

Case Report

Why are there so few cases of anterior tibial vein thrombosis? A case report after total joint arthroplasty and literature review

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Received July 12, 2016; Accepted September 1, 2016; Epub November 15, 2016; Published November 30, 2016

Abstract: Background: Anterior tibial vein thrombosis is a rare type of thrombosis that occurs in the lower limbs and is not detected by radiography. We present the case of a patient with a hip fracture who developed deep vein thrombosis. Her examination and the presentation of her disease during hospitalization were recorded. Venography was performed and revealed thrombi located in the femoral, popliteal, peroneal, anterior tibial and muscular veins. A better understanding of the mechanism underlying anterior tibial vein thrombosis is needed to decrease the incidence of deep vein thrombosis.

Keywords: Arthroplasty, anterior tibial vein, thrombosis, calf, phlebogram

Introduction

DVT (deep vein thrombosis) is one of the most common complications after major orthopedic surgery [1]. The clinical symptoms of these thrombi are often hidden and difficult to detect, and therefore, standard diagnostic methods rely mainly on ultrasound and phlebogram [2, 3].

The distal leg is the most common site of DVTs [4]. According to previous studies, 20% of these untreated calf thrombi have the potential to progress to the proximal veins or to break off and cause a pulmonary embolism [5, 6]. Calf veins consist of three paired veins (the posterior tibial, anterior tibial and peroneal veins), each with an identically named arterial companion, and muscular veins including the soleus and gastrocnemius veins [7, 8] (**Figure 1**). The possible locations of DVTs in the calf are varied, although muscular veins are the most common sites, followed by peroneal veins, posterior tibial veins and finally, the least common sites are the anterior tibial veins [4, 9]. However,

the disparity in anatomical distribution has not received much attention.

The anterior tibial vein originates from the dorsal veins and is accompanied by arteries with the same names, and then drains into the popliteal vein near the tibial-fibular syndesmosis (**Figure 2**). The main physiological function of the anterior tibial vein is to collect blood from the muscle in front of the tibia. Anterior tibial thrombosis is an extremely rare type of lower extremity thrombosis, and isolated anterior tibial thrombosis is even rarer, with a reported incidence of only 0-0.3% [10, 11]. The mechanism responsible for thrombosis has not received much attention, and few objective tests, such as radiography, are available.

The purpose of this case report was to analyze a unique case of anterior tibial vein thrombosis after total joint arthroplasty. The case was diagnosed by a phlebogram. In addition, we review the relevant literature on anterior tibial vein thrombosis.

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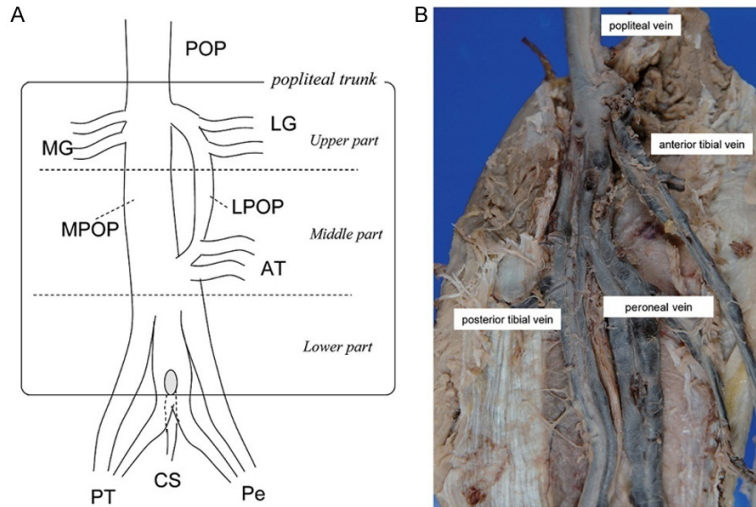


Figure 1. Anatomical scheme (A) and macroscopic photo (B) of crural deep vein and popliteal trunk. POP: Popliteal vein, MG: Medialis of the gastrocnemius vein, LG: Lateralis of the gastrocnemius vein, MPOP: Medialis of the popliteal vein, LPOP: Lateralis of the popliteal vein, AT: Anterior tibial vein, PT: Posterior tibial vein, CS: Centralis of the soleal vein, Pe: Peroneal vein. (Kageyama N, Ro A, Tanifuji T, Fukunaga T. Significance of the soleal vein and its drainage veins in cases of massive pulmonary thromboembolism. *Annals of vascular diseases*. 2008; 1(1): 35-9).

popliteal and peroneal veins, and the patient had a D-dimer level of 7.64 mg/L. The patient then received thrombolytic therapy with batroxobin for 7 days. After this treatment, we reviewed new images and found that most of the thrombi had been reduced. As a result, she underwent a hemiarthroplasty and completed a standard rehabilitation program after the surgery. She underwent another venography on the 6th postoperative day to examine the thrombi in the right lower extremity femoral, popliteal, anterior tibial and peroneal veins. Subsequently, she was discharged and treated with an oral anticoagulant (**Figure 3**).

Review

A PubMed literature search was performed using the search phrases “Anterior tibial vein thrombosis” and “DVT Anterior Tibial Vein”. The search identified several studies describing anterior tibial vein thrombosis. Only one report contained images of an anterior tibial vein thrombosis (**Table 1**).

Discussion

Previous reports have shown that tibial vein thrombosis may occur in patients during intense physical activity, after surgery and in some other cases [10, 12, 17]. Isolated anterior tibial vein thrombosis is extremely rare, especially after total joint arthroplasty. The unique mechanism underlying anterior tibial vein thrombosis requires more detailed investigation.

It remains unknown why there are so few cases of anterior tibial vein thrombosis. We speculate that several factors may contribute to the rarity

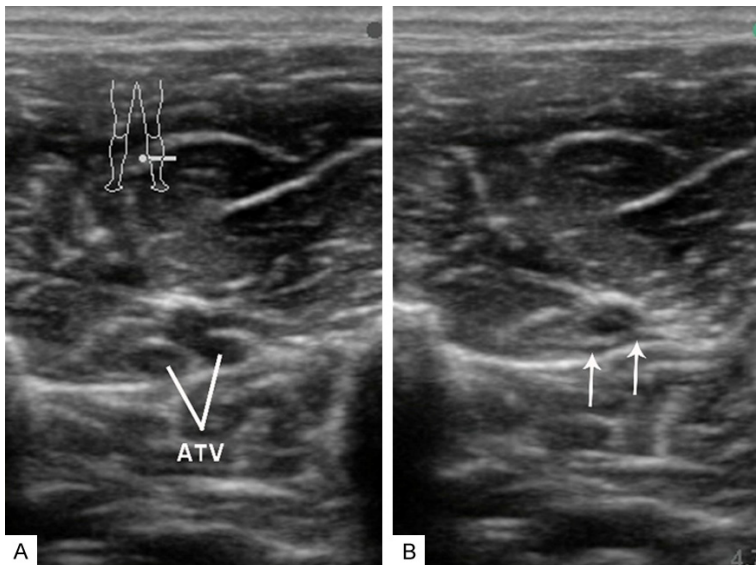


Figure 2. Transverse view of anterior tibial veins: A: Anterior tibial vein originates from the dorsal veins and is accompanied by arteries with the same names; B: Compression ultrasound of anterior tibial vein (Arrow).

Case presentation

A 78-year-old woman was admitted to the hospital 1 month after a right hip fracture. After admission to our department, venography revealed thrombi located in her right femoral,

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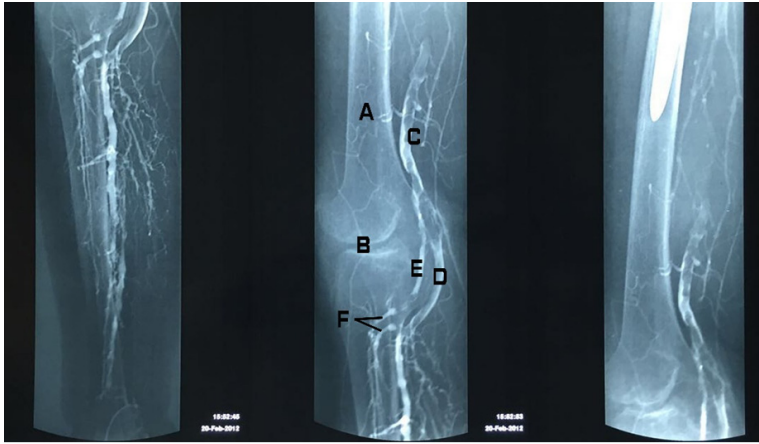


Figure 3. A lateral view of lower deep veins by venography: The femoral vein, popliteal vein, anterior tibial vein and peroneal vein showed filling defect. A. Femoral, B. Knee joint, C. Femoral vein, D. Popliteal vein, E. Lateralis of the popliteal vein, F. Anterior tibial vein.

of this condition. First, anatomical structures and venous hemodynamics may affect the distribution and progression of thrombi in the calf. Muscle veins in the venous system of the calf often directly drain into the posterior and peroneal veins, and they rarely connect to the anterior tibial vein [8, 19]. Thus, when thrombi originate from muscular veins, they can easily progress into the posterior tibial and peroneal veins, but they cannot progress with the same ease into the anterior tibial vein [19]. Kageyama N et al [19] has found that the formation of an anterior vein thrombosis first requires a bypass, which indicates that these thrombi are formed only if the popliteal trunk is extensively occluded. Second, the local venous variation may also affect the presence of thrombi in the anterior tibial vein. Normally, blood from the anterior tibial veins pours into the tibiofibular trunk veins or directly into the popliteal vein. The connection between the anterior tibial vein and popliteal vein may vary depending on the location of the junction sites, which could be in the distal portion, near the joint line, or in the proximal portion [20]. Therefore, patients who undergo total joint arthroplasty may exhibit variations in vessel structure that aggravate the local hemodynamic disorder, thus potentially resulting in thrombus formation. In our study, thrombi occurred at the connection but also involved the popliteal veins and peroneal vein.

Previous studies have demonstrated some discrepancies in the number of cases of anterior

tibial vein thrombosis, and some articles have indicated that anterior tibial thrombosis is not rare [10]. Although angiography is considered to be the gold standard for the assessment for thrombosis, the results obtained through this technique may still be insufficient without a pathological diagnosis. We can attribute these discrepancies to differences in diagnostic criteria. During a phlebogram, a considerable portion of patients may receive deficient assessments due to insufficient contrast filling, inadequate needle puncture or obscuring metallic materials.

The most common vessels to present inadequate filling are the anterior tibial veins. Kaleb et al. have reported that among 1827 patients who underwent hip surgery, 60 diagnoses of anterior tibial vein thrombosis were missed [21]. In addition, interrupted imaging or inadequate opacification may cause a false positive result. Another possible factor contributing to the observed discrepancies is the anatomical definition of the anterior tibial vein because venous variation is common in the lower deep vessel system. These variable anterior tibial veins can flow directly into the popliteal veins near the joint line. These veins have also sometimes been called the lateral popliteal veins. In our study, the thrombosis was located in the connecting branches. Regarding the use of ultrasound for assessment [10], its inferior sensitivity and specificity for the diagnosis of distal veins, along with its dependence on the skill of technicians, may decrease the likelihood of obtaining reliable results compared with the use of venography.

Anterior tibial thrombosis is not easy to diagnose and may be hampered by investigators' lack of experience or familiarity with the phlebographic technique. We found that it was difficult to distinguish the anterior tibial and peroneal veins in a phlebogram because these veins often overlap, which could lead to a misdiagnosis. An additional external or internal rotation X-ray may be needed. Another difficulty associated with the diagnosis of anterior tibial thrombosis is inadequate visualization of the

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Table 1. Publications retrieved in the PubMed literature search for anterior tibial vein thrombosis

Publication	Year	Total number of cases	Image of anterior tibial thrombi	Detection method	Reference number
Rose, et al. J Ultrasound Med.	1994	20	No	Venography	12
Mattos, et al. J Vasc Surg.	1996	23	No	Ultrasound	10
Wang CJ, et al. J Formos Med Assoc.	2000	10	No	Venography	13
Nchimi A, et al. Thromb Haemost.	2007	4	No	Computed tomography venography	14
Jerkic Z, et al. Med Arh.	2009	2	No	Venography	15
Singh K, et al. J Vasc Surg.	2012	2	No	Ultrasound	16
Tak S, et al. BMJ Case Rep.	2013	1	Yes	Ultrasound	17
Guo F, et al. J Neurosci Rural Pract.	2015	4	No	Ultrasound	18

anterior tibial veins. The inappropriate use of tourniquets at the malleolar level may be a key factor in insufficient contrast filling. These reasons may make it difficult for radiologists to provide a final conclusion or may even a result in an incorrect diagnosis.

Currently, the guidelines for DVT prophylaxis after a joint replacement recommend at least 10-14 days of anticoagulant treatment after a total knee arthroplasty and 35 days for a total hip arthroplasty. This regimen may increase the economic burden and also potentially increase the risk for complications such as bleeding and infection. Because there is such a small incidence of tibial vein thrombosis after joint surgery, it is imperative to elucidate the hemodynamic mechanisms underlying anterior tibial vein thrombosis to provide new ideas for clinical prophylaxis of thrombosis.

In summary, anterior tibial vein thrombosis is uncommon after total joint arthroplasty. The case described herein highlights the importance of understanding the unique characteristics of the anterior veins because such an understanding is essential for minimizing the incidence of DVT and decreasing the cost to patients.

Disclosure of conflict of interest

None.

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