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Color duplex-Doppler ultrasonography of lower extremities veins - types of findings

Boris Brkljačić[1], Božidar Šebečić[2], Ante Grga[2], Leonardo Patrlj[2], Andrija Hebrang[1]

[1]Department of Radiology and [2]Department of Surgery, University Hospital "Merkur", Zagreb, Croatia

Background. *The types of ultrasonographic findings observed in patients referred for color duplex Doppler ultrasonography (CDD-US) of veins of lower extremities are presented in this paper.*

Patients and methods. *During 27 months, 934 patients were examined. Among these, 663 were women (71 %) and 271 men (29 %), with the age range 19-86 (mean 58.4) years. Color Doppler scanners Acuson 128 XP 10, ATL HDI 5000 and Siemens Sonoline Elegra were used, with the transducers in the frequency range from 2.5-12 MHz. The types of findings were classified as: (a) deep venous thrombosis (DVT), (b) pathology related to veins without DVT, (c) pathology of adjacent structures, (d) normal findings.*

Results. *DVT was observed in 210 patients (22.5 %) - acute or chronic in 129 patients, and 81 patients were examined in the follow-up of the DVT treatment. Postthrombotic syndrome, varicose veins, superficial thrombophlebitis and popliteal venous aneurysms were seen in 415 patients (44.4 %). The pathology unrelated to veins was observed in 117 patients (12.5 %). Muscular hematomas and popliteal cysts were most common in this group, but very rare pathology was noted, as well. In 192 patients (20.6 %) CDD-US was normal.*

Conclusions. *In patients referred for CDD-US examination of lower extremities veins, a high number of findings unrelated to veins, in addition to well-known findings of various venous pathologies, can be observed on CDD-US. The lesions that clinically mimic DVT should be recognized with US in order to avoid erroneous medical treatment.*

Key words: peripheral vascular diseases - ultrasonography, veins; ultrasonography, Doppler, duplex

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Correspondence to: Assist. Prof.Boris Brkljačić, MD, PhD, Department of Radiology, University Hospital "Merkur"; Zajčeva 19, HR-10000 Zagreb, Croatia. Phone: +385 1 2431 421; Fax: +385 1 2431 397; E-mail: boris.brkljacic@zg.tel.hr

Introduction

In the last decade, ultrasonography (US) has become a primary and routine imaging method for the diagnosis of venous pathology of lower extremities.[1] It is most important and the most commonly used in diagnosing deep venous thrombosis (DVT).[1,2] Color duplex-Doppler ultrasonography (CDD US) has very high accuracy in the detection DVT in the illiac region and in the lower extremities and has almost completely replaced contrast venography in diagnostic algorithm of DVT.[1-3] The advantages of US over venography were well documented in several studies during the last decade.[4-6] CDD US is also routinely used for preoperative visualization of superficial veins, diagnosis and grading of saphenofemoral and saphenopopliteal insufficiency; it enables visualization of changes in postthrombotic syndrome, and it is useful for presurgical mapping of superficial veins used for bypasses.[1-3,7]

The purpose of this article is to present the types of findings observed in patients referred for CDD-US examination of lower extremities veins.

Patients and methods

Between October 20, 1997 and March 31, 2000, 934 patients were referred for CDD-US of lower extremities veins. Among these patients, 663 were women (71 %), and 271 men (29 %). The age range was 19-86 (mean 58.4 years). The two most common reasons for referral of patients were to rule out DVT in clinically suspected cases, or to evaluate deep, superficial and perforant veins prior to the surgery of superficial veins. Patients were also referred for CDD-US follow-up of anticoagulant treatment of the DVT. The most common clinical findings in the patients with suspected DVT were the following: unilateral swelling of the leg, direct trauma of the leg, postoperative state, postthrombotic syndrome with suspected rethrombosis, erysipelas Klippel-Trennaunay syndrome, hemangioma.

CDD-US was performed using state-of-the-art color Doppler scanners Acuson 128 XP 10, ATL-HDI 5000, and Siemens Sonoline Elegra, with the variety of transducers in the frequency range of 2.5-12 MHz. Mostly, transducers in the frequency range from 7,5 to 10 MHz were used.

Routine examination consisted of the compression of the deep veins with the transducer to evaluate venous compressibility, and to rule out DVT. Illiac veins, common femoral veins (CFV), superficial femoral veins (SFV), deep femoral veins, popliteal veins, and all three groups of crural deep veins were examined. Color duplex-Doppler evaluation was always performed. Normal spectra were obtained and tests of distal compression and flow augmentation were performed on the level of CFV, SFV and popliteal veins. Moreover, the superficial veins were examined also for saphenofemoral and saphenopopliteal insufficiency and for the presence of varices and superficial thrombophlebitis. The soft tissue of lower extremities was evaluated for the presence of edema, hematoma, or other pathology.

Contrast venography was not performed in these patients. The medical treatment of DVT was introduced on the basis of CDD-US findings, and was also used in follow-up.

The types of ultrasonographic findings were classified as: (a) deep venous thrombosis (DVT), (b) pathology related to the veins without DVT, (c) pathology of adjacent structures, (d) normal findings.

Results

The types of ultrasonographic findings classified into four groups are presented in Table 1.

Table 1. Types of ultrasonographic findings in all examined patients

Deep venous thrombosis	210	22.5 %
Venous pathology without DVT	415	44.4 %
Pathology of adjacent structures	117	12.5 %
Normal findings	192	20.6 %
Total number of findings	934	100.0 %

Among 934 examined patients, DVT was found in 210 (22.5 %). Acute complete DVT of the leg was found in 97 patients, and acute isolated DVT in 26 patients (crural DVT in 17, CFV DVT in one, popliteal vein DVT in four, illiac vein DVT in four patients). Chronic DVT was found in six patients. Eighty-one patients were referred for the follow-up of DVT during the medical treatment; partial recanalization of DVT was found in 45 patients, and complete recanalization was found in 36 patients. Types of findings in this group are presented in Table 2.

Table 2. Findings in patients with deep venous thrombosis (DVT)

Acute complete DVT	97
Acute isolated DVT	26
Chronic DVT	6
Partial recanalization	45
Complete recanalization	36
Total number of findings	210

Of 934 examined patients, 415 patients (44.4 %), who did not have acute or chronic DVT, were diagnosed with pathology related to veins. In 143 of these patients, the postthrombotic syndrome without signs of DVT was observed, with edema, swelling, insufficient perforate veins and varicose veins. Patients with crural ulcerations were included in this group. In 245 patients, we detected varicose veins, but no significant oedema or ulceration. Twenty-five patients had superficial thrombophlebitis. Popliteal venous aneurysm was observed in one male patient and the aneurysm of the gastrocnemic vein (part of the deep venous system) was observed in one female patient. Types of findings in this group are presented in Table 3.

Table 3. Findings in patients with pathology related to veins, who did not have acute or chronic DVT

Postthrombotic syndrome	143
Varicose veins	245
Superficial thrombophlebitis	25
Venous aneurysms	2
Total number of findings	415

The pathology unrelated to veins was observed in as many as 117 patients (12,5 % of all examined patients). In 27 patients, popliteal cyst was observed; ruptured cyst was seen in 11 cases, inflamed cyst in 2, and hemorrhagic cyst in two. In 34 patients, hematoma was observed in the musculature of lower extremities; the hematoma in the gastrocnemius muscle was seen in 24 patients, in the quadriceps muscle of the thigh in 5 patients, in the soleus muscle in three patients, and two hematomas were adjacent to ruptured Achilles tendons. Iliopsoas bursitis was observed in 10 patients with the enlarged bursa between the trochanter minor, common femoral artery and common femoral vein. Pronounced inguinal lymphadenopathy with swelling of the leg was observed in eight patients with normally patent deep veins. Diffuse phlegmonous inflammation of crural soft tissue was seen in three patients. Six patients had swelling with the clinical signs of erysipelas. Five patients had Klippel-Trennaunay syndrome, though with no evidence of venous thrombosis or A-V fistulas. Two patients had cavernous hemangiomas, one adjacent to the knee, and the other in the femoral region. In one patient with acute myeloic leukaemia, multiple abscesses in muscles of both legs were seen. One patient

had a large sarcoma of the gastrocnemius and soleus muscles, misdiagnosed clinically as DVT. One patient had iatrogenic pseudoaneurysm (PSAN) of the peroneal artery; it occurred after the orthopaedic surgery (patellar ventralization) with traumatic injury of the peroneal artery with a screw during the surgery. One patient had partially thrombosed aneurysm of the popliteal artery. In one patient with Von Recklingshausen's disease, multiple nodules were found in the soft tissue of lower extremities.

In a small group of patients without DVT, the anticoagulant therapy was erroneously introduced prior to the CDD-US examination, based only on clinical symptoms of leg swelling. The patients in whom DVT was misdiagnosed and mistreated with anticoagulant therapy had several underlying diseases: three patients had hematomas in the gastrocnemic muscle, and one in quadriceps muscle of the thigh; two patients had inflamed popliteal cysts; two patients had diffuse phlegmonous inflammation of the crural soft tissue; one patient had a large sarcoma of the gastrocnemius and soleus muscles. In one patient with iatrogenic PSAN of the peroneal artery, the anticoagulant medications were being administered for three months; actually, a large hematoma and swelling compromised arterial perfusion of the limb. The immunocompromized patient with acute myeloic leukaemia, who had multiple abscesses in the soft tissue of both legs, had a typical clinical manifestation of DVT. Luckily, unnecessary anticoagualant therapy was avoided with the CDD-US examination.

In addition to that, in seventeen patients, isolated edema of the superficial tissues was observed that could not be related to venous pathology. In seven of these patients, cardiac pulsatility was transmitted to the peripheral veins, with bilateral swelling, indicating that the edema was of cardiogenic origin.

Table 4. Findings in patients with pathology of adjacent structures unrelated to veins

muscular hematomas	34
popliteal cysts	27
isolated edema of soft tissues	17
illiopsoas bursitis	10
marked inguinal lymphadenopathy	8
erysipelas	6
Klippel-Trennaunay's syndrome	5
diffuse inflammation of the soft tissue	3
cavernous hemangiomas	2
very rare pathologies	5
Total number of findings	117

In 192 patients (20.6 %) CDD-US of lower extremities veins was completely normal, and no pathology was found in the soft tissue as well.

Discussion

In our practice, most common referrals for venous CDD-US are to rule out DVT, to follow-up the effects of anticoagulant therapy in established DVT, and to evaluate venous system prior to surgery of superficial veins. Groups of patients with the high risk of developing DVT are the patients after a major trauma, bone fractures, surgery, especially orthopedic surgery (e.g. hip replacement), patients with coagulopathies, pregnant and puerperal women, and all patients who are bed-ridden for longer period of time.[1-3,7,8] The risk increases with obesity and previous thromboembolic episodes. The risk of DVT is higher with aging; in old people, after long surgery, the risk of DVT is 40-70 %, whereas pulmonary embolia occurs in 1-5 % of patients.[1,2,8] The accuracy of CDD-US in the diagnosis of DVT above the knee is 99 %, and below the knee 81 %.[1-3,9-11] It is well-known that the clinical diagnosis of DVT is not very accurate. Classical clinical symptoms, like positive Homan's sign, local swelling and ten-

derness, are not reliable, and DVT is often overcalled, based on these findings. The same clinical symptoms can be caused by a variety of other conditions: abscesses, muscle hematoma, ruptured popliteal cyst, etc. Also, DVT is often clinically silent, with absent local symptoms.[1-7,11]

The results of the present study show that various pathology was found in almost 80 % of patients referred for CDD-US examination of lower extremities veins. The accuracy of CDD-US in diagnosis and follow-up of the therapy of DVT is well established, as well as in the diagnosis of the postthrombotic syndrome, varicose veins and superficial thrombophlebitis.[1-11] Contrast phlebography can be safely omitted in the diagnosis of these cases. In our study, US findings were normal only in 20.6 % of the referred patients. These data indicate the high clinical yield of US examination of lower-extremity veins. However, the referral of patients for US examination is not the responsibility of radiologist, but of the general practitioner and/or various clinicians (surgeons, specialists in internal medicine, oncologists, etc.).

A well-established capacity of US to visualize DVT, changes of postthrombotic syndrome, and changes of superficial veins was confirmed in the present study. Nevertheless, the reported results indicate that unexpected pathology, or pathology unrelated to veins was found in as many as 12.5 % of patients. This, we believe, may have important clinical consequences. Popliteal cysts, especially in cases of rupture, hemorrhage or inflammation, are known to be the causes of the leg swelling. The same applies to iliopsoas bursitis, traumatic muscular hematomas, and inguinal lymphadenopathy.[1-3] Such changes cannot be seen with contrast venography, while ultrasonography enables their visualization with very high accuracy.

We believe that, for an effective management of patients, it is important to emphasize relatively rare, and unexpected changes as observed by CDD-US in our patients. This refers especially to those patients who were misdiagnosed to have DVT on the basis of clinical symptoms, and who were consequently mistreated with anticoagulant therapy. These patients were not initially referred to CDD-US examination, and received therapy without US confirmation of the diagnosis of DVT. Among these patients, we found muscular hematomas, inflamed popliteal cysts, diffuse phlegmonous inflammation of the soft tissue, rare tumors, and even more rare iatrogenic pseudoanerysm of the peroneal artery. It should also be kept in mind that abscesses in the soft tissue can be seen in immunocompromized patients.

Ultrasonography is nowadays the main diagnostic modality in cases of venous pathology and ultrasonologists should be familiar with all the presented types of findings. There is no doubt that the erroneous diagnosis of DVT has serious clinical implications, as unnecessary administration of anticoagulant medications can result in life-threatening complications. All physicians included in diagnosis and treatment of the diseases related to the peripheral veins have to be aware of the high diagnostic accuracy of US in visualization of both, venous pathology and the pathology of adjacent structures that is unrelated to veins, but that can mimic venous diseases. Therefore, we believe that the anticoagulant therapy for DVT should not be introduced prior to US examination of lower extremities veins, even if all typical clinical symptoms of DVT are present.

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