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Regular Article

Overuse of Compression Ultrasound for Patients with Lower Extremity Cellulitis☆

Craig G. Gunderson *,[1], John J. Chang [1]

Yale School of Medicine, Department of Internal Medicine, Veteran's Administration Healthcare System, 950 Campbell Ave, West Haven CT 06516

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ABSTRACT

Background: Compression ultrasound (CUS) is often ordered in hospitalized patients with cellulitis to assess for deep vein thrombosis (DVT). Despite this common practice, the rate of use and utility of CUS has not been well described.
Methods: We conducted a retrospective cohort study of adult patients with lower extremity cellulitis hospitalized between October 1, 2008 and September 30, 2013 at an academic medical center. Cases meeting inclusion criteria were reviewed for the use of CUS, the indication for CUS, the occurrence of DVT, and the 3 month follow-up occurrence of DVT after discharge.
Results: A total of 239 patients were identified using ICD-9 coding data with a discharge diagnosis of cellulitis or abscess of leg. Of these, 183 met criteria for inclusion in the study, 133 of whom had CUS to assess for DVT (73%). Of the 133 who received CUS, 11 studies found DVTs (8%). Of the 11 DVTs, 8 had been previously diagnosed, and 3 were new. Of the new DVTs, only one was ipsilateral to the leg with cellulitis.
Conclusion: Most patients admitted with lower extremity cellulitis received CUS to assess for DVT. Despite this common practice, the rate of acute ipsilateral DVT was low and matched the rate of acute contralateral DVT. Previously diagnosed DVTs were commonly re-imaged. Overall the use of CUS had minimal impact on patient management and the routine use of CUS to assess for DVT in hospitalized patients with cellulitis appears to be unnecessary.

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Introduction

Cellulitis is a common type of skin and soft tissue infection resulting in more than 600,000 hospitalizations per year in the United States [1]. The occurrence of deep vein thrombosis (DVT) is often considered in patients with cellulitis because of the shared presentation of unilateral limb swelling, erythema and pain [2,3], and compression ultrasound (CUS) is often ordered in hospitalized patients with cellulitis. We recently performed a systematic review of the risk of DVT in patients with cellulitis and found an overall pooled rate of proximal DVT of 2.1% (95% CI, 0.5%-9.1%) [4]. In our review we only found two studies that reported rates of CUS use in patients with cellulitis; one from Denver reported that 42% of patients admitted with cellulitis received ultrasounds, but did not individually review the cases to determine the indication for the ultrasound or report the rate of DVT [5]. The other study from New Zealand reported that 16% of patients with cellulitis admitted to the hospital received CUS, but also did not individually review the cases to determine the indication for the study [6]. This study reported a low rate of proximal DVT (1.25%).

In summary, based on our recent systematic review of the literature, no study carefully reports the frequency and indication for CUS in patients with cellulitis. The purpose of the current study is to review a cohort of patients hospitalized with cellulitis to describe the frequency of CUS as well as to record the rate of positive studies and impact on management. Our hypothesis is that the majority of patients being admitted with cellulitis has CUS to assess for DVT and that the rate of DVT and impact on management is low.

Methods

Study Design

The West Haven Connecticut Veteran's Administration Hospital (WHVA), located outside New Haven, Connecticut is a 228 bed tertiary care center affiliated with Yale Medical School. All patients discharged from the WHVA with an International Classification of Disease, 9th Revision (ICD-9) primary diagnosis of cellulitis or abscess of the leg

Abbreviations: CUS, compression ultrasound; DVT, deep vein thrombosis; WHVA, West Haven Connecticut Veteran's Administration Hospital; ICD-9, International Classification of Disease, 9th Revision; RVO, residual vein obstruction; ACCP, American College of Chest Physicians; IDSA, The Infectious Disease Society of America.

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* Corresponding author at: Department of Internal Medicine, West Haven Veteran's Hospital, West Haven, CT 06516.
E-mail address: Craig.Gunderson@va.gov (C.G. Gunderson).
[1] Tel.: +1 203 932 5711x2616; fax: +1 203 937 3425.

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(682.6) between October 1, 2008 and September 30, 2013 were reviewed for possible inclusion in the study. For patients with multiple hospitalizations for cellulitis at the WHVA during the study period only the first episode was included. Patients' records were then reviewed using a standardized data extraction form for demographics, length of stay, type and location of infection, admitting service, putative risk factors for cellulitis and deep vein thrombosis, whether previous admissions for cellulitis had occurred, prior compression ultrasounds, use of anticoagulation and indication, D-dimer, whether CUS was ordered and indication and result. Post-discharge records were reviewed for the occurrence of deep vein thrombosis at three months. All patients with documented cellulitis of the lower extremity were included. Patients were excluded if they had infection involving a different location or if they had a different type of soft tissue infection that did not also involve a spreading infection of the leg, such as diabetic foot ulcers, abscesses without cellulitis, peripheral artery disease with gangrene and necrotizing soft tissue infections. The study was approved by the WHVA Institutional Review Board.

Study Definitions

Leg cellulitis was defined as any spreading infection involving the leg [7]. In the manner of Jenkins et al. [5], cases of cellulitis were divided into cases with complicating factors such as abscess, peripheral artery disease or chronic ulcers and cases without such factors. Risk factors for DVT were defined by the Wells Criteria [8]; active cancer was defined as receiving treatment for cancer within the previous six months or currently receiving palliative care, excluding basal-cell and squamous-cell carcinoma of the skin; bedridden was defined as recently bedridden for 3 or more days; major surgery was defined as major surgery within the past 12 weeks requiring general or regional anesthesia. DVTs were defined by evidence of thrombosis of the popliteal or more proximal veins on compression ultrasonography. New DVTs were assumed when there was no known prior history of leg DVT. Prior DVTs were defined as cases with previously diagnosed leg DVTs as documented in notes and confirmed by prior CUS at our institution. These were further classified as recurrent DVTs when there was proximal extension of prior thrombosis into a previously fully compressible proximal segment or an increase in size of thrombus as commented by the radiology report compared with old studies. If there was a prior DVT and the thrombus had not extended proximally or increased in size this was classified as residual vein obstruction (RVO) in accordance with the American College of Chest Physicians (ACCP) guidelines on antithrombotic therapy and prevention of thrombosis [9]. In cases with prior DVT in which the original and new CUS were not directly comparable because one had been done outside our institution, the DVT was recorded as uncertain recurrent or RVO.

Data Analysis

The primary outcomes of the study were the frequency of patients with leg cellulitis that had CUS done to evaluate for DVT and the frequency of studies that were positive for DVT. Patients were grouped by whether they had CUS done and compared in terms of demographics and relevant clinical characteristics. For comparison of dichotomous variables, chi-square or Fisher's exact tests were used. For continuous variables, t-tests or Mann–Whitney U tests were performed. Variables with p values less than 0.2 on bivariate analysis were included in a multivariate logistic regression analysis. P values <0.05 were considered significant. All analyses were performed using SPSS version 21.0 (Chicago, Illinois).

Results

239 patients were identified during the study period with a discharge diagnosis of cellulitis or abscess of the leg. In total, 56 patients were excluded; 17 cases had more than one admission for leg cellulitis during the study period and the later admission excluded; 17 cases had abscesses without cellulitis; 7 had stasis dermatitis and antibiotics discontinued; 4 had prepatellar bursitis; 2 had diabetic foot infections without leg cellulitis; 2 had chronic ulcers without cellulitis; 3 had miscellaneous non-cellulitic infections, including a case each of pneumonia, chronic osteomyelitis, and disseminated mycobacterium marinum. Fig. 1 diagrams the overall results of the study. Of the 183 included patients, 133 (72.7%) had CUS done to exclude DVT. Of the 133 studies, 11 (8.3%) were positive for thrombosis including 3 (2.3%) new diagnoses and 8 (6.0%) patients with prior ipsilateral leg DVTs that were re-imaged. Table 1 shows the clinical characteristics of the 11 patients with DVT. Of the new diagnoses, one patient had an ipsilateral DVT, one had a contralateral DVTs compared with the leg with cellulitis and one case had bilateral cellulitis with a unilateral DVT. Of note, the one patient found to have a new ipsilateral DVT refused anticoagulation and may in fact have had a chronic DVT as he told the physician that he had been recommended to take anticoagulation for his legs in the past and refused. We chose to include him as a new DVT however given the lack of confirmatory documentation. Of the eight patients who had prior known leg DVTs, six of the eight imaged DVTs were ipsilateral to the side with cellulitis, one was contralateral and one patient had bilateral DVTs with unilateral cellulitis. Six of the eight old DVTs were classified as residual thrombus since clot had not extended proximally or grown, one of the eight was classified as recurrent and one was uncertain due to lack of prior imaging at our institution. Five of the eight were already on anticoagulation for DVT while three were restarted although two of these patients were classified as residual vein obstruction rather than recurrent DVT. Interestingly, none of the treating teams distinguished between residual vein obstruction and recurrent DVT and all DVTs, whether old or new, prompted resumption or continuation of anticoagulation.

Table 2 shows the demographic and clinical characteristics of the included cases categorized by whether CUS was done to assess for DVT. Both groups were similar in terms of age, gender, admitting service, year of admission and whether they were on anticoagulation and whether they had had previous CUS of the same limb to assess for DVT. Patients who had CUS were significantly more likely to have cellulitis without a complicating factor, chronic edema, and risk factors for DVT, including prior DVT and being bedridden. There were also non-significant trends for patients who had CUS to have longer lengths of stay and paresis. Patients with traumatic wounds were less likely to have CUS ordered. After multivariate adjustment, only cellulitis without complicating factor was significantly associated with having CUS performed (odds ratio 2.6, 95% confidence interval: 1.2-5.9).

Table 3 shows the demographic and clinical characteristics of the patients that had CUS categorized by the result of the CUS. Compared with the group that did not have DVT, the patients with DVT were significantly more likely to have a prior history of DVT. There were also non-significant trends for the group with DVT to have chronic edema and leg ulcers and to already be on anticoagulation. Lastly, there was a trend for the frequency of DVT to vary by year. Multivariate analysis was not performed due to the limited number of patients with DVT.

Of the 183 patients included in the study, 181 had documented follow-up 3 months or later in clinic and were without newly diagnosed DVT. Two patients were lost to follow-up post discharge.

Discussion

The primary finding of our study is that the majority of admissions with leg cellulitis at our facility are being screened for DVT by CUS. Why this is being done is uncertain. The Infectious Disease Society of America's (IDSA) Guideline on Skin and Soft Tissue Infections does not even mention CUS as a test to consider in patients with cellulitis [10]. Our recent systematic review of the rate of DVT in patients with cellulitis concluded that although the quality of the literature was limited the available evidence indicated a relatively low rate of proximal DVT in patients with cellulitis, comparable to the rate of patients in the "low risk"