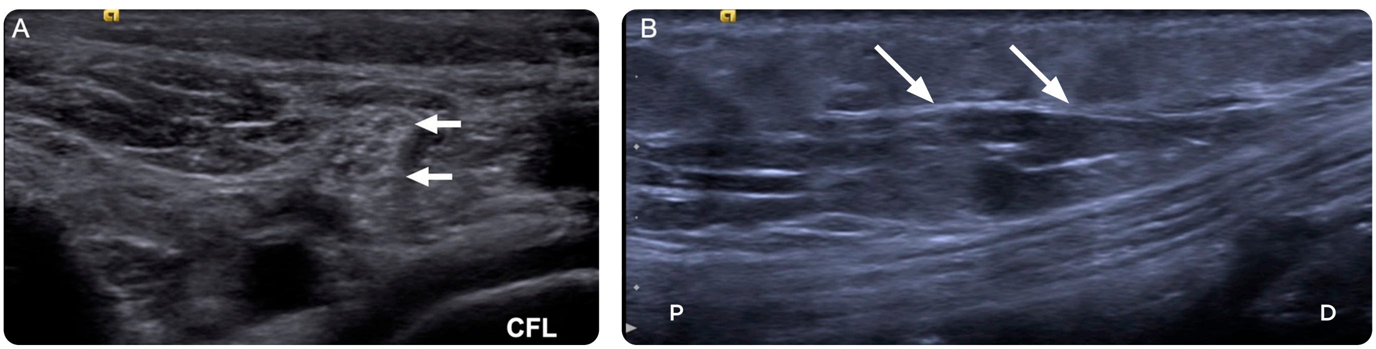

Figure 2. a) Transverse image of the popliteal fossa with the sciatic nerve (arrows) (CFL: lateral femoral condyle). b) Sagittal image of the sciatic nerve (arrows) (P: proximal, D: distal).

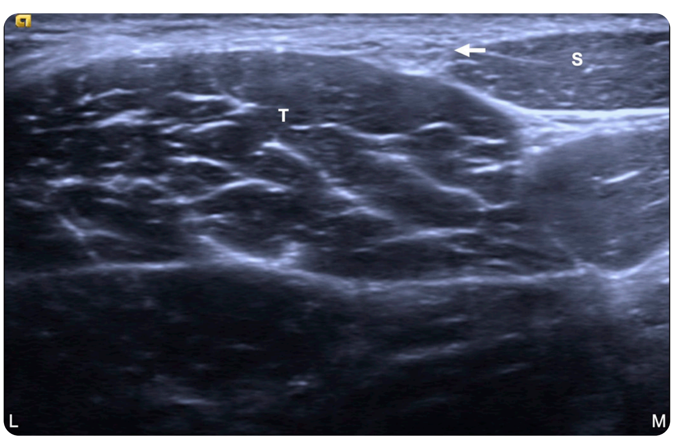

Figure 3. Axial image in the inguinal region: lateral femorocutaneous nerve (arrow), surrounded by fat (S: sartorius, T: tensor fascia lata, L: lateral, M: medial).

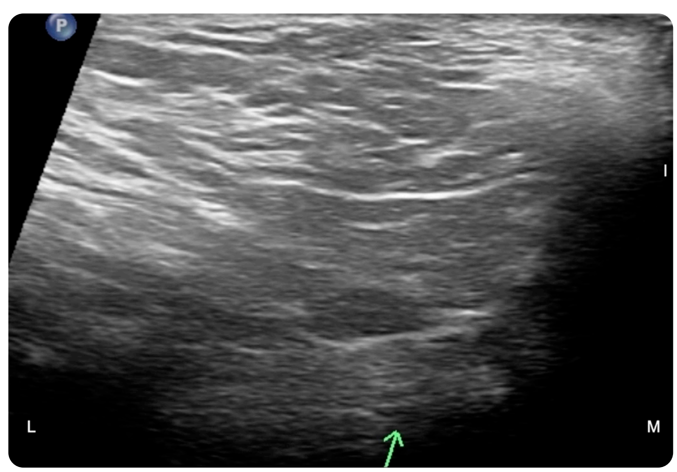

Figure 4. Transverse image with medial approach with the pudendal nerve (arrow) (I: ischium, L: lateral, M: medial).

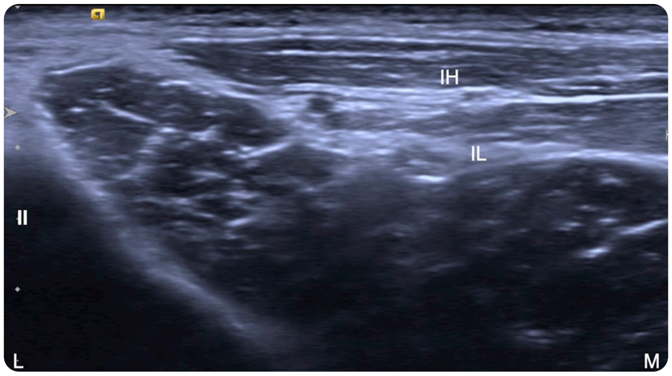

Figure 5. Transverse image of the lower abdomen with the ilioinguinal (IL) and iliohypogastric (IH) nerves between the oblique muscles and the transversus abdominis (IL: iliacus, L: lateral, M: medial).

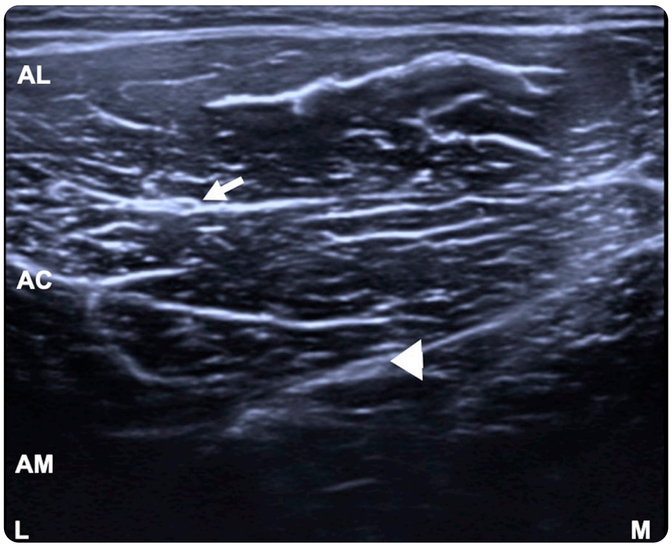

Figure 6. Transverse image of the proximal thigh in the region of the adductors, the anterior branch of the obturator nerve (arrow) and the posterior branch (arrowhead) between the adductor longus (AL), adductor brevis (AC) and adductor magnus (AM) muscles (L: lateral, M: medial).

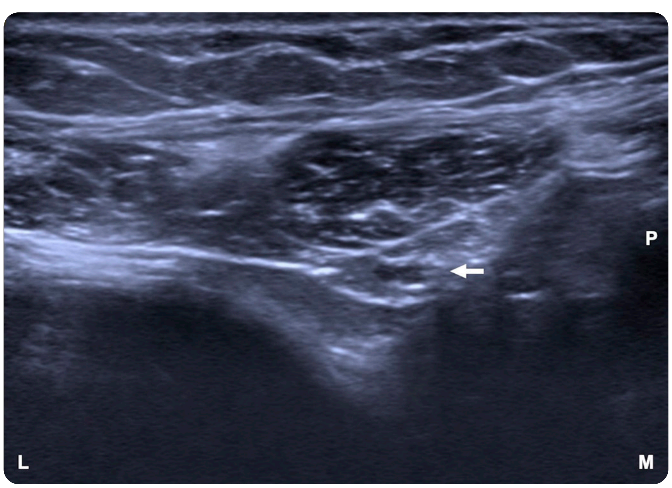

Figure 7. Transverse image in the lower abdominal region, caudal to the inguinal ligament showing the genitofemoral nerve (arrow) (P: pubis, M: medial, L: lateral).

placed in the topography of the iliac spine, at the site of visualization of the sacrotuberous ligament, using the identification of the internal pudendal artery that accompanies this nerve.

In the medial approach technique, the patient is in prone position with moderate abduction of the femurs, with transducer in the axial plane at the level of the ischial tuberosity which is then rotated cephalad at 45 degrees, seeking a mediolateral position between the ischial tuberosity and the hamstring spine, in a plane perpendicular to the sacrotuberous ligament; the nerve follows an oblique direction to this ligament.

In the anterior approach, the patient adopts a gynecological position and allows palpation of the ischial tuberosity with flexion of the hips and knees; the transducer in sagittal orientation can allow visualization of the pudendal artery and nerve (posterior) or if the transducer is directed anteriorly, in the perineum, it allows identification of the distal branches (13, 21, 22) (figure 4).

3.5. Iliohypogastric nerve

It originates from the first lumbar branch (L1), emerges from the upper part of the lateral border of the psoas major and crosses in an oblique direction in front of the fibers of the quadratus lumborum towards the iliac crest. It then pierces the posterior part of the transverse abdominis near the iliac crest and divides, between the transverse abdominis and the internal oblique, into the lateral and anterior cutaneous branches. With the use of color Doppler, the monofascicular pattern of the iliohypogastric nerve is easily identified in the oblique cut plane, between the transversus abdominis and internal oblique muscles of the abdomen (21) (figure 5).

3.6. Ilioinguinal nerve

It originates from L1, is a smaller branch than the iliohypogastric, arises from the lateral border of the psoas major, just inferior to the iliohypogastric and runs in an oblique direction, crosses the quadratus lumborum and iliacus; it then pierces the transverse abdominis near the anterior portion of the iliac crest and communicates to the iliohypogastric between the transverse abdominis and the internal oblique. When it is very small, it joins the iliohypogastric.

It is identified 1 to 2 cm medial and cephalad to the anterosuperior iliac spine, in the fascia compartment, between the internal oblique and the transverse abdominis muscle. Sensory innervation is variable due to overlap with the iliohypogastric; as a general rule, it provides sensory innervation to the proximal end of the inner thigh and lower abdomen (8).

3.7. Obturator nerve

It is a mixed nerve originating from the lumbar branches (L2-4) and, like the femoral nerve, constitutes a distal branch of the lumbar plexus. It provides innervation to the thigh muscles and participates in the control of adduction and rotation of the thigh, and also innervates the hip joint.

Caudal to the course in the obturator canal, the ultrasound exploration is very simple, both divisions show monofascicular and hypoechoic pattern; the anterior branch is located below the adductor longus muscle, between this and the adductor brevis, and the posterior branch is located between the adductor brevis and the adductor magnus (23) (figure 6).

3.8. Genitofemoral nerve

Also called genitocrural, it originates from L1 and L2. In the anterolateral abdominal wall it runs obliquely between the psoas fibers and emerges from its medial border, close to the spine. It descends on the anterior surface of the psoas major, covers the peritoneum and divides into femoral and genital branches (the spermatic and lumboinguinal nerves). The genitofemoral, in the groin region, enters the deep inguinal ring by crossing the inguinal canal. The small nerves described, the iliohypogastric, ilioinguinal and genitofemoral nerves and their terminal branches, can be identified in up to 60% of patients, provided that a high resolution transducer is used (13) (figure 7).

3.9. The femoral nerve

The femoral nerve is formed from the L2, L3 and L4 nerve roots. In the pelvis it arises in deep location from the psoas complex, which it passes through, innervating the psoas and iliacus muscles. It exits the pelvis into the anterior compartment of the thigh through a rigid osteofibrous tunnel, located deep to the inguinal ligament, here separated from the femoral artery by a portion of the psoas.

The femoral nerve is easily identified in the homonymous triangle where it is located next to the superficial femoral artery and vein, and medial to the sartorius muscle. The borders of the femoral triangle are: above, the inguinal ligament; medial border, formed by the adductor longus, and the lateral border, the sartorius muscle. The femoral nerve divides into its sensory and motor branches approximately 2 to 3 cm distal to the inguinal ligament and gives rise to the saphenous nerve. The superficial femoral artery and vein are the important anatomical markers for locating the femoral nerve (8, 24, 25) (Figure 8).

3.10. The saphenous nerve

The saphenous nerve is the terminal cutaneous branch of the femoral nerve, the largest and longest. It originates from the L2, L3 and L4 branches. It provides sensory innervation to the thigh, anteromedially at the knee and medially in the distal leg. Important anatomical landmarks for its location are the femoral triangle at the thigh, the internal rectus, sartorius and greater saphenous vein at the medial aspect of the knee, and the anterior tibial tendon at the ankle. As an anatomical marker, in the ankle the saphenous nerve is located ventral to the medial malleolus, located in the vicinity of the saphenous vein. In the anterior thigh, the important marker for its localization is the superficial femoral artery. The saphenous nerve and the superficial femoral artery run through the femoral canal, deep to the sartorius (13, 16) (figure 9).

3.11. Sural nerve

The sural nerve originates in the central portion of the posterior aspect of the calf and provides purely sensory innervation to the posterolateral aspect of the leg. It originates from both the tibial nerve and the common peroneal nerve, the medial cutaneous branch of the tibial nerve and the lateral branch of the common peroneal nerve. It arises in the medial region of the leg to innervate the lateral portions of the ankle and foot; it descends between the two heads of the gastrocnemius and crosses the deep fascia, in the proximal segment of the leg. The sural runs in the subcutaneous fat, in the posterior midline along with the lesser saphenous vein; it crosses lateral to the Achilles tendon, approximately 12 cm proximal to the calcaneus and runs to the lateral border of the ankle. The important anatomical markers are the Achilles tendon and the peroneal malleolus, evident in the short axis image where the lesser saphenous vein and the sural nerve are identified in the subcutaneous fat, posterior to the lateral malleolus (16, 23, 24) (Figure 10).

3.12. Tibial nerve

The tibial nerve is composed of the L4, S1, S2 and S3 branches. It provides motor innervation to the superficial and deep compartments of the leg. The content of the superficial compartment includes the gastrocnemius, soleus and plantaris and the content of the deep compartment includes the popliteus and flexors. The tibialis also innervates the popliteus muscle and participates in the sensory innervation to the posterolateral leg via the sural nerve. In the posterior aspect of the knee, the tibial nerve is located between the medial head and lateral head of the gastrocnemius muscles and travels with the posterior tibial artery between the superficial and deep compartments of the leg.

The tibial nerve travels distally to the foot, as does the posterior tibial artery; in the ankle the tibial nerve is located posterior to the medial malleolus, with the artery and vein of the same name, between the flexor digitorum longus and the flexor digitorum longus tendon of the first toe. The tibial nerve is the largest of the divisions of the sciatic nerve. In the distal ankle, between the medial malleolus and the heel, it divides into the following branches: medial calcaneal nerve, lateral plantar nerve, medial plantar nerve and the first branch of the lateral plantar nerve (24) (Figure 11).

Baxter's nerve, the other name for the first branch of the lateral plantar nerve, is a common cause of chronic neuropathic pain in cases of heel pain. This first branch of the lateral plantar nerve is a small mixed motor and sensory branch that provides motor innervation to the quadratus plantaris, flexor digitorum brevis and abductor digitorum minimus muscles and sensory innervation to the calcaneal periosteum and plantar longus ligament or calcaneal plantar ulnaris ligament (25, 26).

3.13. Common peroneal nerve

The common peroneal nerve (CPN) or common fibular nerve, proper, originates from the nerve roots from L4 to S2. Before it separates from the sciatic nerve, it provides a motor branch for the short portion of the biceps femoris. It does not provide additional innervation until its bifurcation in the leg into the deep peroneal nerve and the superficial fibular nerve. The NPC provides sensory innervation to the lateral aspect of the proximal third of the leg via the lateral sural cutaneous nerve.

In the popliteal fossa, the common peroneal nerve is deep to the biceps femoris and lateral to the fibular head at the knee. After its superficial course, in the subcutaneous fat, it enters the osteofibrous tunnel of the neck of the fibula, in the fibular or peroneal tunnel, formed by the origin of the peroneus longus and the peroneal head. When it emerges from this tunnel, the PCN trifurcates into the deep peroneal nerve, superficial peroneal nerve and the recurrent articular branch. The most important anatomical markers for locating the common fibular nerve are the peroneal head and the homonymous tunnel.

An anatomical variant is the accessory peroneal nerve, with a prevalence of 17-28% in anatomical studies. It generally arises from the superficial peroneal nerve, in its course below the muscle mass of the

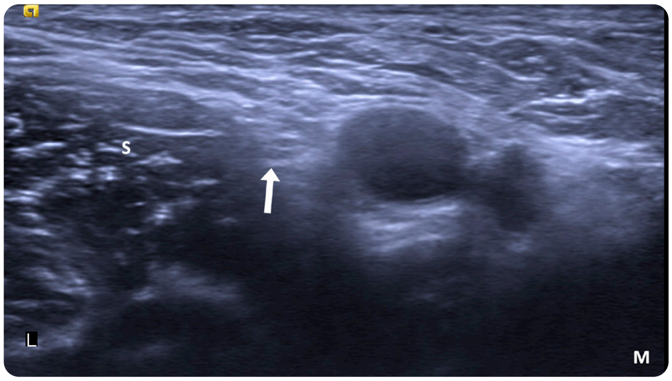

Figure 8. Axial anteromedial image of the proximal thigh, the femoral nerve (arrow) has superficial location to the femoral artery and vein (S: sartorius, M: medial and L: lateral).

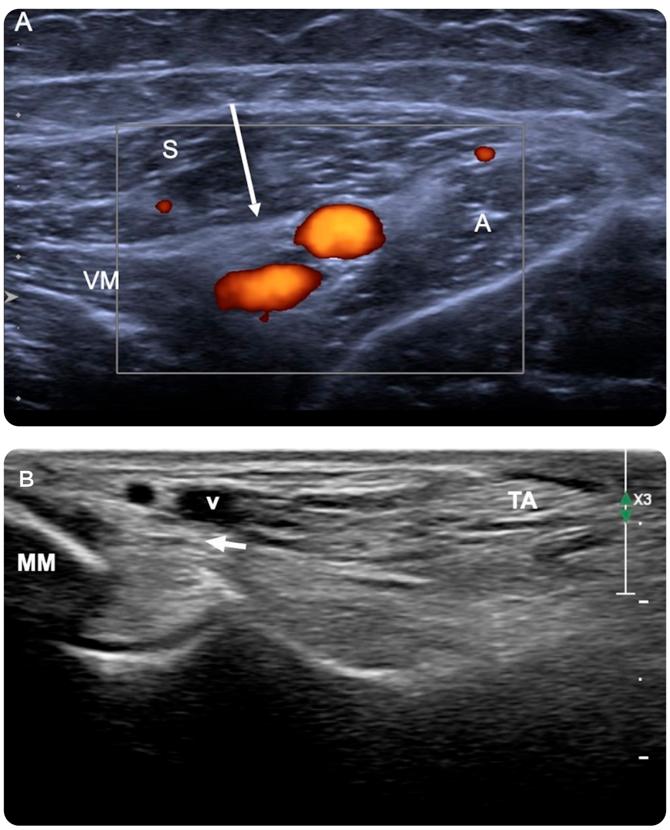

Figure 9. a) Axial image of the thigh, the saphenous nerve (arrow) has superficial location to the femoral artery and vein (S: sartorius, VM: vastus medialis and A: adductors). b) Medial transverse image in the ankle, the saphenous nerve (arrow) is located in the vicinity of the homonymous vein (v) (MM: medial malleolus, TA: anterior tibial tendon).

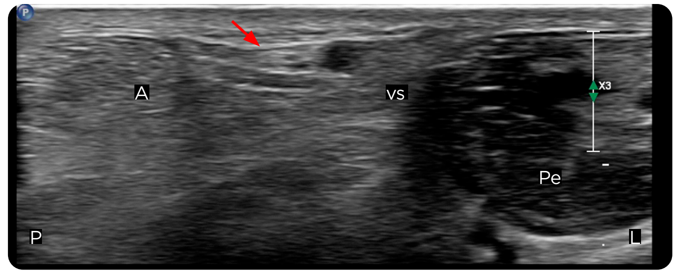

Figure 10. Axial image of the posterolateral ankle: the sural nerve (arrow) is identified between the Achilles tendon (A) and the lesser saphenous vein (vs) (Pe: peroneal, P: posterior, L: lateral).

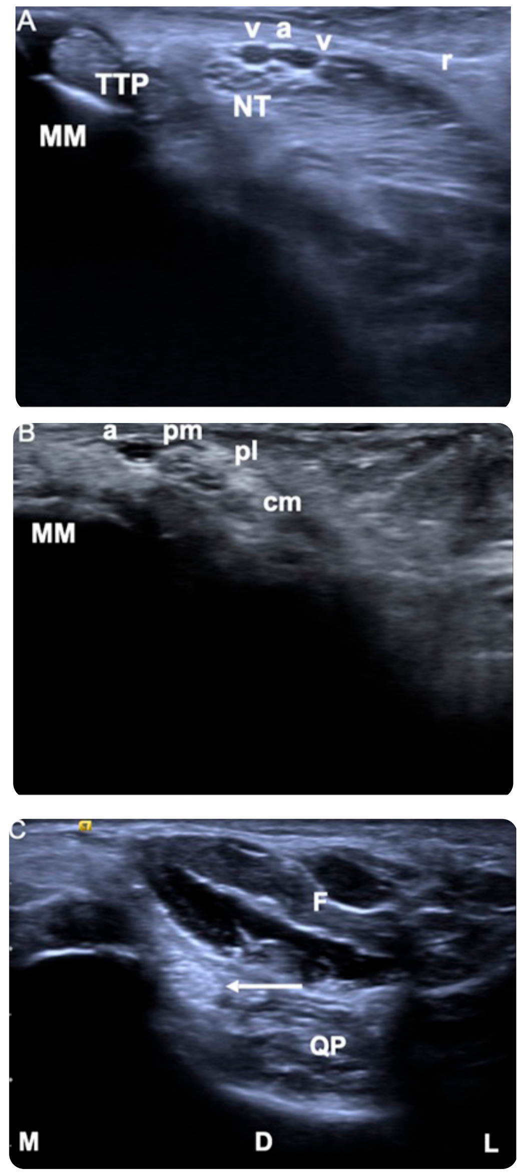

Figure 11. a) Transverse image of the tibial nerve in the ankle (TTP: posterior tibial tendon, a: posterior tibial artery and veins and r: flexor retinaculum, MM: medial malleolus). b) Distal to the tarsal tunnel the medial plantar nerve (pm), lateral plantar nerve (pl) and medial calcaneal nerve (cm) are observed. c) Transverse image in the internal region of the sole of the foot with the medial plantar nerve (arrow) (QP: plantar square and F: short flexor of the first toe, M: medial, D: dorsal, L: lateral).

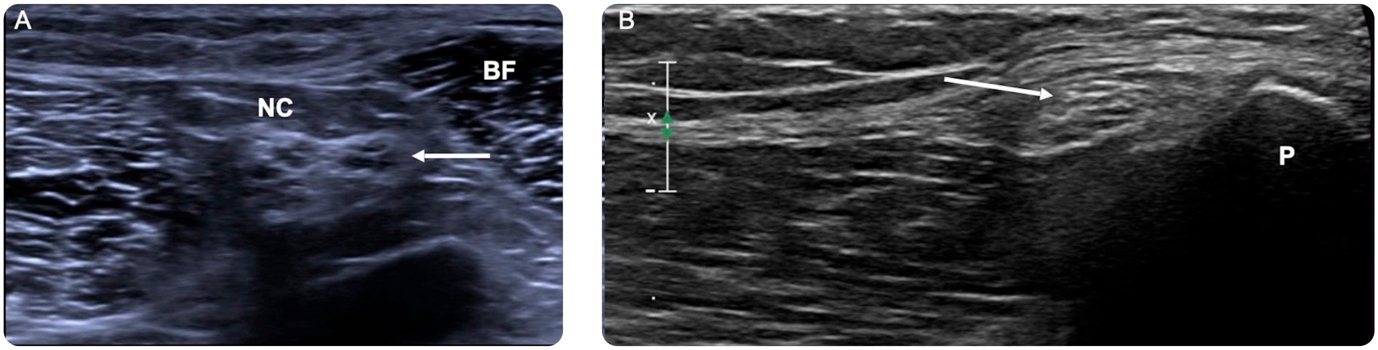

Figure 12. Axial images of the origin of the common peroneal nerve (arrow) of the sciatic nerve (NC) in the popliteal fossa and fibular head (P) (BF: biceps femoris muscle).

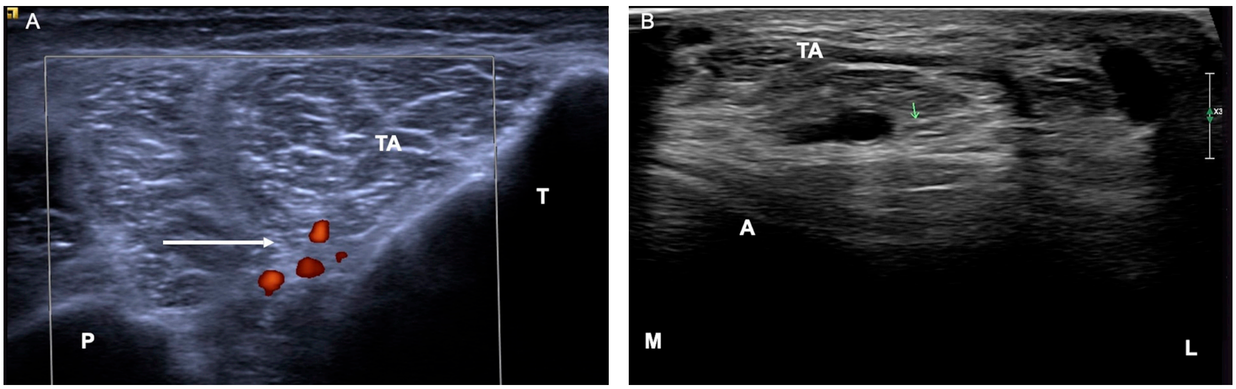

Figure 13. a) Axial Doppler image in the leg, the deep peroneal nerve (arrow) is located ventral to the interosseous membrane below the anterior tibial muscle (MTA) (T: tibia and P: perone). b) Image in the transverse plane, the deep peroneal nerve (arrow) is observed lateral to the anterior tibial artery (TTA: anterior tibial tendon, A: talus, M: medial, L: lateral).

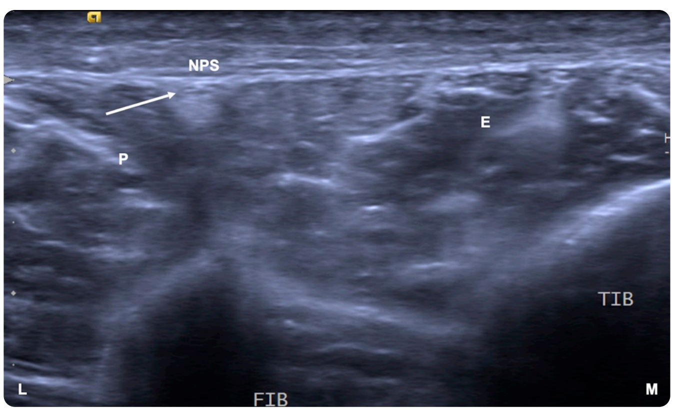

Figure 14. Axial image in the proximal leg, the superficial peroneal nerve (SPN) (arrow) is located in the aponeurotic plane between the extensor digitorum longus muscle (E) and the peroneals (P) (F: fibula and TIB: tibia, L: lateral, M: medial).

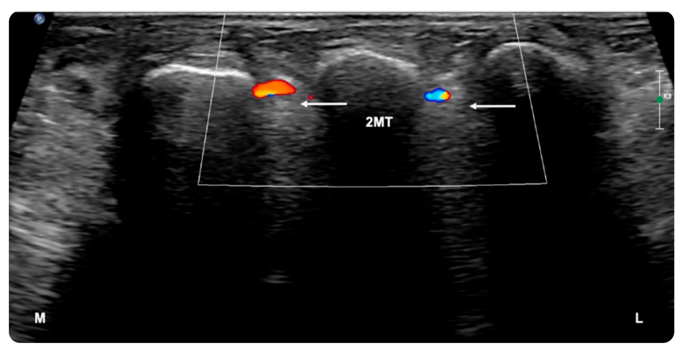

Figure 15. Transverse plane image of the metatarsals showing the nerves in the second and third intertarsal spaces (2MT: second metatarsal, L: lateral, M: medial).

peroneus brevis. It runs distally to the posterior aspect of the foot. It then innervates the extensor digitorum brevis muscle (16, 24) (Figure 12).

3.14. Deep peroneal nerve

The deep peroneal nerve is the largest division of the common peroneal nerve. In the leg it descends next to the anterior tibial artery, just in front of the interosseous membrane. This nerve provides motor innervation to the muscles of the anterior compartment. It crosses the anterior aspect of the ankle, adjacent to the anterior tibial artery, between the extensor digitorum longus and extensor digitorum longus muscles. Although it usually has lateral or external location to the anterior tibial artery, there are some anatomical variants. In the identification of the deep peroneal nerve, the anterior tibial artery is used as a marker, in the proximal to distal sweep in the short axis plane, the nerve crosses medially to laterally over the artery; the nerve has deep location to the posterior tibial artery (24) (figure 13).

3.15. Superficial peroneal nerve

The superficial fibular nerve, or superficial peroneal nerve, is a small lateral branch of the common peroneal nerve that runs in the lateral compartment of the leg; it originates in the neck of the fibula and follows an anterocaudal trajectory in the subcutaneous fat, 10 to 12.5 cm proximal to the lateral malleolus. It provides motor innervation to the peroneus brevis and peroneus longus muscles and provides sensory innervation to the lateral aspect of the leg. It has two sites of easy ultrasound localization, the superficial and subcutaneous, proximal in the leg, in the fatty plane between the anterior and lateral compartments or the distal, located laterally to the lateral malleolus (27, 28) (figure 14).

3.16. The nerves of the fingers

The nerves of the toes commonly receive fibers from both the medial and lateral plantar nerves. In the intertarsal spaces, these nerves turn sharply upward around the intermetatarsal ligament and divide into medial and lateral digital branches that innervate the adjacent digits. The medial plantar nerve gives rise to the three common digital nerves and the plantar digital nerve proper to the first toe; there are also plantar digital branches for the smaller toes. As an anatomical reference, the intermetatarsal bursa is located dorsal to the intermetatarsal ligament. It is useful the exploration with the "golf club" in the short axis plane with the color Doppler tool with the visualization of the digital artery as a guide (24) (figure 15).

4. Conclusion

The advantages of US in the review of medium and small peripheral nerves is indisputable, even superior to the MR study, provided that the operator uses anatomical markers.

This is clear when using tools such as color Doppler, performing a comparative examination and dynamic exploration according to the case under study.

It should be remembered that nerves are an integral part in musculoskeletal ultrasound, therefore basic knowledge of sonoanatomy and scanning techniques is crucial.

While in the last decade US of nerves and neuropathies has become popular -particularly in specialties other than radiology-, in the future, this seems to consolidate with technological improvement, specifically with the development of transducers and software.

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