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Mini Review

Clinical Significance of Anterograde Angiography for Preoperative Evaluation in Patients with Varicose Veins

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Keywords: Deep venous collateral angiography; Lower extremity varicose veins; Iliac vein compression

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Abstract

Objective: To investigate the clinical significance of preoperative lower extremity venography in patients with varicose veins.

Methods: From February 2019 to July 2023, 498 patients (583 diseased lower limbs) with lower limb varicose veins as the first symptom were selected and admitted to the Seventh People's Hospital of Chongqing. Paracentesis of the deep veins of the lower extremities was performed in all affected limbs to observe the morphology of the deep veins from the ankle to the pelvis, the patency of the deep veins, and the reflux of contrast medium when the patients performed the Valsalva manoeuvre. The aetiology of varicose veins was analysed according to the imaging manifestations and individualised treatment plans were formulated according to the different aetiologies.

Results: The imaging success rate of 583 diseased lower limbs was 100%, of which 285 (48.9%) were primary lower limb deep vein valve insufficiency, 186 (32%) were simple superficial varicose veins, 63 (10. 8%) were iliac vein compression syndromes, 41 (5%) were post-thrombotic syndromes of the deep veins of the lower limbs and the others (primary deep vein avascularity of the lower limbs, bifemoral venous malformations, congenital varicose vein osteohypertrophy syndrome, tumour compression, etc.) 8 articles (1.37%).

Conclusion: The advantages of lower extremity deep vein bypass angiography are simple operation, low trauma, and high specificity, which can help to diagnose the aetiology of lower extremity varicose veins and guide the clinical treatment.

Introduction

Varicose veins of the lower limbs mainly refer to the clinical syndrome of the saphenous vein and its branches, or with affected limb swelling and skin nutritional disorders [1]. In the early and middle stages, the quality of life of patients will be affected to varying degrees. In the later stage, some patients will lose the ability to work, and seriously affect the quality of life of patients [2]. The literature reports that about 10%~20% of the people worldwide suffer from superficial varicose veins of varying degrees, and increase with age, with the incidence of up to 50% [2,3]. Domestic literature reports that the prevalence of adults with primary superficial varicose veins of the lower limbs is 10%, with similar prevalence in men and women and slightly higher prevalence in women [4].

At present, the pathogenesis of lower limb varicose veins has not been clearly stated, but it is mainly believed that it is related to congenital and various factors such as venous valve weakness, superficial venous valve insufficiency, venous hypertension, poor blood flow return, and blood reflux [5]. Clinically, the lower extremity varicose veins are divided into countercurrent varicose veins and obstructive

varicose veins according to the different pathological changes [6]. Countercurrent varicose veins mainly include primary varicose veins of the lower limbs and primary deep vein valve insufficiency. This type of disease is treated mainly with superficial veins and blocks blood reflux. Obstructive varicose veins are common in the lower extremity deep vein thrombosis syndrome, iliac vein compression syndrome, and other diseases [7]. The fundamental cause of this kind of disease is that the deep vein blood vessel is not smooth, so the treatment must be mainly the primary disease [8]. Although the extrinsic clinical manifestations of the two diseases are similar, they are different in terms of pathogenesis, pathological changes, and treatment modalities. If the blind treatment, it may cause misdiagnosis and mistreatment [9]. Lower extremity venography serves as the gold standard for the diagnosis of lower extremity venous lesions [10], can accurately provide the imaging of the lower limb venous system, show the whole femoral vein and the lower limb vein overview, clear diagnosis, and provide a reliable basis for the selection of a reasonable treatment plan.

In this study, we collected 498 patients with lower extremity varicose veins admitted to Chongqing Seventh People's Hospital from February 2019 to July 2023, collected the deep vein angiography results of 583 limbs, summarized the diagnosis and treatment experience, and discussed the clinical significance of antegrade angiography of lower extremity deep vein in patients with lower extremity varicose veins, which is reported as follows.

Materials and methods

General information

Selected 498 patients (583 patients with diseased lower limbs) with lower extremity varicose veins from February 2019 to July 2023 as the first symptom, of these, 287 were male and 211 were female cases. Age ranged from 16 to 81 years with a mean of (56.7 ± 12.3) years. Disease duration ranged from 0.21 to 45.00 years and mean body mass index (body mass index, BMI) (25.3 ± 2.0)kg/m2. Among them, 283 patients were with simple left lower limb lesions, 130 patients were with simple right lower limb lesions, and 85 patients were with bilateral lower limb lesions. Clinical manifestations-etiology-anatomy-pathophysiology (clinical etiology anatomy pathophysiology, CEAP) venous classification system: 178 affected limbs C2,167 affected limbs C3,183 affected limbs C4,30 affected limbs C5, and 25 affected limbs C6. All affected limbs were examined by lower limb venography, including 368 in the left lower limb and 215 in the right lower limb.

Preparation before imaging

All patients signed contrast-related informed consent 1 day before examination, performed Valsalva movement training and iodine allergy test to exclude iodine contrast agent for sensitivity, take 0.1 ml of iodixanol injection (iodine concentration 320 mg/ml) into the forearm for skin injection, 20 min later, observe the local swelling range not exceeding 1 cm patients had feasible antegrade angiography of lower limb veins.

Methods

The Philips FD20 digital vascular subtraction angiography machine (digital signature algorithm, DSA) was employed to perform deep vein angiography. After entering the catheterization room of the interventional room, the patient lay flat on the examination bed. Before the angiography, a 22 G venous vein was inserted, and dexamethasone sodium phosphate injection was injected 10 mg 10 min in advance to prevent an allergic reaction. The tourniquet was inserted 5cm above the ankle joint of the affected limb, and 100 ml of 50% iodoxaxol injection diluted in normal saline was injected within 1 min. Dynamic observation of affected limb deep vein, when the contrast, reaches the upper segment of large saphenous vein Valsalva, test, observe venous valve morphology, function and contrast reflux, observe the pelvic iliac vein, the surgeon squeeze calf gastrocnemius or told patients to stretch-ankle action, can make the contrast of the calf vein plexus rapid reflux, to increase the clarity of the iliac vein development. If further observation of the IVC lesion is required, the femoral vein angiography can be performed.

Observational indicators

Simple varicose veins of lower limbs: smooth deep vein

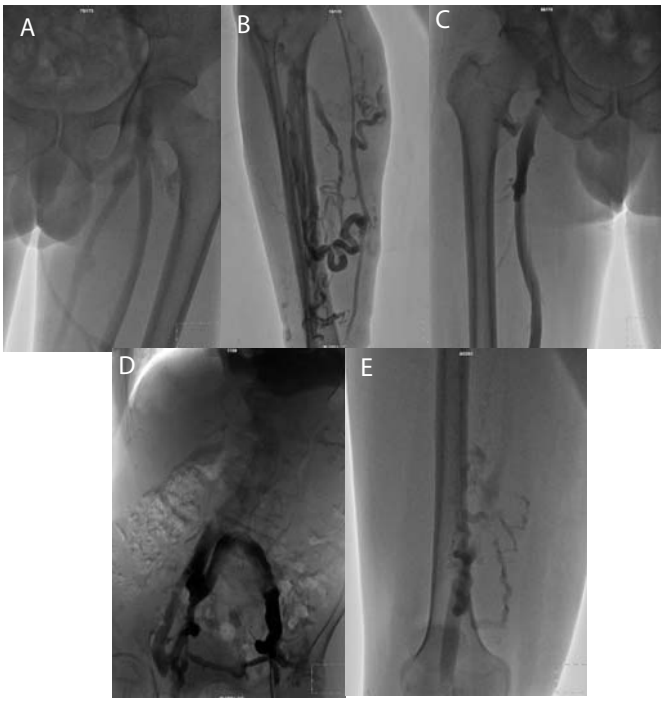

Figure 1: Deep Vein Angiography of lower limbs.
A: Primary superficial varicose veins of lower limbs, counterflow of femoral saphenous vein; **B:** Primary lower limbs shallow varicose veins, superficial veins in the calf; **C:** Primary deep veins of the lower limbs incomplete valve closed and deep veins of lower limbs appear "straight barrel"; **D:** The iliac vein compression syndrome, the intersection of the iliac vein and inferior vena cava is shadowed by the formation of large surrounding collateral circulation;
E: Post deep vein thrombosis syndrome, deep vein tube wall rough, uneven density, with peripheral massive collateral circulation is formed.

development, smooth tube wall, and clear valve shadow (Figure 1). Valsalva The test shows that the sinus shadow is symmetrically protruding to the two sides, the deep veins are bamboo-shaped, the valve has no contrast flow; the proximal end of the great saphenous vein is dilated, and the superficial veins of the calf are thickened and flexion, with earthworm-like changes [11]. Primary lower limb deep vein valve insufficiency: the deep vein was patent, with a straight tubular expansion, the venous valve blurred or disappeared, lost the bamboo appearance, and the inferior valve bright band disappeared during the Valsalva test. Iliac vein compression syndrome: widened transverse diameter of compressed vein with thick upper and lower fine horn; localized filling, shaded fibers, and adhesive structures; development of internal iliac vein, lumbar ascending vein, or pelvic collateral circulation; delayed or retention of contrast emptying [12-14]. Sequela of lower limb deep vein thrombosis: slow contrast reflux. The wall of the deep vein is stiff, and hairy, with main lumen occlusion or irregular stenosis, showing filling defect and forming "orbital sign"; some appear after recanalization and lose "bamboo shape", showing the formation of numerous collateral circulation with varicose veins [11]. Primary deep vein of lower limbs without valve: the main deep vein was patent throughout the whole process, with no visible valve shadow, no signs of thrombosis sequelae, and serious superficial varicose veins. Congenital venous malformation bone hypertrophy syndrome: deficiency or stenosis of deep veins, superficial varicose veins in the posterolateral side of lower limbs. Buga syndrome: lower limb angiography is similar to shallow vein, through femoral vein inferior vena cava angiography, can find retrohepatic inferior vena cava stenosis or occlusion.

Statistical method

Data were analyzed using SPSS 26.0 statistical software, measurement data were expressed as ($x \pm s$), count data by n (%), grade data by rank sum test, and $p < 0.05$ was considered statistically significant.

Results

The contrast success rate of 583 diseased lower limbs was 100%, including 285 (48.9%), 186 (32%), iliac vein compression syndrome 63 (10.8%), 41 lower extremity deep vein thrombosis syndrome (5%), and others (1%, congenital varicose bone hypertrophy, tumor compression) 8 (1%). Among them, there were 3 primary deep veins of the lower limbs without valve disease, with a long course of the disease, all of which required the injection of varicose vein foam sclerosing agent.1 case of tumor compression, clear cell carcinoma after a needle biopsy, tumor targeted therapy; 1 bone hypertrophy syndrome of congenital venous malformation (Figure 1), the affected limb was left lower limb, after conventional "left lower extremity arteriogram", "malformation vascular sclerosis injection"; 3 cases of Buga syndrome, repeated "IVC balloon dilation".

Discussion

Venous system disease with lower varicose veins as the first symptom is one of the most common clinical diseases, and the disorder of shallow venous return of the lower limbs can cause varicose veins of the lower limbs [15], such as long-standing after sedentary, valve regurgitation, primary valve dysplasia, sequelae of deep vein thrombosis, iliac vein stenosis, etc. [16]Among them, non-thrombotic iliac vein stenosis (iliac vein compression) is an important cause of the occurrence of lower limb varicose veins [17]. Some studies show that secondary varicose veins are in 27.39% of hospital admissions with lower varicose veins as the first symptom, among which iliac vein compression syndrome accounted for 23.04% [18]. In the Bonn vein study, 32% of patients with early disease (C2) and greater saphenous vein reflux developed a higher CEAP category within 6 years [19]; Because the treatment principles of reflux varicose veins and reflux disorder varicose veins are different, it is particularly important to identify the etiology of varicose veins in the lower limbs.

The standard surgical method for simple lower limb varicose veins is the segmental stripping of the great saphenous vein with high ligation, while secondary lower limb varicose veins cannot be treated in this method. The causes of recurrent varicose veins in the lower limbs include neovascularization due to trauma [20], The exact ligation of the saphenous vein branch and valve insufficiency was not properly managed. The high recurrence rate is not only related to the technical level of physicians and the individual differences of patients but also closely related to the insufficient preoperative assessment of varices of the lower limbs [21]. If the venous return of the lower limbs is blocked, the simple varicose vein ligation and stripping, the venous system of the lower limbs appears after the operation stasis hypertension, leading to venous swelling of the lower limbs, which seriously affects the surgical effect [21,22]. Therefore, antegrade angiography of the lower limb deep vein can fully understand the anatomical structure of the lower limb venous system and make a correct diagnosis of the disease, so as to provide a reliable basis for the next reasonable treatment.

In this study, in patients with lower extremity varicose veins, the causes of lower extremity varicose veins were primary inferior deep vein valve insufficiency (48.9%), simple superficial varicose veins (32%), iliac vein compression syndrome (10.8%), posterior deep vein thrombosis syndrome of lower limbs (5%), and others (1.37%). This result is similar to that of many domestic studies [23-25]. This fully demonstrates the accuracy of the results of this study. According to the different etiology, the corresponding treatment method should be selected. For simple varicose veins, high ligation of large saphenous vein + varicose vein spot stripping or large saphenous vein + radiofrequency ablation + varicose vein foam sclerosis

injection (polydocacalcohol) can be selected. Long-term pressure treatment of elastic socks on the affected limb after surgery can achieve a good effect on correlation studies [26,27]. It shows that in patients with varicose veins of the lower limbs with deep vein valve insufficiency, superficial vein surgery alone can improve valve regurgitation and reduce lower limb swelling and other related symptoms. For iliac vein compression syndrome and lower extremity deep vein thrombosis syndrome, iliac vein balloon dilatation + stent implantation is generally the first step, and superficial varicose veins are treated in the second phase [28,29]. However, with bifemoral venous malformation, pelvic tumor compression of the iliac vein, and lower extremity deep venous tumor dilation, KTS often only needs symptomatic pressure treatment [30,31]. Patients with lower extremity varices with CEAP grade C4 or above preferred to have obstructive lower extremity varices diagnosed than patients with CEAP grade C3 or below [21,32].

For lower limb venous diseases, there are various imaging examination methods, including lower limb venography, multi-layer spiral CT, and ultrasonography [21,33]. Color Doppler ultrasound is widely used in clinical practice due to its simple, economical, and non-invasive characteristics [33]. However, the Doppler ultrasound position has certain requirements, for it can not cooperate or cooperate with poor patients for accurate diagnosis and positioning, at the same time ultrasonic evaluation of the lower limb vascular examiner experience and operation dependence, vulnerability to body shape, lower limb edema, trauma, lower limb venous anatomy variation and the influence of factors such as deep location, reduce its sensitivity [34]. DSA angiography clearly shows the ankle to the iliac vein and even the inferior vena cava [32,33]. Lower extremity venography generally uses antegrade venography, retrograde venography, and popliteal venography [34]. Anterograde angiography of deep venous veins of lower limbs is in line with the normal physiological route, simple and safe operation, with little trauma, no obvious damage to veins, and wide clinical application. During the examination, this study found that the application of lower extremity venography in patients with lower extremity varicose veins has the following unique advantages: (1) lower extremity venography is not affected by patient position, obesity, and intestinal gas accumulation, and the image sharpness is significantly higher than the X-ray image, avoiding traditional femoral vein or popliteal vein puncture and reducing trauma; (2) lower limb venography is comprehensive, can choose subtraction according to need, and can dynamically playback the angiography process with high accuracy. The literature reports that the recurrence rate of lower limb varicose veins is still 15% to 35% [35,36], One of the most important reasons for recurrence is the failure to detect some of the lesions, leading to incomplete primary surgery [37,38]; (3) lower limb venography can clearly observe the iliac vein lesions and pelvic collaterals, is the most simple and reliable way to diagnose iliac vein compression syndrome, compared with the vascular color ultrasound Doppler ultrasound, lower limb venography has the operator experience less, less time, is conducive to vascular surgeons to evaluate lower limb vein and develop a reasonable treatment plan. (4) significant anatomical variation of lower limb veins, according to literature reports about 1 / 3 of patients with lower limbs have two associated large saphenous vein, through vein variation is more common, intravenous angiography can clear through vein location, diameter, reflux, according to the situation when necessary can ligation pathological penetration to reduce the risk of recurrence of varicose veins.

To sum up, lower limb deep vein anterograde angiography has the advantages of simple operation, small trauma, high specificity, observing the whole picture of the lower limb vein, comparing the digital gastrointestinal ray small, storing dynamic images, helping clinicians to patients with venous system have intuitive understanding, avoid the blindness and one-sided surgery, and reduce the misdiagnosis rate, the recurrence rate of clinical treatment options.

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Author's contribution

First author: Yi Liu, Completed the case collection and paper writing.

Co-first author: Dong Liu, Junchen Li, Complete the operation.

Corresponding author: Zhumin Cao (MD,PhD) Completed the surgery and revised the paper.

Co-corresponding author: Kai Deng, (MD), Data analysis and completed the surgery.

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