IDENTIFICATION OF INTRALUMINAL THROMBUS BY ULTRASONOGRAPHY IN EMERGENCY DEPARTMENT PATIENTS WITH ACUTE DEEP VENOUS THROMBOSIS

Ninfa Mehta, MD, MPH, Joshua Schecter, MD, and Michael Stone, MD

Department of Emergency Medicine, SUNY Downstate/Kings County Hospital Center, Brooklyn, New York

Reprint Address: Ninfa Mehta, MD, MPH, Department of Emergency Medicine, SUNY Downstate/Kings County Hospital Center, 450 Clarkson Avenue, Brooklyn, NY 11203

Abstract—Background: Traditionally, the diagnosis of deep venous thrombosis (DVT) using duplex ultrasonography (DU) has relied on the absence of venous compressibility. Visualization of an intraluminal thrombus is considered an uncommon finding. Objectives: The purpose of this study is to determine the frequency of intraluminal thrombus in emergency department (ED) patients diagnosed with acute DVT. Methods: Retrospective chart review of adult ED patients with DU examinations demonstrating acute DVT. Patients with chronic DVT or patients in whom DU did not demonstrate DVT were excluded from data analysis. Study reports and ultrasound images were reviewed and analyzed for the presence of intraluminal thrombus. Results: There were 189 patients who met inclusion criteria, of which 160 (85%) were found to have intraluminal thrombus. Conclusion: Intraluminal thrombi are present in the majority of patients in our ED in whom acute DVT is identified by DU. © 2012 Elsevier Inc.

Keywords—ultrasound; deep venous thrombosis

INTRODUCTION

Acute deep venous thrombosis (DVT) is a medical emergency that demands immediate treatment to prevent life-threatening complications such as pulmonary embolism. Venography, contrast computed tomography, and duplex ultrasonography are diagnostic modalities used to evaluate patients for the presence of DVT. Most institutions currently use duplex ultrasonography (DU) as the initial diagnostic modality of choice.

In recent years, emergency physician-performed ultrasonography has been shown to be accurate in the diagnosis of DVT (1). The most common criteria for the diagnosis of DVT using DU is the identification of venous non-compressibility (1–3). Although acute DVT can be associated with a visible hypoechoic intraluminal thrombus (IT), we were unable to determine the incidence, and the criterion for diagnosis of DVT remains the failure to fully compress a vein while applying pressure with the ultrasound transducer. However, in evaluating patients with acute DVT in our emergency department (ED), our anecdotal experience has suggested that our patient population has an unusually high incidence of visible IT. There is little known or published about the incidence of visible IT in patients with DVT. Neither Zwiebel and Pellerito nor Rumack et al. make mention of this in the chapters on DVT in their vascular texts (4,5). This study aims to determine the incidence of visualized IT identified by DU in ED patients diagnosed with acute DVT.

MATERIALS AND METHODS

Study Design

After institutional review board approval, a retrospective chart review of our institution’s electronic medical record...
was conducted. All patients referred for DU from the ED between January 1, 2006 and January 31, 2009 were identified and medical records were reviewed by the investigators.

Setting

This study population was evaluated at a large urban teaching hospital and level I trauma center with an annual ED census of approximately 120,000 patients.

Selection of Participants

The study population consisted of adult ED patients aged > 18 years who were referred for DU of one or both lower extremities. Patients in whom DVT was not diagnosed, and patients who were diagnosed with chronic DVT, were excluded.

Duplex Ultrasonography Examinations

DU was performed by credentialed vascular ultrasound technicians, by Radiology residents, or by Radiology attendings. All study images were saved to an electronic Picture Archiving and Communication System (PACS) and were interpreted by board-certified staff radiologists.

Methods of Review

Three of the investigators performed independent blinded review of the eligible patients’ records. Criteria for determining the presence of visible IT were 1) mention of hypoechoic or echogenic thrombus or defect in the final study interpretation, or 2) IT present on blinded review of PACS images by two of the investigators (NM, MBS). This review was done independently by two emergency physicians. The reviewers accessed the images of patients with diagnosed DVT to determine if a thrombus was or was not visible. A thrombus was determined to be present only if both reviewers agreed.

RESULTS

There were 2330 adult patients referred for DU from the ED during the study period. DU identified 189 patients (8.1%) with acute DVT; 102 patients (54%) were female, and the average age was 61 years. Review of the images enabled identification of IT in 160 of these 189 patients (84.7%). The interobserver agreement was 1.0.

DISCUSSION

Approximately 260,000 cases of acute DVT are diagnosed annually in the United States. Furthermore, DVT is a disease process that, if untreated, can lead to serious complications, including pulmonary embolism and death. Accurate, timely diagnosis is therefore of utmost importance in the ED, and DU is the initial diagnostic modality of choice (6). Traditionally, the diagnosis of thrombosis has been made by compression ultrasonography (7). The incidence of visible hypoechoic thrombus in the setting of acute DVT is not well established. In one recent study, 28 of 45 patients with DVT had a thrombus visible to the emergency physician, and 6 of those had normal compressibility (8).

The incidence of visible IT was very high in this population. It is possible that our patients, almost all of whom are of Caribbean descent, may have a genetic predisposition to the formation of echogenic DVT due to unknown factors affecting clot architecture. It is also possible that technology has improved dramatically in recent years, and advances in spatial resolution improve our ability to visualize intraluminal thrombi.

Our study was a pilot study done to investigate our anecdotal observations that the majority of our patients with acute DVT also demonstrated visible IT on DU. Similar studies will need to be conducted in different patient populations to determine if these results can be reproduced. Sonographers should be aware that visible IT may not be an uncommon finding in certain populations, but at present should continue to rely on the lack of venous compressibility for the diagnosis of DVT by DU.

Limitations

This study is a retrospective electronic medical record review, and although there are inherent limitations to this design, it represents our best current option to identify a large number of patients with DU examinations demonstrating DVT. In addition, upon review of the PACS images, 48 of the positive DVT studies demonstrated IT yet did not include mention of thrombus in the dictated report. Although it is possible that the investigators were biased towards identifying additional IT, this potential bias was minimized by blinded independent review wherein the diagnosis of visible thrombus was made only when both investigators agreed. In addition, interobserver agreement was 1.0, demonstrating excellent interobserver reliability. This study was conducted at a single institution, and it is possible that genetic aspects of our relatively homogenous patient population increase the incidence of visible IT in patients with DVT. Further studies in more diverse patient populations are required to determine if this finding is reproducible.

CONCLUSION

Although compressibility remains the standard for the diagnosis of DVT, it may be possible to use IT as an
additional diagnostic criterion for DVT. It is imperative to
do further studies before applying this criterion to diverse
populations.

REFERENCES

1. Burnside PR, Brown MD, Kline JA. Systematic review of emergency
physician-performed ultrasonography for lower-extremity deep vein
2. Kline JA, O’Malley PM, Tayal VS, Snead GR, Mitchell AM. Emer-
gency clinician-performed compression ultrasonography for deep
52:437–45.
emergency department for the diagnostic management of clinically
4. Zwiebel W, Pellerito J. The role of Ultrasound in the management
of extremity venous disease. In: Introduction to vascular ultra-
sonography. 5th edn. New York: Elsevier Saunders Publishing;
5. Rumack C, Wilson S, Charboneau J. The peripheral veins. In: Diag-
Wells PS. Compression ultrasonography for diagnostic management
of patients with clinically suspected deep vein thrombosis: prospec-
7. Lensing AW, Prandoni P, Brandjes D, Huisman PM, Vigo M,
Tomasella G. Detection of deep-vein thrombosis by real-time
8. Crisp JG, Lovato LM, Jang TB. Compression ultrasonography of the
lower extremity with portable vascular ultrasonography can accu-
rately detect deep venous thrombosis in the emergency department.

ARTICLE SUMMARY

1. Why is this topic important?
This topic is important because in patients with echo-
genic clot, it is possible to state that they have a deep ve-
nous thrombosis and treat them accordingly.
2. What does this study attempt to show?
This study shows a different way to characterize a clot
other than compressibility, the traditional method.
3. What are the key findings?
Key findings include the presence of an echogenic clot
and intravascular thrombus may represent dvt.
4. How is patient care impacted?
The method described can provide faster and more
thorough study to find a deep venous thrombosis.