Neat-Miss in Focused Lower-Extremity Ultrasound for Deep Venous Thrombosis

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Abstract—Background: Focused, proximal compression ultrasound (FPCUS) is a commonly used point-of-care study in the Emergency Department (ED). Pelvic vein deep venous thrombosis (DVT) is a rare presentation, and Emergency Physicians need to be aware of the limitations and pitfalls of FPCUS. Objective: A case of external iliac vein DVT diagnosed in the ED is presented, with a focus on subtle signs seen during FPCUS that led to further investigation and appropriate diagnosis. Case Report: We describe a patient who presented with lower-extremity pain and was subsequently diagnosed with external iliac DVT. A FPCUS study by Emergency Physicians was performed and demonstrated subtle findings that led to further investigation and appropriate diagnosis. Conclusion: Emergency physicians using FPCUS in the evaluation of lower-extremity pain or swelling need to be aware of the pitfalls, limitations, and advanced techniques to avoid misdiagnosis while evaluating for DVT. © 2013 Elsevier Inc.

Keywords—DVT; Emergency Medicine; point-of-care; ultrasound; compression

INTRODUCTION

Isolated pelvic vein deep venous thrombosis (DVT) is an uncommon presentation. Point-of-care ultrasonography is frequently used in the Emergency Department (ED) as a diagnostic tool for the evaluation of lower-extremity DVT. We present a case of pelvic vein DVT that demonstrates pitfalls of focused proximal compression ultrasound (FPCUS) and discuss subtle findings that, if unrecognized, could have prevented Emergency Physicians from making the diagnosis.

CASE REPORTS

An 84-year-old man presented with atraumatic right lower-extremity pain radiating from the thigh to the lower leg for 1 day. The patient had decreased mobility due to chronic back pain. Past medical and social history were significant for atrial fibrillation, hypertension, prostate cancer (under radiation therapy), and tobacco use. Physical examination demonstrated a swollen/tender right lower extremity without erythema. Laboratory evaluation was within normal limits.

FPCUS was performed by the Emergency Physician. Scanning using the FPCUS protocol demonstrated complete apposition of the walls with gentle compression of all venous structures from the superficial/deep femoral vein juncture to the popliteal trifurcation. Although full apposition of the walls of the proximal common femoral vein was obtained, it required extreme force, as noted by the sonologist. A duplex ultrasound was ordered due to the patient’s physical examination findings and risk factors for DVT and was performed by the institution’s vascular laboratory. Dampened venous pulsation in the common femoral vein at the level of the inguinal ligament...

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was exhibited, with thrombus noted in the right external iliac vein.

Heparin therapy was initialized in the ED, and an inferior vena cava filter was later placed during the hospital admission. The patient was discharged home on enoxaparin without complication.

**DISCUSSION**

This case demonstrates potential limitations of FPCUS, which classically does not pursue clots proximal to the common femoral vein. The standard FPCUS protocol utilizes gray-scale visualization of the common femoral vein proximal to the greater saphenous vein insertion distally to the superficial/deep femoral vein junction and then from the popliteal vein distally to the trifurcation. The venous structures are compressed along this path identifying complete apposition of the vessel walls and obliteration of the venous lumen. Other advanced techniques are not routinely applied.

A DVT in the pelvic vessels is rare. Isolated pelvic vein DVT accounts for approximately 2% of all DVT cases (1). The low frequency of isolated pelvic vein DVT combined with the more controversial incidence and treatment options of isolated calf vein thrombosis make FPCUS a valuable tool for clinicians evaluating the symptomatic patient (leg pain, swelling, erythema) in the ED, where time and resources are often stressed.

Ultrasound technology has been used in the diagnosis of DVT dating back to audible Doppler in the 1960s (2). Over the past two decades, real-time B-mode and Doppler ultrasound have proven to be safe and effective for the evaluation of suspected DVT. DVT can be diagnosed by lack of complete venous compression and direct clot visualization. Adjunct findings include absence of variation in the color flow or spectral Doppler wave pattern with augmentation and lack of phasic variation in the Doppler flow pattern with respiration. Compressibility alone is often used as the only criterion and has demonstrated both high sensitivity and specificity (2,3). An evaluation using color Doppler without compression demonstrated poor sensitivity (38%) and only moderate specificity (92%) (4). A review showed ultrasound to be highly accurate and the study of choice for the non-invasive diagnosis of DVT (3). Ultrasound has largely replaced the traditional diagnostic modality (contrast venography). Sensitivity of compression sonography has been reported between 97% and 100%, with specificities of 98–100% (5,6). Ultrasound is non-invasive, rapid, and accurate, making it the test of choice at many centers. Ultrasound does face limitations such as anatomical variation, obesity, and edema falsely causing poor compressibility, as well as inherent difficulty in evaluating the calf and iliac vessels (5). Pelvic vein DVT can be difficult to visualize and detect with compression ultrasound technique due to shadows from bowel gas or challenging body habitus.

There are other imaging options. Contrast-enhanced computed tomography (CT) scanning, specifically CT venography (CTV), has been evaluated in studies that have shown it to be effective and statistically equivalent to ultrasound in the diagnosis of lower-extremity thrombosis (7,8). CTV can be combined with CT angiography of the chest to evaluate for pulmonary embolism. Ultrasound seems to be the better choice for evaluation of isolated lower-extremity DVT, as it does not involve ionizing radiation or the nephrotoxic contrast agents injected during CTV (2). Magnetic resonance venography (MRV) has been successful in diagnosing DVTs (reported sensitivity of 100% and specificity 95%), including isolated pelvic vein DVTs, which were not visualized on vascular sonography (1).

Ultrasound allows for the visualization of other pathology. A 2009 study showed 26% of abnormal ED ultrasounds for DVT had clinically significant non-DVT findings, including pseudoaneurysm, arterial thrombosis, graft complications, and incidental tumor diagnosis (9). Musculoskeletal injury, lymphadenopathy, and Baker’s cysts can mimic non-compressible vasculature and must be considered to avoid inappropriate anticoagulation (2).

FPCUS with repeat examination in 5–7 days has been shown to be safe and effective in the evaluation of suspected DVT. The focused examination is based on the fact that focal segmental and isolated pelvic vein thromboses are rare, and with repeat ultrasound, propagation of a calf vein thrombosis to a more clinically significant proximal DVT would be detected. An additional study showed that with limited training, FPCUS by Emergency Physicians had a median examination time of approximately 3.5 min, and a 98% agreement with vascular laboratory studies (10). These limited examinations with follow-up correlated well with full vascular duplex performed in a radiology laboratory (2,10). A sensitivity of 100% and specificity of 99% was reported in a study evaluating Emergency Physician FPCUS with limited training (11). Point-of-care ultrasound for DVT has been shown to improve time to disposition of ED patients as well (12). Having a test that is readily available, rapid, and accurate, thus expediting disposition of the patient, is paramount to the Emergency Physician.

The clinician must be aware of the test’s limitations. Isolated pelvic vein DVT should be sought when the patient demonstrates the possible symptoms of a DVT, including leg pain, swelling, and erythema, with a “negative” FPCUS (1). Many of the risk factors such as advanced age, immobility, malignancy, recent surgery, exogenous estrogen use, prior DVT, pregnancy, or thrombophilic diseases are the same for pelvic vein DVT.
Pregnancy has been shown to put patients at five-times greater DVT/pulmonary embolism risk, and isolated pelvic vein DVTs have been reported with a frequency of 10–12% in the pregnant and postpartum periods (13). The appearance of chronic DVT on ultrasound with acute lower-extremity DVT symptoms should also prompt further investigation for acute thrombosis proximally in the pelvic veins (1). The constellation of findings, including these symptoms, risk factors, and the ultrasound findings should prompt the clinician to consider pelvic vein thrombosis.

One technique that can be used to recognize thrombi proximal to the femoral vessels is to assess respiratory variation. Using Doppler flow evaluation there should be variation of flow in the vessels with the change in intrathoracic pressure caused by respiration. Lack of this variation has been shown to be an effective way to indirectly evaluate the pelvic veins (2,14). The clinician should consider the evaluation of respiratory variation when there is clinical suspicion and the iliac vessels cannot be directly visualized due to the mentioned limitations. It is important that physicians recognize other clues that a more proximal clot may be present, such as vessel dilatation, or if extreme force is needed to compress the venous structure under interrogation. Standard FPCUS protocols should call for gentle compression to achieve vessel wall apposition. Additionally, direct visualization and compression of the external iliac vein can be used in some patients. The clinician should consider this more proximal evaluation with PFCUS, when possible, as MRV found that 41% of pelvic vein DVTs occur in the external iliac vein (1). We also recommend pelvic vein evaluation when FPCUS demonstrates turbulent flow (Figure 1), a dilated common femoral vein, or more than usual force is required for vessel wall apposition.

Treatment traditionally requires prolonged anticoagulation with low molecular-weight heparins or warfarin. The 2008 American College of Chest Physicians (ACCP) guidelines calls for catheter-directed thrombolysis for extensive acute DVT. Despite this, only 14.3% of patients underwent catheter-directed thrombolysis and 4.8% underwent thrombectomy at a tertiary referral center (15). The ACCP guidelines do not define “extensive acute proximal DVT.”

CONCLUSION

Standard FPCUS could have missed the external iliac DVT in our case. This is significant because pelvic vein/iliofemoral thrombi have a high risk of embolization and increased risk of post-thrombotic syndrome (2,15). Physicians performing point-of-care ultrasound must be aware of its limitations. When signs and symptoms are consistent with the diagnosis of DVT, the ED sonologist must be aware of subtle findings that can indicate rare pathology. Additionally, they should be familiar with using additional techniques such as augmentation and evaluation of respiratory variation by Doppler, or choose alternate imaging modalities including formal duplex ultrasonography, CTV, or MRV, when necessary.

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Figure 1. Turbulent flow (arrow) is noted on gray scale imaging at the level of the saphenous vein (S) take-off from the left common femoral vein (V). The common femoral vein was compressible in this location. “A” denotes the superficial and deep femoral arteries.


