Duplex scan for deep vein thrombosis—defining who needs an examination of the contralateral asymptomatic leg

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Objectives: Determine the prevalence and clinical significance of deep venous thrombosis (DVT) in the asymptomatic contralateral extremity of patients referred to the vascular laboratory with unilateral symptoms and DVT confirmed by duplex scan.

Method: From December 2003 to October 2006, a total of 4813 patients were referred to our vascular laboratory for unilateral venous duplex scans. We prospectively studied 239 patients who were found to have acute DVT and had unilateral symptoms. Contralateral examinations were performed and demographic data, including risk factors for DVT, were entered into a computerized database.

Results: Of the 239 patients, 133 (55.6%) had a major DVT (popliteal vein or above) and 106 (44.4%) had a calf vein DVT. The majority were outpatients (195, 81.6%) and the rest were inpatients (44, 18.4%). The contralateral leg was normal in 192 (80.3%) patients, whereas 47 (19.7%) patients had some evidence of venous thrombosis. These thromboses consisted of acute major DVT (18/47, 38.3%), acute calf vein DVT (14/47, 29.8%), and less clinically significant chronic or superficial thrombus (15/47, 31.9%). All 18 patients with major contralateral DVT had underlying risk factors for thrombosis: active malignancy (12/18), recent surgery (4/18), or trauma (2/18). Patients with asymptomatic contralateral calf vein involvement often had thrombotic risk factors (10/14) but occasionally did not (4/14). Patients with an active malignancy were significantly more likely to have DVT in the asymptomatic leg (18/47, 38.3%) than were patients without cancer (23/192, 12%; both P < .0001). Inpatients were much more likely to have contralateral asymptomatic thrombosis (15/44, 34.1%) than outpatients (31/195, 15.9%; both P < .006). If treatment had been based on the findings in the symptomatic leg, all but 2 of the 239 patients would have been adequately treated. These two patients had multiple thrombotic risk factors that should have precluded ordering of a unilateral examination.

Conclusions: Inpatients have a very high incidence of clinically silent contralateral thrombosis (34%) and should usually undergo bilateral examinations. Patients with active malignancy have a 38% incidence of asymptomatic contralateral clot and should always have a bilateral study. Outpatients with unilateral symptoms and no associated risk factors for thrombosis can safely undergo unilateral examinations and should be adequately treated according to the unilateral findings. Algorithms to select patients for limited studies should include screening data for active malignancy, recent trauma or surgery, pregnancy, hormone therapy, or history of thrombophilia. (J Vasc Surg 2008;48:413-6.)
Table 1. Risk factors for thrombosis in patients with deep venous thrombosis (DVT) in the asymptomatic limb

<table>
<thead>
<tr>
<th></th>
<th>Active malignancy</th>
<th>Surgery within 30 days</th>
<th>Trauma</th>
<th>Prolonged bed rest</th>
<th>Pregnancy</th>
<th>None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major DVT (18 patients)</td>
<td>12</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Calf vein clot (14 patients)</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
</tbody>
</table>

and permission was obtained to examine the contralateral leg. Patients with chronic thrombophlebitis were not included in the study. Results of duplex scans in both legs as well as demographic data including risk factors for DVT were entered into a computerized database. For purposes of the study, patients presenting to the emergency room were considered outpatients. No patients were excluded because of age, comorbidity, or risk factors for thrombosis. All patients underwent color flow duplex imaging of the major veins of the lower extremity including the common femoral, profunda femoris, and popliteal veins. Thrombus in these veins was recorded as major DVT. Iliac veins were imaged if thrombus extended above the inguinal ligament or if there was loss of respiratory variability at the level of the femoral vein. Examination of the calf veins including the posterior tibial, peroneal, soleal, and gastrocnemius veins was also a routine part of every examination. In this study, only patients with acute DVT were included. The diagnosis of acute DVT was based on findings of noncompressibility of visualized deep veins. Patients with bright echoes within the thrombus were deemed to have chronic venous thrombosis and were excluded from the analysis.

The majority of the vascular technologists (7/9) had obtained the Registered Vascular Technologist (RVT) credential. Duplex imaging equipment was manufactured by several nationally recognized vendors (Acuson Sequoia [Siemens USA, Malvern, Pa], Philips IU22 and 5000 [Philips Biomedical Systems, Bothell, Wash], and Zonare [Zonare Medical Systems, Mountain View, Calif]). Ultrasound probes of various frequencies were selected to obtain optimal images on the basis of the patient’s body habitus. Typically this procedure used linear probes of 9-3 MHz or curved probes of 5-2 MHz. Most patients with major DVT were treated with fractionated or unfractionated heparin followed by warfarin. Calf vein thrombus was treated with either antiplatelet therapy or standard anticoagulant therapy according to the preference of individual referring physicians. This study did not address the type of therapy or its effectiveness in the patient cohort: It was limited to the extent of disease in the asymptomatic extremity. When chronic venous thrombosis or superficial thrombophlebitis was found, these results were also recorded although they rarely affected the therapy implemented in these patients.

Recorded thrombotic risk factors included recent surgery, trauma, use of oral contraceptives or hormonal therapy, pregnancy, active or remote malignancy, previous history of DVT, and history of thrombophilia. For purposes of this study, patients who received surgery, radiation therapy, or pharmacologic therapy for malignancy within 1 year of the examination were considered to have active disease. Comparisons were made between the inpatient and outpatient cohorts. The study was exempted by the institutional review board, because all information was de-identified and no follow-up patient information was collected.

RESULTS

Between December 2003 and October 2006, venous duplex scans were performed on 14,834 patients in the vascular laboratory of a tertiary care hospital with a level one trauma center. Of this total, 10,021 were bilateral scans and 4813 were unilateral. The majority of patients underwent bilateral venous duplex imaging. During this period all patients referred for unilateral venous examination because of unilateral symptoms and found to have acute DVT in the symptomatic leg underwent imaging of the other leg. With the use of this algorithm, a total of 239 patients were found to have acute DVT in the symptomatic leg. The study group consisted of 125 women and 114 men, all with acute venous thrombosis. The majority were outpatient examinations (195), whereas 44 studies were performed on hospitalized patients. Thrombus in the symptomatic leg was limited to calf veins in 106 patients (44.4%). Major DVT was found in 133 patients (55.6%). The contralateral study was normal in 192 patients (80%) and abnormal in 47 (20%). Results of duplex scans in the asymptomatic leg consisted of acute major DVT in 18 patients, acute calf vein DVT in 14 patients, chronic major DVT in 11 patients, chronic calf vein thrombus in two patients, and superficial thrombophlebitis in two patients.

There was at least one underlying risk factor for venous thrombosis in all 18 patients with acute major DVT in the asymptomatic leg. These factors included active malignancy in 12 patients, recent surgery within 30 days in four patients, and trauma in two patients. The presence of risk factors for DVT was less predictable in patients with calf vein thrombosis. Of 14 patients in this category, four had active malignancy, one had undergone recent surgery, and two had experienced trauma. Two other patients had been on prolonged bedrest and one was pregnant. However, four patients (28.5%) had no known risk factors. Table I summarizes the high prevalence of coagulopathic risk factors in patients with clinically silent contralateral DVT.

The most important clinical concern regarding a study of this type is whether results of the unilateral examination will provide information that allows adequate treatment for all patients in the cohort. Because not all physicians treat calf vein thrombophlebitis with heparin and warfarin, it was important to know if any patients with major DVT in the asymptomatic leg had lesser disease in the symptomatic one. There were two such patients in this study. One
Table II. Extent of contralateral thrombosis in study group

<table>
<thead>
<tr>
<th></th>
<th>Contralateral major DVT</th>
<th>Contralateral calf vein DVT</th>
<th>Contralateral chronic major and calf DVT</th>
<th>Contralateral superficial clot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Symptomatic major DVT</td>
<td>16</td>
<td>5</td>
<td>13</td>
<td>2</td>
</tr>
<tr>
<td>Symptomatic calf DVT</td>
<td>2*</td>
<td>9</td>
<td>0</td>
<td>0</td>
</tr>
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</table>

*DVT*: Deep venous thrombosis.

*Includes one patient with paraplegia after open reduction internal fixation for fractured hip, who had been on prolonged bed rest, and one patient who presented with leg pain and pulmonary embolus after surgery.

Table III. Effect of patient population on findings of contralateral deep venous thrombosis

<table>
<thead>
<tr>
<th></th>
<th>Inpatient</th>
<th>Outpatient</th>
</tr>
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<tr>
<td>Contralateral leg negative</td>
<td>29/44 (66%)</td>
<td>164/195 (84%)</td>
</tr>
<tr>
<td>Contralateral leg positive</td>
<td>15/44 (34%)*</td>
<td>31/195 (16%)</td>
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*χ² = 7.645, P < .006.

Table IV. Effect of active malignancy on findings of deep venous thrombosis (DVT) in the asymptomatic extremity

<table>
<thead>
<tr>
<th></th>
<th>Malignancy</th>
<th>No malignancy</th>
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<tr>
<td>Normal</td>
<td>29/47 (61.7%)</td>
<td>169/192 (88%)</td>
</tr>
<tr>
<td>DVT</td>
<td>18/47 (38.3%)*</td>
<td>23/192 (12%)</td>
</tr>
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*χ² = 18.403, P < .0001.

This patient presented to the emergency room with leg pain and a pulmonary embolus after surgical repair of a femur fracture and would have been treated with full anticoagulation. The remaining patient had developed paraplegia from an epidural hematoma after surgical repair of a hip fracture and had been on prolonged bedrest. These patients are included in the analysis because they had been referred for a unilateral examination, even if this referral seems inappropriate in retrospect. With the exclusion of these two patients, Table II shows that no patient would have been treated on the basis of findings in the symptomatic leg.

This study also evaluated the difference between inpatients and outpatients (Table III). The examination in the contralateral extremity was positive in 15 of 44 inpatients (34%). Only 31 of 195 (16%) outpatients had contralateral DVT. This difference is highly significant (χ² = 7.645, P < .006).

Table IV shows that the prevalence of active malignancies was significantly higher in the group with bilateral thrombosis (18/47, 38.3%) than in those with unilateral findings (23/192, 12%).

DISCUSSION

This study evaluated the necessity of routinely examining both legs of patients referred to the vascular laboratory with unilateral symptoms of DVT. Blebea et al reported on a national survey of ICAVL-accredited laboratories. They found that 75% of responding laboratories did not routinely scan both legs for DVT. The current study offers supporting data for this approach in the diagnosis of DVT, providing that certain clinical characteristics of the patient are considered. Specifically, unilateral studies should be performed in outpatients who have been screened for risk factors that increase their risk for developing DVT.

Other authors have emphasized the importance of the clinical presentation in determining how aggressively to evaluate the asymptomatic limb. Miller et al. found DVT in the asymptomatic extremity in 5% of 250 patients presenting with unilateral symptoms. The vast majority of these few patients had other factors that suggested they were at risk for DVT in the asymptomatic leg. They either had advanced malignancy, hypercoagulability, recent joint surgery, or thrombus localized to the calf veins. The authors recommended performing bilateral studies in patients with unilateral symptoms who had an advanced malignancy, had undergone recent joint surgery, or suffered from a hypercoagulable state. Some have questioned the need to evaluate both legs when performing lower extremity venous imaging regardless of the presence of underlying coagulopathy. Strothman et al reported on 248 patients with acute DVT. Patients who had an acute DVT in the asymptomatic leg also had a concomitant acute DVT in the symptomatic leg. The authors concluded that contralateral venous scanning in patients with unilateral symptoms was not indicated. They further argued that limiting studies in this manner would improve efficiency for vascular laboratories.

Not everyone agrees with limiting studies to the symptomatic limb. Lohr et al reported DVT in 35% of their patients with asymptomatic lower extremities. Therefore, they advocate bilateral examinations in all patients. Lemesh et al identified 12 of 705 (1.7%) patients who had DVT in the asymptomatic limb without DVT in the symptomatic limb. They also found bilateral DVT in 17% of patients presenting with unilateral symptoms. They concluded that doing a bilateral examination provided additional information that would prove useful in follow-up care of their patients.

After reviewing papers by Nadich et al and Sheiman, Cronan concluded that patients with bilateral symptoms warranted a bilateral examination. He determined that the incidence of unilateral clot in an asymptomatic extremity in generally healthy patients is approximately 1% and could not justify the additional expense of a bilateral study for a...
yield this low in patients with unilateral symptoms. In patients with underlying conditions that increased the risk of thrombosis, there was a greater likelihood of finding DVT in the asymptomatic limb. Accordingly, he stated that patients with an active malignancy required bilateral examinations in the asymptomatic leg. There appears to be a distinct difference between inpatients and outpatients with regard to the prevalence of unsuspected DVT in the asymptomatic contralateral extremity. Outpatients generally are healthier and are less likely to have other comorbidities that may increase the risk of thrombosis in the asymptomatic limb. Garcia et al. reported that 5% of their 250 inpatients in their study had DVT in only the asymptomatic leg. None of their 276 outpatients had thrombus confined to the asymptomatic leg. They asserted that unilateral studies were sufficient for outpatients presenting with unilateral symptoms. However, they advocated routine screening of both legs in inpatients.

The current study shows a very high incidence of clinically silent DVT in the asymptomatic contralateral extremity (34%). Outpatients in this patient cohort were significantly less likely to have contralateral thrombus (16%), and none of these outpatients would have been inadequately treated if therapy were implemented on the basis of findings in the symptomatic extremity. Those outpatients with clinically silent contralateral thrombus can be predicted by a screening questionnaire that inquires about coagulopathic risk factors such as active malignancy, recent surgery, trauma, prolonged bed rest, pregnancy, or contraceptive therapy. Two patients might have been inadequately treated on the basis of only findings in the symptomatic leg. They had calf vein thrombus in the symptomatic limb but major DVT in the asymptomatic one. One patient presented with a pulmonary embolism, which would require full anticoagulation. The other was paraplegic and had been on prolonged bed rest. Our recommendation for bilateral studies for inpatients would require that both legs be examined and avoided inadequate treatment.

Patients with a history of an underlying malignancy present a unique set of circumstances. Giess et al. found that patients with malignancy and bilateral symptoms had a 10% incidence of DVT. They concluded that patients with malignancy and bilateral symptoms should undergo a bilateral examination. In the current report, 38.3% of patients with clinically silent contralateral thrombus had a history of active malignancy. These data suggest that bilateral studies should always be done on patients under treatment for malignant disease.

**CONCLUSION**

This report shows that a unilateral venous duplex scan is appropriate in patients with unilateral symptoms. A unilateral examination is clearly justified in outpatients whose symptoms lateralize to one extremity and who are free of other comorbidities that increase the risk of contralateral thrombosis. Patients with a history of an active malignancy should always undergo bilateral examination because of the high incidence of asymptomatic contralateral thrombosis in these cases. In-patients are more likely to have been sedentary and have a much higher incidence of unrecognized thrombosis in symptomatic extremities. They should be considered for bilateral examination. Vascular laboratories should develop specific screening policies to identify patients who are under treatment for malignancy, or have had recent surgery or trauma, or who may have other forms of thrombophilia such as pregnancy, hormone therapy, or known coagulopathy.

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Conception and design: RP
Analysis and interpretation: RP
Data collection: RP
Writing the article: RP
Final approval of the article: VM, SW, RP
Critical revision of the article: VM, SW, RP
Statistical analysis: RP
Obtained funding: RP
Overall responsibility: RP

**REFERENCES**


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