Ultrasound Observation of the Sciatic Nerve and its Branches at the Popliteal Fossa: Always Visible, Never Seen

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Background. In studying patients with sciatic nerve (SN) varices the author found that the sciatic nerve and its major divisions, the tibial and peroneal nerves, could be readily identified on ultrasound imaging of the popliteal fossa. The sciatic nerve lies in the space between the popliteal vein and the small saphenous vein.

Objectives. To confirm that the sciatic nerve can be identified on ultrasonography in patients with venous disease as well as in normal subjects.

Method. Thirty unselected patients (60 limbs) attending for outpatient consultations were investigated by duplex ultrasound examination of the popliteal fossa. In 10 subjects varicose veins were present, in 20 no varices were visible on clinical examination.

Results. The sciatic nerve and its branches were visible and easily recognised in all cases. The sciatic nerve and the small saphenous vein lay in close proximity in cases with small saphenous vein incompetence.

Conclusions. Ultrasound identification of the sciatic nerve in the popliteal fossa allows assessment of its relationship with the adjacent veins. This technique may be useful in identifying the location of the nerve prior to surgical intervention for varices in the popliteal fossa as well as for endo-luminal occlusion procedures given the close proximity of the vein to the nerve. Sciatic nerve varices, tumours, extrinsic dislocation and nerve lesions may also be detected.

Keywords: Duplex ultrasonography; Popliteal fossa; Sciatic nerve; Venous disease.

Introduction

In studying patients with sciatic nerve (SN) varices the author found that the sciatic nerve and its major divisions, the tibial and common peroneal nerves, could be readily identified on ultrasound imaging of the popliteal fossa. This is facilitated by the particular echogenic pattern of the sciatic nerve due to its internal structure. However, this ability of ultrasonography is rarely mentioned in published literature on venous diseases of the lower limb.

The ultrasonic appearances of the SN and of its course in the thigh have been described in a paper concerning the exploration of traumatic thigh lesions which directly or indirectly involve the nerve.1 The use of ultrasonography to guide local anaesthetic injections for SN block to obtain anaesthesia in the lower limb has also been reported.2 Neurologists have used ultrasonography in the investigation of motor and sensory neuropathies involving the SN.3 Solid tumours and cysts may also be detected by this means4,5 and radiologists have reported the use of ultrasonography for anatomic identification as well as the means of distinguishing between nerves and tendons.6–8

In the popliteal fossa the SN and its branches lie close to the main venous structures, and are sometimes involved in their pathology. It is astonishing that although ultrasound examination for assessment of the popliteal vein (PV) and small saphenous vein (SSV) is routine prior to surgery or treatment, time is never spent in the identification of nervous structures that are readily seen during this investigation.

The purpose of this study is to describe the ultrasonic features of the nervous structures of the popliteal fossa and establish how frequently these can be seen in normal subjects and those with varicose patients.

Material and Methods

Thirty unselected patients (60 limbs, men: n=5, women: n=25) attending for outpatient consultations were investigated by duplex ultrasound examination...
of the popliteal fossa. Ten patients had lower limb varicose veins as the reason for their consultation. In three patients, varices involved the small saphenous vein. The remaining patients attended for other surgical conditions and had no lower limb varices. These patients had mild leg pain and telangiectases without truncal saphenous varices, osteo-articular symptoms and post-mastectomy arm swelling.

Both lower limbs of all patients were investigated with the subjects in the standing position and the knee in slight flexion in keeping with the author’s standard practice. A 10 MHz ultrasound probe was used of a Caris Plus Esaote machine (Esaote S.p.A., Genoa, Italy).

Placing the ultrasound probe transversely on the popliteal skin crease, the tibial nerve was identified, lying between the PV and the SSV. In cross-section, the nerve appears usually as a round formation, hyperechogenic in respect to the surrounding muscular tissues, often containing small round hypo-echogenic areas related to the single nerve fibres (Figs. 1 and 4(b)), with the perineurium producing bright boundary echoes.

When the SSV is dilated, the nerve may have a slightly compressed cross section so that it may appear as a semilunar or rhomboid shape (Figs. 2 and 3). The contrast of the SN may be increased compared to the other tissues by varying the insonating angle of the transducer. As the angle of insonation increases the total echogenicity of the tissues is reduced, but to a higher degree in muscles and tendons than in the nerve (Fig. 3).

A further manoeuvre, which facilitates identification of the nerve is to pass the probe up and down the popliteal fossa region for short distances during transverse scanning. The muscles and other soft tissues appear ‘out of focus’ and change rapidly whereas the constant appearance of the nerve makes this structure more obvious. These manoeuvres facilitate identification of the point where the SN divides into the tibial and common peroneal nerves. The latter passes laterally from the SN and is smaller in calibre. It is visible for a short distance (Fig. 4(c) and (d)).

The sapheno–popliteal junction (SPJ), when present, generally runs along the lateral edge of the nerve, closely applied to it. However, the SPJ may have a medial course, particularly when it does not form the terminal part of the SSV. In these cases the SPJ forms an ‘anastomotic’ shape between the thigh extension (TE) of the SSV and the PV (Fig. 5). The TE continues proximally along the thigh to communicate with superficial veins (including the GSV) or deep veins in the posterior thigh.

In a longitudinal scan the sciatic nerve lies superficially to the PV and exhibits a fibrillar appearance with parallel linear internal echoes (Fig. 6). Once identified, the nerve may be followed in the proximal direction, deeply under the muscular masses (Fig. 4(a)) to the root of the thigh. Distally the nerve becomes difficult to identify below the popliteal skin crease as the calibre of the nerve decreases following emission of muscular branches.

Results

In all 60 limbs it was possible to identify the SN and its branches using the methods and descriptions above. In cases with SSV incompetence and dilatation, the nerve appeared ‘compressed’, with its section adapted to the residual space (Fig. 2). Three subjects had a sciatalgic symptomatology defined as pain in any region along the course of the Sciatic nerve (from gluteus to the external part of the foot), but without specific US signs.

The nerve had a variable echogenicity in different subjects apparently without any significance.

Discussion

The SN and its major divisions are readily identified in the popliteal fossa on ultrasound imaging.
but papers published in the field of phlebology rarely discuss these structures. Publications on the methods for examination of the venous system of the lower limb usually do not mention evaluation of the SN and its branches.

However, these structures are in close proximity to some of the most commonly treated vessels in everyday phlebological practice. It is surprising that pre-operative evaluation does not normally take into account the nerves, which will be encountered during surgical exploration of the popliteal fossa. In cases of re-operation in the popliteal fossa, the pre-operative identification of the nerves inside the scarred tissues may be particularly useful. The series of patients reported here included none with recurrent varices. However, the author has found it possible to visualise the sciatic nerve in such cases and found it useful in planning surgery for recurrent varices in the popliteal fossa.

A well-known complication of surgical intervention for varicose veins arising in the popliteal fossa is common peroneal nerve palsy. These are thought to be due to compression of the nerve by retraction of the tissues during the operation. Traction on the nerve may also be part of the process leading to this occasional severe complication of varicose vein surgery. Less frequently the nerve may be divided during dissection of the popliteal fossa. The nerve lesion may lead to the development of a neuroma, which can be visualised by ultrasound imaging.

I have found that the terminal part of the SSV near the SPJ lies in close proximity to the tibial nerve.

![Fig. 2. Left leg, SSV incompetence, transverse image. The appearance of the nerve (arrows) is irregular, impressed by dilatation of the SSV (S).](image)

![Fig. 3. Increasing the angle of insonation decreases the total echogenicity of the image but to a greater degree in muscles and tendons than in the nerve. This increases the relative intensity of the nerve. Left—perpendicular insonation. Right—angled insonation with relatively increased echogenicity of the SN.](image)
especially when the SSV is dilated due to venous incompetence. This has implications for endo-luminal treatments for varicose veins. Both radiofrequency ablation and endovenous laser treatment involve considerable heating of the vein wall. It is inevitable that this will cause damage to tissues surrounding the vein. If either of these treatments is carried out in the region of the SPJ there is clearly a risk of thermal injury to the tibial nerve. Laser treatment may also lead to perforating of the treated vein which might lead to ecchymoses in the region of the nerve.12

Ultrasound guided sclerotherapy is now a commonly performed treatment for varicose veins. It is clear that the extravasation of sclerosant occur
following injection near the SPJ the SN may be damaged by the sclerosant. It may be wise to avoid direct injections of the SSV in the popliteal fossa. Even in a correctly injected vein the post-sclerotherapy inflammatory reaction could involve the termination of the SSV. This might lead to an inflammatory process involving the sciatic nerve, which is closely applied to the SSV in this region and temporary discomfort in the distribution of the nerve.

Finally direct observation of the SN and its branches by phlebologists could be useful for recognising nerve pathology which might lead to symptoms in the distribution of the sciatic nerve. Such conditions include sciatic vein varices, traumatic lesions, cysts, neoplastic and lesions arising from nerve compression.

References