Ultrasound Guided Regional Anaesthesia- Study on Dual-View technique for anterior visualization of the sciatic nerve

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Abstract

Background; Identifying sciatic nerve from anterior thigh is difficult due to its depth, inconsistent surface anatomy and its location posterior to the femur. In this study we evaluated the ease of identification of sciatic nerve using 'dual view' technique in comparison with 2 other techniques.

Objective; To evaluate the identification rate of anterior approach to the sciatic nerve using the short-axis view at the proximal third, mid-thigh and using 'dual view' technique

Methods; After approval from Institutional Review Board , 52 anterior thigh sonograms were evaluated in patients who consented for this procedure. This was a study to compare sonographic identification rates of sciatic nerve using conventional anterior thigh transverse view scanning at proximal third (technique 1) and mid thigh (technique 2), with a 'dual view' technique (technique 3) which involves using both transverse and longitudinal axis views to pinpoint the sciatic nerve.

Results; Anterior visualization of the sciatic nerve using transverse axis scans at the mid thigh were found to have higher identification rates compared to the scans over the proximal thigh (82.7% v 73.1%). 'Dual view' technique yielded the highest visualization rates among the 3 techniques (92.3%). Mean skin to nerve distances were 7.15 ± (1.54) cm, 6.75 ± (1.57) cm and 6.37 ± (1.36)cm with proximal thigh transverse scan, mid thigh and 'dual view' technique respectively. Mean femur to nerve distances was 4.52 ± (0.75) cm, 5.04 ± (0.67) cm and 4.77 ± (0.60) cm with similar techniques.

Conclusion; 'Dual view' technique gives a higher percentage of accuracy in identifying the sciatic nerve using the anterior approach compared to conventional transverse view scan.

Anterior approach to the sciatic has several advantages over the posterior or lithotomy techniques. With the anterior approach (classical approach by Beck, or modified Chelley-Delaunay technique) [1] [2] the block can be performed with the patient in the supine position, particularly beneficial in patients who have compromised mobility due to trauma, arthritis or obesity.[2] Both the sciatic and the femoral nerve can be blocked without needing to change position. Identifying sciatic nerve from anterior thigh is difficult due to its depth, inconsistent surface anatomy and its location posterior to the femur. Internally rotating the femur may help expose the nerve, so that it is made amenable to approaches from the anterior, at or above the level of lesser trochanter.[3] Both techniques are equally difficult technically and as a result, the anterior approach is the least popular of the three techniques to block the sciatic nerve.[4]

This anterior approach is made slightly easier with the use of ultrasound, as the nerve can be "seen" and traced along its course provided it is correctly identified.[5] The landmarks of importance are the adductor groups and the hamstrings, distinguished by the different echo texture of the fibres, and

also the lateral intermuscular septum.[6] However, as the muscle groups in this region are relatively thick, the sciatic, which supposedly is hyper-echoic and oval to circular in shape,[7] appears thinned out. With the background of thick muscles with fascia layers, flattened sciatic nerve can be difficult to identify in the transverse view, especially at the proximal thigh.

Ultrasound guided technique to block the sciatic has been described as the proximal thigh, and the mid-thigh approach. Using curved low frequency transducer, the sciatic nerve is viewed at its short-axis. Three techniques to identify the nerve have been documented:

The 'big triangle' technique[8]

The sciatic is situated as the third point of a triangle, straight down from the femoral vessels, whereby the vessels and the femur are the other two points of the triangle.

The 'small triangle' technique[8]

The sciatic is the apex of a small triangle, bounded medially by the semitendinosus andsemimembranosu muscle, beneath the adductor group.

'Flashing the adductor' technique[8]

With the use of nerve stimulator, and advancing the stimulating needle in Doppler mode, the adductor group of muscles is displayed as a flashing 'indicator light'. As the stimulating needle bypasses the adductor magnus and into the fascia containing the sciatic, the 'flashes' will disappear-indicating the close proximity of the sciatic nerve.

We have observed that scanning the sciatic in its long-axis view, will help to correctly identify the depth of the sciatic nerve, especially if it is difficult to confirm in the transverse view. The probe can be placed antero-medially to the femur, and the nerve will appear as a distinctly continuous hyper-echoic structure with a characteristic fascicular pattern. When the structure is followed distally, it will be seen to diverge to its two branches. This 'diverging highway' appearance will help indicate the point where the sciatic nerve gives its common peroneal and tibial branches. The probe can be brought back proximally before the point of divergence, and the nerve can be blocked at any point proximally throughout its course in the thigh, in its transverse view.

We have seen that with this ‘dual view’ technique, the sciatic nerve may be easier to identify, and can act as a confirmatory maneuver in cases which the sciatic is not well defined.

Objective

To evaluate the identification rate of anterior approach to the sciatic nerve using the short-axis view at the proximal third, mid-thigh and using ‘dual view’ technique.

Methodology

A thigh sonogram of 52 patients, were obtained in General Operation Theatre of Hospital Kuala Lumpur, after explanation and consent was taken prior to surgery.

Inclusion criteria
All preoperative patients with American Society of Anaesthesiologist (ASA) Classification I - 3, and post operative cases with Post Operative Recovery Score of 6 who consented for procedure.

Exclusion criteria
All patients without consent and patients aged less than 12

Patients were positioned supine with the thigh to be imaged exposed up to the inguinal region. An anaesthesiologist who has done at least twenty anterior scanning of the thigh, will conduct this procedure. In cases of uncertainty, opinion of another anaesthesiologist with at least similar ability is sought. The thigh was divided into three regions, the proximal thigh, mid thigh and distal thigh. To visualize the sciatic nerve, a curved-array low frequency transducer (M Turbo, Sonosite) was placed at the proximal third in its transverse view (technique 1) and then at the mid thigh region in its transverse axis (Technique 2). The nerve was seen as an oval or elliptical hyper-echoic structure deep to the adductor group of muscles. The depths from the skin and the distance of the sciatic nerve to the femur were recorded. Images seen on any part in that divided area were documented according to it designated thirds.

The ultrasound transducer was then rotated 90 degrees, to image the sciatic nerve in its longitudinal axis. Confirmation was by the appearance of continuous hyper-echoic structure with a characteristic fascicular pattern, which diverges as the probe was moved distally. (Diverging highway sign). Once this was seen, the probe was moved back to the point before this divergence, traced until the most proximal point where the image can be identified clearly, and was then rotated back to visualize the sciatic nerve in its transverse axis (Technique 3). The distance to the femur, and its depth to the skin at this point was recorded.

Other data recorded were demographics, weight, ASA classification and co-morbid. Statistical analysis of the compiled data was done via SPSS software version 12:0

Results

49 were sonogram of male thighs and 3 were female. 31 patients were Malay, while 11, 4 and 6 were Chinese, Indian and other races respectively (chart 1). Mean age, weight and ASA classification are as illustrated in Table 1.

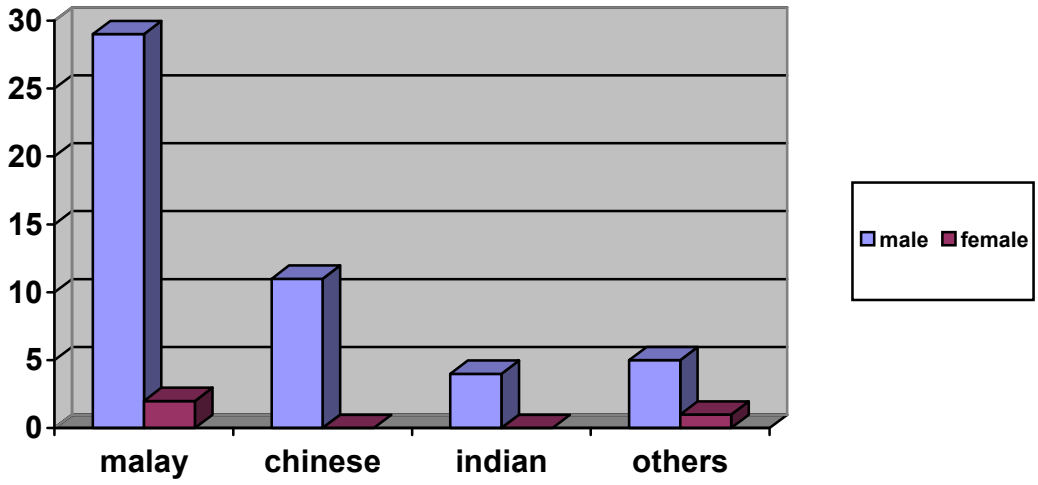

Chart 1: Chart showing number of patients, in relation to race and gender

Table 1: Table showing age, weight and ASA classification of patients

Age (years)	39.9 ± 18.1
Weight (kg)	63.0 ± 13.0
ASA Classification : ASA 1 ASA 2 ASA 3	 42 (80.8%) 9 (17.3%) 1 (1.9%)

Mean distances of sciatic nerve to skin (skin to nerve) and to femur (femur to nerve) using short axis view at proximal thigh (PT), mid thigh (MT) and at the most proximal point the sciatic nerve is seen using dual view technique are shown in Table 2. At proximal thigh, the mean skin to nerve distance was 7.15 ± 1.54 cm and the femur nerve distance

was 4.52 ± 0.75 cm. Using short axis view at mid thigh region, the mean distances were 6.75 ± 1.57 cm and 5.04 ± 0.67cm respectively. With dual view technique, the sciatic nerve could be seen at mean distance of 6.37 ±1.36 cm from skin, and 4.77 ± 0.60 cm from femur.

Table 2: Table showing skin-nerve and femur-nerve distances from various techniques, and numbers (percentage) of sciatic nerve detection

Location of ultrasound probe (view)	Skin-nerve distance (cm) ± SD	Femur-nerve distance (cm) ± SD	Number of sciatic nerve detection
Proximal thigh (short-axis view) - Technique 1	7.15 ± (1.54)	4.52 ± (0.75)	38 of 52 (73.1%)
Mid thigh (short-axis view) - Technique 2	6.75 ± (1.57)	5.04 ±(0.67)	43 of 52 (82.7%)
Dual view technique (short axis with long-axis view) at its most proximal site -Technique 3 -	6.37 ± (1.36)	4.77 ± (0.60)	48 of 52 (92.3%)

The sciatic nerve was able to be identified in 38 out of 52 sonograms at the proximal thigh, giving a detection rate of 73.1% with the transverse/short axis view. Using short axis view at mid thigh region, 43 sciatic nerves were successfully identified, giving an identification rate of 82.7%. However, dual view technique yielded the highest identification rate of 92.3%, out of 52 thigh sonograms.

As for co-morbidity, most of the cases were ASA 1 patients, with nine (9) ASA II. Patients with ASA II mostly have hypertension and or diabetic with or without neuropathy. Only one (1) patient was classified as ASA class III

There were four (4) patients in whom the sciatic nerves were not identifiable at all with either of the views. One (1) patient had hypertension, diabetes and cerebro-vascular injury, while another patient has diabetes and chronic limb ischaemia. Another patient (1) only had hypertension alone, while another patient was a healthy ASA I, 36 year old patient.

Discussion

Regional block of the sciatic nerve using the anterior approach is made feasible with the use of ultrasound.[9,10] Quoted success rates have been documented to be the same as the posterior approach.[11] However, identifying the sciatic nerve can be difficult anteriorly due to its location behind the femur and its anisotropic appearance, especially in the proximal third (Figure 1). Visualizing the sciatic nerve in the middle of the thigh is made slightly easier as its hyper echoic shadow stands out in the background of relatively hypo echoic muscle fibres (Figure 2). Our study showed that the identification rate based on appearance alone is higher, when visualizing the nerve using the transverse view in the mid-thigh region compared to the proximal third.

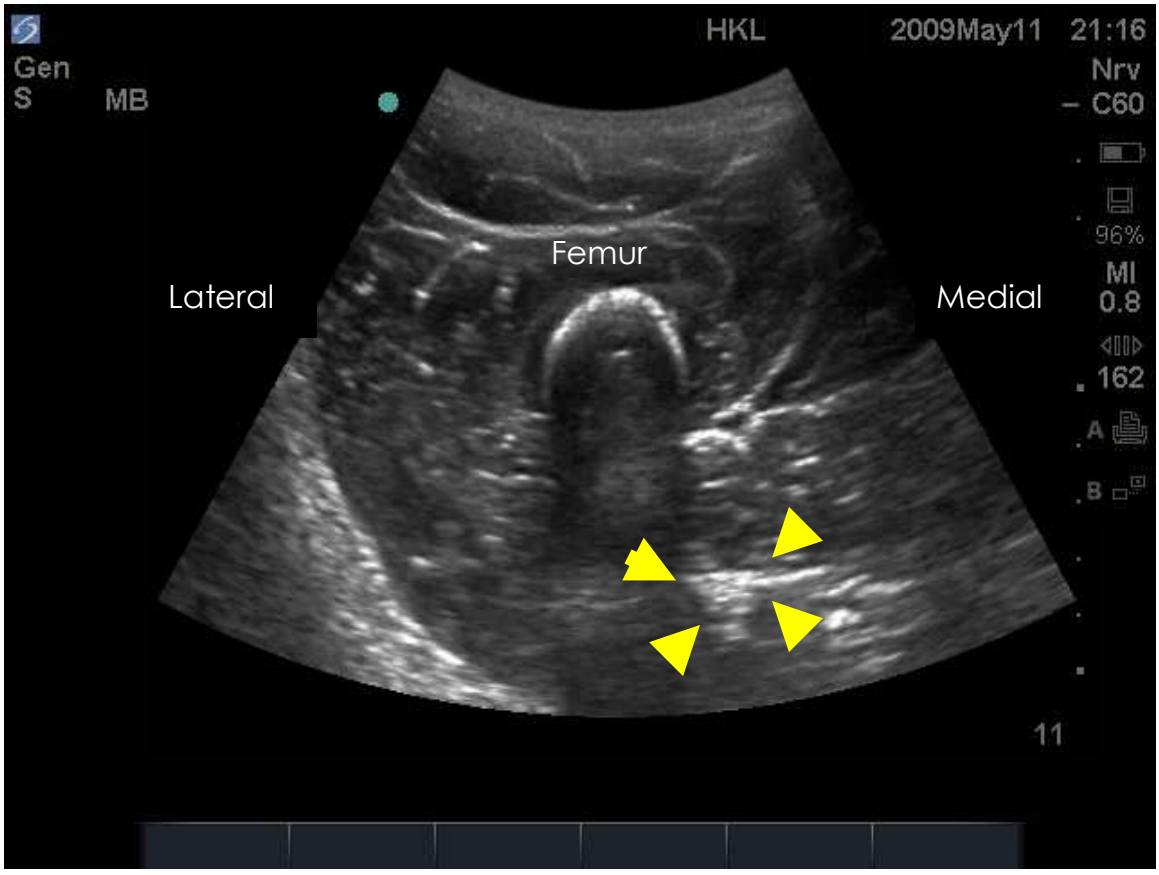

Figure 1. Transverse view of the sciatic nerve in the anterior thigh scan at the proximal third

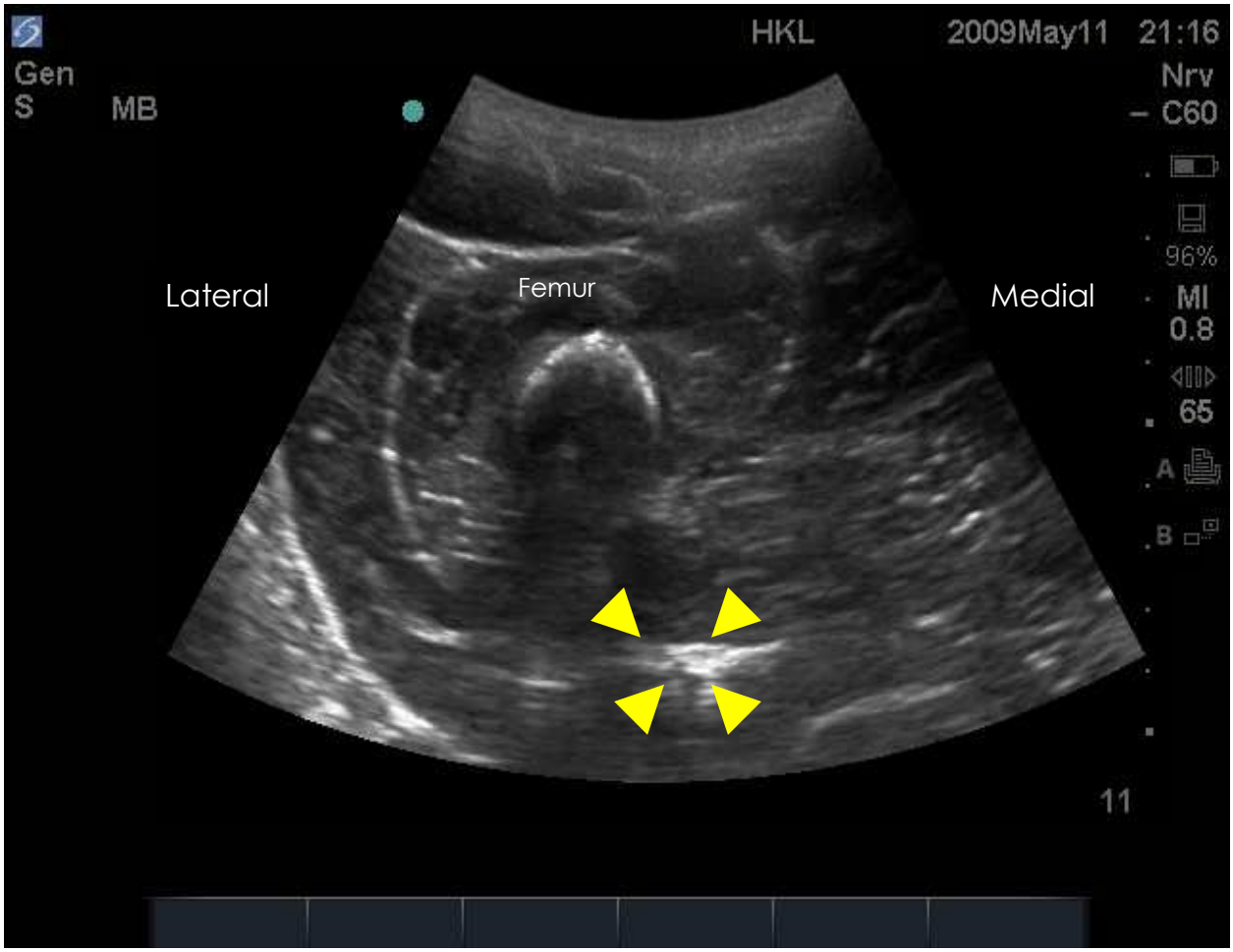

Figure 2. A transverse view of the sciatic nerve in the anterior thigh scans at the mid thigh

However, using 'Dual view' technique, the identification rate was found to be the highest compared to the two previous techniques. Confirmation of the sciatic nerve under ultrasound, can be made by its continuous appearance, and also as it diverges distally along its course towards the popliteal fossa ('diverging highway' sign- Figure 3).

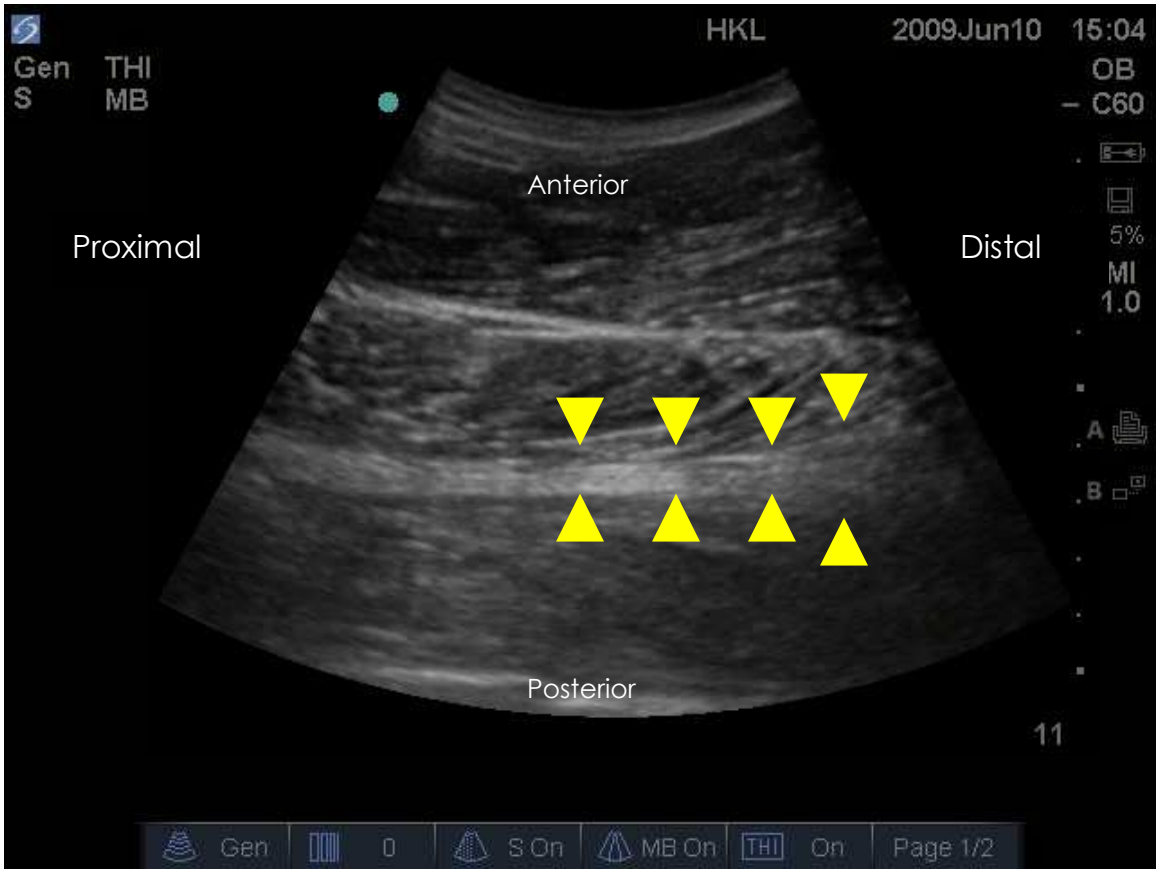

Figure 3. A longitudinal view of the sciatic nerve with the transducer over the antero-medial aspect of the thigh. Distally, the sciatic nerve can be seen to diverge to its branches ('Diverging highway' sign)

This technique can be used as an extra maneuver to confirm the location of sciatic nerve, besides scanning in the transverse view at either of the two points (Figure 4). Local anaesthetic can be deposited at the most proximal point seen; hence more sensory areas will be covered for block,

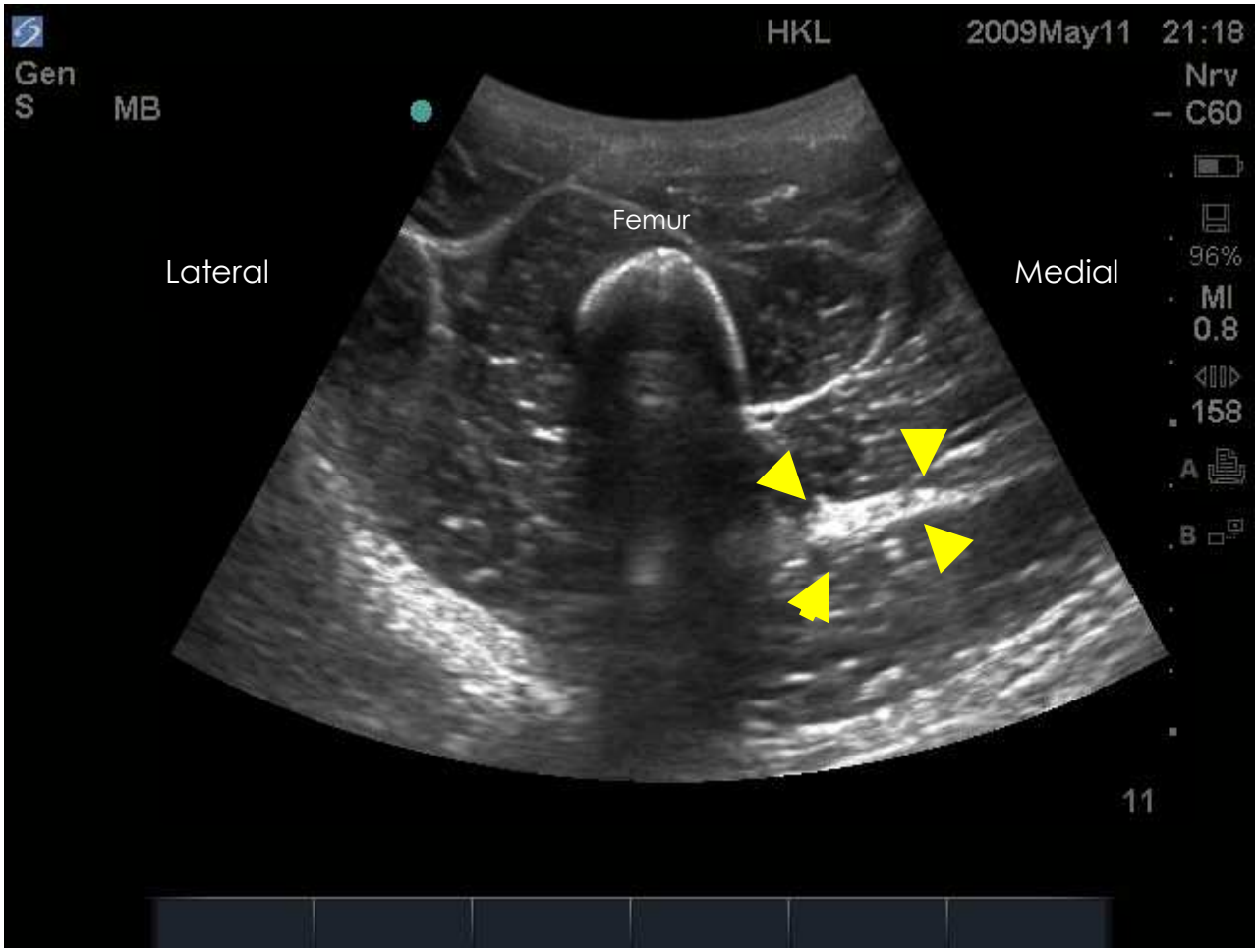

Figure 4. A transverse view of the sciatic nerve in the anterior thigh scans at the proximal thigh using 'dual view' technique. The sciatic nerve was viewed in a longitudinal axis first before having the transducer rotated to view the sciatic nerve in its transverse axis

In our observation, the sciatic nerves of 2 sonograms were wrongly identified during transverse scan at the proximal third region. After using dual-view technique, they were found not to be the sciatic nerve. Among the three techniques of visualizing the sciatic nerve anteriorly, this 'dual view' technique was found to have the highest identification rate, with the mid-thigh transverse view being the second most successful. The proximal thigh transverse view was the least successful technique in correctly identifying the location of the sciatic nerve anteriorly based on appearance alone.

There were no distinct relationship in the distances between skin to nerve, and femur to nerve among the three techniques. The mean depths for the three methods were 7.15 cm, 6.75 cm and 6.37 cm respectively. It was expected that the depth (skin to nerve) at the mid-thigh would be more than the proximal third, as the nerve comes out from

the pelvis and lies superficially in the popliteal fossa, but this was not found to be the case. This could be due to the fact that, at the mid thigh region, the sciatic nerve would have coursed itself directly beneath the femur, and to visualize it requires the transducer to be moved medially. Shorter skin to nerve distances could be found because of the elliptical cross-sectional shape of the thigh.

Mean distance of the sciatic nerve using 'dual view' technique was also found to be the shortest compared to the other two techniques. This observation can be explained by the way in which the distances were measured from the ultrasound screen. Measurements of the distances were taken from the center of the screen, to the superior-most part of the transverse view (short-axis view) of the sciatic nerve. As the transducer was placed antero –medially on the thigh and due to the cross-sectional shape, the distance can be seen to be smaller compared to its antero-posterior distances. It is unclear whether the shorter mean distance from the skin is the reason why the 'dual view' technique apparently has a higher success rate. We have had success in identifying the nerve using this technique even though it is deeply seated. Another reason for its higher success rate is that the additional maneuver, which is visualizing the nerve in its longitudinal axis, act as a validating sign which suggests the targeted structure which we thought could be the sciatic nerve, is indeed correct.

The number of cases was relatively small to look into the relationship between co-morbidities in relation to the ease of identification. Most of the patients were ASA I cases, and in almost all patients, the sciatic nerve can be seen using any of the three techniques, except for 4 patients. One patient had bilateral amputation done secondary to ischaemic neuropathy and in this case, the nerve was not seen. In another patient, the sciatic nerve could not be identified even though he had no co-morbidity. In view of this small number, any correlation could not be made.

A combination of the short axis and longitudinal view will bring a higher success rate to visualize the sciatic nerve. With this approach, the depth of the nerve can be identified along its course, and injectate can be deposited as proximal as possible covering a larger sensory block distribution. Another advantage of this technique is that, the difficulty in identifying the sciatic nerve in its transverse view alone can be minimized as this technique can also be used as a confirmatory maneuver to ascertain its location deep to the structures.

Conclusion

Based on our findings, we recommend the use of 'dual view' technique to visualize the sciatic nerve for regional block via the anterior approach.

References:

1. Beck GP. Anterior approach to sciatic nerve block. *Anesthesiology* 1963; 24: 222-4
2. Chelley JE, Delaunay L. A new anterior approach to the sciatic nerve block. *Anesthesiology* 1999; 91:1655-60
3. Vloka JD, Hadzic A, April E, Thys DM. Anterior approach to the sciatic nerve block: the effects of leg rotation. *Anesthesia Analgesia* 2001;92:460-2
4. Hadzic A, Vlodka JD, Kuroda MM, Koorn R, Birnbach DJ; The practice of peripheral nerve blocks I the United States: A national survey. *Reg Anesth Pain Med* 1998; 23:241-6
5. Alon YBA, Bigeleissen P, Chelly JE. Ultrasound guided antero-medial sciatic approach. *Anesthesiology* 2008; 109A340
6. Barrington MJ, Lai SL, Briggs CA, Ivanusic JJ, Gledhill SR. Ultrasound –guided midthigh to sciatic nerve block: a comparison with the posterior approach. *Anesth Analg.* 2009 Feb; 108(2):660-5
7. Tsui BCH, Ozelsel TJP. Ultrasound-Guided Anterior Sciatic nerve Block Using a Longitudinal Approach: "Expanding the View". *Reg Anesth Pain Med*. 2008 May-June; 3 (33):275-6
8. www.neuraxiom.com
9. Chan VW, Nova H, Abbas S, McCartney CJL, Perlas A, Xu DQ. Ultrasound examination and localization of the sciatic nerve: A volunteer study. *Anesthesiology* 2006; 104:309-314
10. Alon Y. Ben-Ari, Bigeleissen P, Chelly JE. Ultrasound Guided Antero-Medial Sciatic Approach. *Anesthesiology* 2008; 109 A340
11. Ota J, Sakura S, Hara K, Saito Y. Ultrasound-guided anterior approach sciatic nerve block- a clinical and anatomical study. *Reg Anesth Pain Med*. 2008 Jul-Aug; 33 (4): 369-76.