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'Current trends in lower limb Doppler scanning in Ireland'

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ABSTRACT

Introduction: The clinical need to diagnose and treat above knee deep vein thrombosis (AKDVT) has long been established in literature and in practice. On the other hand, the need to diagnose and treat below knee deep vein thrombosis (BKDVT) continues to be debated in literature. This has resulted in variation in clinical guidelines and protocols nationwide. This research aims to establish if there is a standard practice in Irish ultrasound departments and if so, what that practice is and where sonographers are getting information to inform this.
Methods: A questionnaire was designed using SurveyMonkey and distributed using online platforms. The questionnaire aimed to establish the experience of the sonographer, the types of exams performed, protocols/guidelines used as well as scenarios where the sonographer might deviate from protocol.
Results: The study yielded 90 responses. The research found 49% of sites perform whole leg ultrasound routinely and 46% perform proximal ultrasound only. 41% of respondents said their protocols were based on clinical guidelines however, 22% of participants didn't know what these guidelines were. 49% of respondents were unaware of what treatment a patient would receive in cases where there is a high clinical suspicion of DVT, but the ultrasound is negative for DVT.
Conclusion: The research has established a lack of consistency amongst sonographers and scanning practices with a fairly even split (49% of respondents perform whole leg ultrasound and 46% perform proximal only). Not only has the research identified a lack of standardised scanning approach nationwide, but inconsistencies are also seen in the guidelines that inform our department's protocols as well as inconspicuous terms used in radiology reporting and jargon in literature in relation to DVT.
Implications for practice: 1. An inconsistency in practice has been established. Discussions are now needed to decide what guidelines should be implemented into Irish Ultrasound DVT protocols. 2. A national protocol for BKDVT would result in all patients in Ireland having access to the same standard of care. 3. Call for consensus on appropriate training for sonographers undertaking LLDs.

Introduction

Deep venous thrombosis (DVT) is part of a disease process known as venous thromboembolism (VTE) and when left untreated can be fatal condition.[1] It can lead to a pulmonary embolism if part of the blood clot travels to the lungs. More than 1.5 million cases of VTE are diagnosed every year across Europe, with greater than one third resulting in death.[2]

When scan findings are positive for DVT, Incidence of BKDVT is greater than AKDVT with some studies[5,6] reporting as high as 60.2% BKDVT incidence in comparison to 39.8% AKDVT.

Confusion over the classification of DVT is evident in literature with various definitions of BKDVT being observed throughout. Nitta et al., define BKDVT as 'anterior and posterior tibial vein, peroneal vein and soleal vein.[5] Fleck et al., describe BKDVT as 'thrombus involving paired tibial, peroneal or deep muscular veins (gastrocnemius and soleal) of the calf[7]'. Galanaud et al., considered a BKDVT to involve anterior/posterior tibial, peroneal, gastrocnemius or soleal veins.[8] Interestingly, Nitta et al., consider clot in the great saphenous vein to be 'DVT' when it is indeed a superficial vein. They also report an unusually high incidence of soleal DVT which is not seen in the other studies.[7,8] A study by Labropoulos et al. (2003)[22] suggests a fairly even distribution of clot occurrence in the various calf vessels including peroneal veins, soleal veins, posterior tibial

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veins and gastrocnemius veins. Such findings would suggest that all of these vessels should be interrogated, if gastrocnemius and soleal veins are not investigated, it is suggested that 40% of BKDVTs would be missed.

Compression ultrasound investigates either the entire leg from groin to calf (whole leg) or just from groin to popliteal fossa (proximal). A systematic review[9] stratified ultrasound techniques into 3 main types: single limited (once off scan of CFV, FV and PV), serial limited (serial scans of CFV, FV and PV) and whole leg compression ultrasound (CFV, FV, PV and calf veins). It is well established that the sensitivity and specificity of ultrasound for proximal DVT is high[9] (97% and 98% respectively) however according to a meta-analysis,[9] distal DVT diagnosis by ultrasound had a sensitivity of just 50–75% and specificity of 90–95%. Contrast venography is now rarely undertaken because ultrasound is quick, safe and inexpensive.[11] It should be noted however, that historically, contrast venography assessed the whole leg and its successor in many instances, does not.[9] Other imaging modalities that are used less often include MRI and CT venography.

There is a lack of consensus regarding the optimal DVT scanning protocols. The NICE guidelines[12] suggest that those with suspected DVT, should have a 'proximal leg vein ultrasound scan and quantitative d-dimer test within 4 h of presentation'. The RCR Guidelines[13] don't specify whether proximal or whole leg scanning is required. BMUS guidance use The Society for Vascular Technology of Great Britain and Ireland's (SVT) protocols to inform their guidance.[14] This is a comprehensive document with clear technical instructions. They provide a list of vessels which should be interrogated – common femoral vein, femoral vein, proximal profunda femoris vein, popliteal vein. However, they suggest that assessment of calf veins is 'controversial' and should be assessed 'at the level of detail agreed with locally referring clinicians.

Treatment of isolated BKDVTs is a grey area in which the risk/benefit calculation has long been debated. The concern is that BKDVTs can recur or extend to the proximal veins where the risk of complications is increased.[15] When an isolated BKDVT is diagnosed, the treatment will vary and could result in any of the following treatment plans: clinical surveillance, a shorter course of anticoagulation to standard or full-dose anticoagulation in those with severe symptoms or risk factors. Interestingly, a recent Cochrane review which looked at treatment of BKDVT, revealed that those who receive anticoagulation for distal DVT have a lower risk of VTE recurrence.[15]

Methods

Ethical exemption was granted from the host institution on 15th December 2020. An online survey was sent to sonographers working in Ireland. Vascular technicians were not included in the study population nor were clinicians performing point of care ultrasounds due to different training and experience by these professionals.

The questionnaire was created using SurveyMonkey (https://www.surveymonkey.com/r/FK9HZYR) to make it quick and accessible to encourage responses across a broad geographical area. The survey was piloted on five sonographers working in the UK and some minor adjustments were made to improve clarity and formatting. The pilot study established the approximate time required to complete the survey. Pilot data was excluded from the analysis. Social media was the main mode of distribution, as well as word of mouth among colleagues. Facebook (closed Facebook group for Irish Radiographers) and Twitter were the social media domains used to distribute the survey. A period of one month was allocated for the collection of responses (8th of March 2021–8th of April 2021).

Survey data was exported in an Excel spreadsheet. Descriptive analysis was carried out on data generated from closed questions. Thematic analysis was used to analyse responses to the open questions. The questions were analysed one by one and recurring themes were extracted.[20]

Results

A total of 90 responses were received over a one-month period. These were sonographers, not departments. It is difficult to ascertain how many sonographers and departments are in operation in Ireland since there are both public and private sectors.

Sonographer experience

Ninety-one percent f participants work in a site where an A&E department is in operation. Since DVTs can occur because of prolonged immobilisation or can develop following surgery, it is important to recognise that although a large volume of referrals come through A&E, DVT is not confined to this type of referral. 42.2% of participants had more than 10 years' experience in Ultrasound. Greater than 80% of respondents had more than 2 years' experience (Fig. 1).

Fifty-two percent of participants work at a centre where 10–20 LLDs are performed each week. These results provide insight into the experience of the sonographers with more than 65% of respondents working at a centre where more than 10 DVT scans are performed each week (Fig. 2).

Protocol and guidelines

There was a significant variation in scanning protocols used at various sites. Forty-nine (44) of respondents perform whole leg ultrasound routinely and 45.6% (41) of respondents perform proximal ultrasound only (Fig. 3). Five percent selected 'other'. One participant listed the vessels that they routinely check – '*Common Femoral Vein (CFV), Femoral Vein (FV), Popliteal Vein (PV), Sapheno-Femoral Junction (SFJ), Long Saphenous Vein (LSV), Short Saphenous*

Years' Experience	n	%
0-2	17	18.9
2-4	17	18.9
4-6	9	10
6-10	9	10
>10	38	42.2

Figure 1. Number of Years' Experience of respondents.

Number of Scans	n	%
0-5	7	7.8
5-10	24	26.7
10-20	47	52.2
>20	12	13.3

Figure 2. Number of scans performed (average).

Scan Type	N	%
Whole Leg	44	48.9
Proximal	41	45.6
Other	5	5.6

Figure 3. Exam routinely performed.

Vein (SSV), SaphenoPopliteal Junction (SPJ), Anterior Tibial Vein (ATV) and Posterior Tibial Vein (PTV)'. Another participant suggested they would do a whole leg ultrasound and if no phasic flow was noted distally, they would check the external iliac vein (EIV) and the inferior vena cava (IVC). One participant mentioned they would do a proximal scan but also check the trifurcation of the calf veins.

Ninety-two percent (83) of respondents had written protocols in place which informed their practice. Two percent (2) said they had no protocols in place and 5.6% (5) of respondents said that they had protocols in place, but they do not routinely adhere to these.

A significant variation was also observed in the guidance used to inform protocols. Fourty one percent (37) of participant's said that their protocols were informed by clinical guidelines however 22.2% (20) of participants didn't know what guidelines these were.

Thirty-two percent (29) of participants said their protocols were informed by 'long-standing tradition', 15.6% (14) said their protocols were informed by their on-site emergency medicine team, 14.4% (13) by the local haematology team, 18.9% (17) were informed by review of the current literature and 8.9% (8) of participants selected the 'other' option where some participants admitted the protocols were informed by radiologists, some suggested a multidisciplinary approach (radiology, haematology and emergency medicine) was used to inform their protocols (Fig. 4).

The main guidelines implemented in protocols included the NICE guidelines (37% – 30) and the RCR guidelines (25.9% – 21). 7 participants said they were unsure what guidelines their protocols were based on and 6 respondents said their protocols were based on BMUS guidelines (Fig. 5).

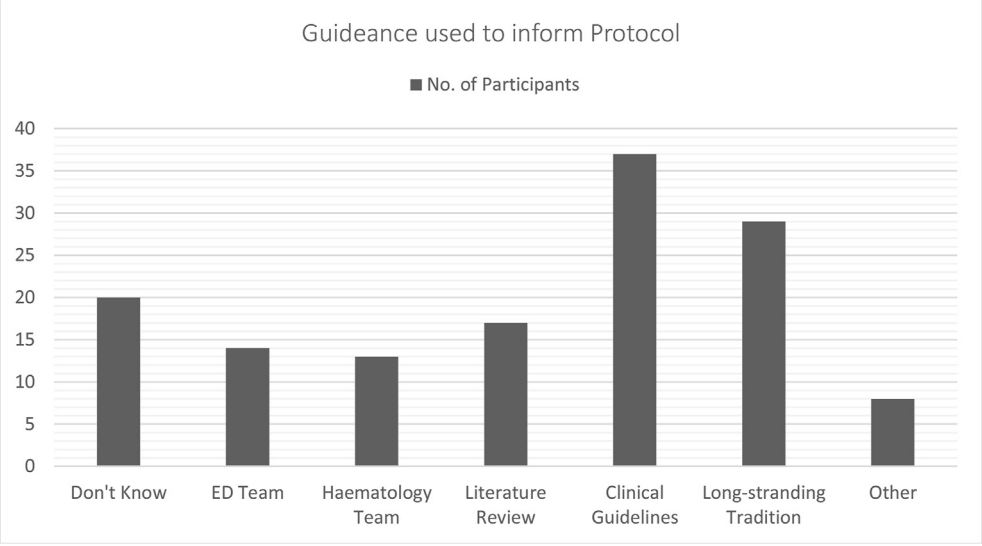

Figure 4. Guidance used to inform Protocol.

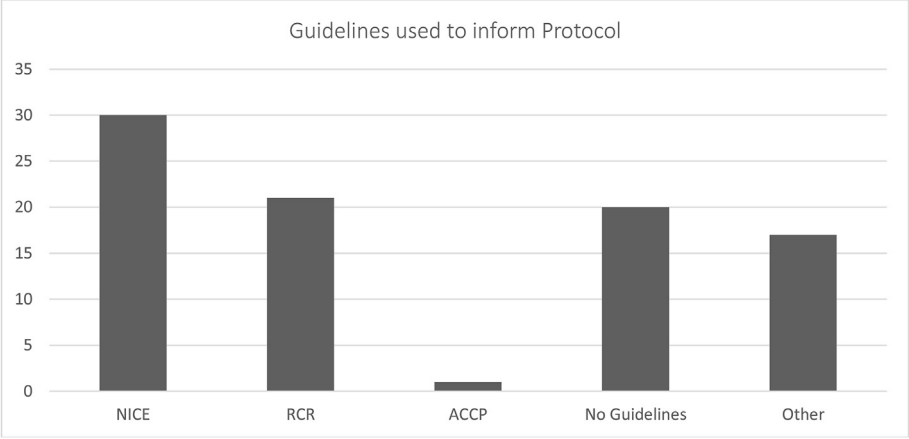

Figure 5. Where guidelines are utilised to inform protocol, Guidelines used.

Calf Symptoms	N	%
Proximal scan and point of max tenderness.	35	45.5
Proximal scan only.	3	3.9
Whole leg.	20	25.9
Proximal scan and invite patient for follow-up scan if symptoms persist.	5	6.5
Other.	14	18.2

Figure 6. Deviation from routine protocol if calf symptoms present.

Deviation from protocol

Forty-six percent (35) of participants said they would perform a proximal ultrasound scan as well as the point of maximum tenderness in the calf if a patient presented with calf symptoms. Twenty-six percent (20) of participants would scan the entire calf vessels and 6.5% (5) would perform a proximal scan and an interval scan if symptoms persisted. Eighteen percent of participants would always scan the entire leg and one responder said they would also perform an MSK scan of the calf. It may be worth noting that the option to skip this question if you answered 'whole leg' to question 4 would have been appropriate (Fig. 6).

When there is a high clinical suspicion of DVT, but the ultrasound scan is negative, 49.4% (42) of respondents were uninformed of the patient's course of treatment. 35.3% (30) of participants stated the patient would be monitored with a follow-up scan. 10.6% (9) said that the patient would be placed on anticoagulation regardless of the scan outcome and no follow-up imaging would be performed. 4.7% (4) said that no action was needed as the scan was negative for DVT (Fig. 7).

Interval scan time

(Fig. 8).

Discussion

Sonography experience

It is well-documented in literature that whole-leg ultrasound is technically challenging and is only useful in the hands of skilled sonographers.[9,16] This study showed that more than 80% of respondents had >2 years' experience performing LLDs with 65% of respondents working at a centre where more than 10 DVT scans are performed each week. Although it is not clear how much experience one would need to become competent in detection of calf

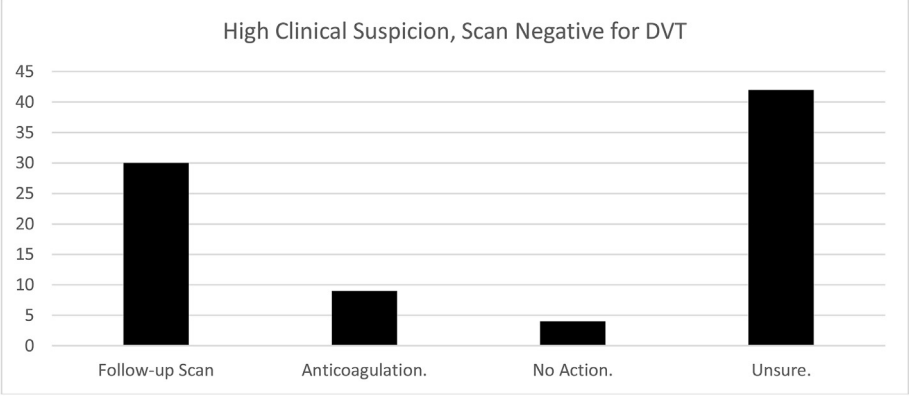

Figure 7. Action taken when there is a high clinical suspicion for DVT but the ultrasound scan is negative.

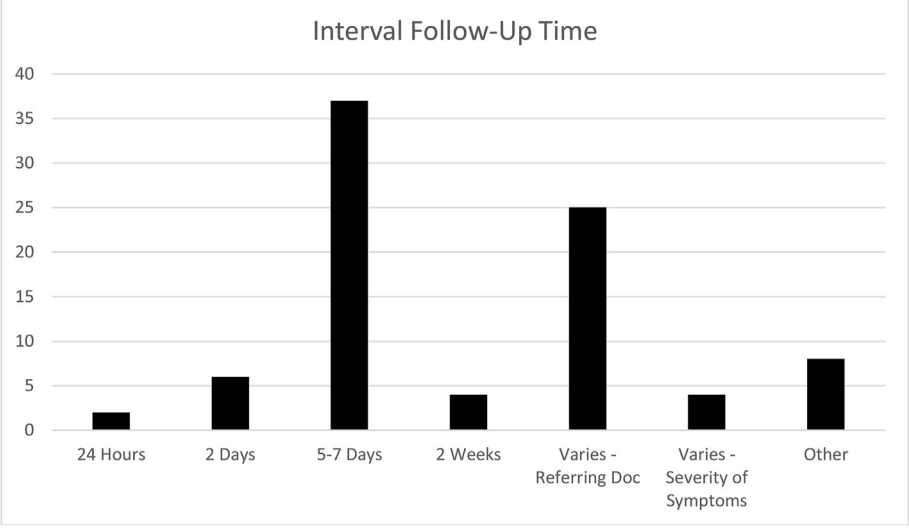

Figure 8. If follow-up is required due to high clinical suspicion, time to follow-up scan.

DVTs, it could be argued that experienced sonographers (>2 years) with access to plenty (>10 per week) of scans of this nature would be well placed to develop this skill. Indeed, teaching and mentorship would be required. The IAC[17] suggests that staff should have an 'appropriate level of training' which they suggest for LLDs, is 100 cases. Interestingly, BMUS or the AIUM[18] do not clearly outline what or how much experience a healthcare professional needs to be deemed competent at performing LLDs. Almost all participants in this study (91.11%) work at a centre with an A&E department which would suggest that a wide range of clinical scenarios are experienced by the participants of the study.

Protocols and guidelines

Although 92.2% of respondents stated that they have protocols in place that reflect their daily practice, there is a significant variation across local protocols. Forty-nine percent of participants perform whole leg ultrasound routinely, whereas 45.6% perform proximal ultrasound only. Moreover, sonographers are often not involved in protocol design. Although a multidisciplinary approach is advisory, 14.4% of protocols were informed by a local ED team, 18.9% were informed by local haematology team and perhaps the most concerning finding was 32.2% of protocols were in place due to long-standing tradition.

There is a notable variation in sources of information used to inform sonographer's practice, alarmingly 22.2% of participants didn't know what guidelines their scanning protocols were based on. This may suggest that a higher number of centres have protocols in place which are not informed by guidelines. Thirty-seven percent of protocols in participant sites were based on the NICE guidelines[12] and 25.9% were based on the RCR guidelines.[13]

The RCR guidelines[13] do not mention whether whole leg or proximal leg scanning should be utilised. The NICE guidelines[12] recommend a proximal leg vein ultrasound scan for patients with a Wells score >2. According to the NCGC[19] who inform NICE guidelines, their justification for performing proximal scan only, is due to 'the clinical importance of picking up extra calf vein blood clots by scanning the whole leg is uncertain. Moreover, the evidence review suggested that ultrasound scan of calf veins are not very sensitive in picking up calf vein DVT. A repeat proximal scan is recommended to ensure that any clots propagating to the proximal veins are not missed'.[19] It should be noted that the NCGC[19] has not been updated since June 2012.

Interestingly, the AIUM[18] have recently updated their guidance for LLDs and offer a very comprehensive explanation for doing so. They now recommend that whole leg scanning be performed for all patients to avoid errors in identifying those who need calf imaging and those who do not. They suggest that whole leg scanning avoids the need for serial examinations and examination of the calf may explain symptoms other than DVT. They also inform the sonographer which vessels to image.[18]

Deviation from protocol

The AIUM[18] provides a comprehensive guideline for performing LLDs but recognises that 'deviations may occur depending on the clinical situation'.[18] This study found that 45.5% of participants would perform a proximal ultrasound scan as well as the point of maximum tenderness in the calf if a patient presented with calf symptoms.

When there is a high clinical suspicion of DVT, but the ultrasound scan is negative for DVT, 49.4% of respondents were not aware of what treatment the patient would receive. This is concerning as NICE[12] suggests that if a proximal scan is negative for DVT and D-Dimer is positive, then the patient should be followed up in 6–8 days. There is a concern that perhaps this follow-up is not taking place in some cases. 35.3% stated the patient would be monitored with a follow-up scan and

Ten percent of participants said that the patient would be placed on anti-coagulation regardless of the scan outcome and no further imaging would be performed. The latter is concerning for the risk/benefit evaluation of anticoagulation if the patient is unnecessarily placed on anticoagulation. It also raises the question on why the scan would be performed in the first place?

Five percent said that no action was needed as the scan was negative for DVT. Again, concerning and although only a small percentage of respondents selected this response, a patient who is symptomatic for DVT, with a negative proximal ultrasound is at risk for progression if calf DVT is not ruled out initially by whole leg ultrasound or subsequently by a follow-up scan.

Interval scan time

The NICE guidelines[12] suggest repeating a proximal leg scan 6–8 days later for all patients with a positive D-dimer test and a negative proximal LLD.[19] Findings from the survey would suggest compliance with recommended interval scan times across Irish sonography departments. More DVTs are identified by whole leg scanning but this is time-consuming and the impact on patient outcomes is unknown.[12] Whole leg ultrasound is more technically challenging and is subject to variability due to the number of calf veins and their calibre in comparison to proximal veins. There is a risk of increased false negatives on whole leg ultrasound.

Conclusion

The research has established a lack of consistency amongst sonographers and scanning practices in Ireland. The most significant of which is a fairly even split between participants routinely performing proximal only (46%) and whole leg ultrasound (49%). This research has highlighted the need for consistency both with protocols and guidelines as well as the terms and jargon used in literature and clinical practice when discussing distal DVT. It is important that sonographers, vascular technicians, haematologists, radiologists, and other members of the multi-disciplinary team form a consensus regarding diagnosis and treatment of BKDVT.

Does the answer to this lie solely in a change to ultrasound protocols? Absolutely not, the answer is deep-rooted in long traditions, historical practice and pressure on departments, not solely radiology. However, if a BKDVT is not diagnosed, then it cannot be treated. Establishing a diagnosis of isolated calf DVT may be important even if anticoagulation is not required as it provides information on the risk of recurrent DVT, subsequent diagnosis of cancer, and chronic venous insufficiency.[21]

Conflict of interest statement

None.

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