Ultrasound guided full mechanical thrombectomy of a floating thrombus in the common femoral vein

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Abstract

A Floating Venous Thrombus (FVT) in the deep venous system has a high potential to cause pulmonary embolization. There are no defined criteria for treatments described in the literature, which range from anticoagulation and fibrinolytic treatments, through open or endovascular thrombectomies, to more invasive procedures such as surgical interruption with ligation of the venous system. Catheter-directed thrombolysis is effective for treatment of venous clots, but it is associated with increased risk of bleeding. Mechanical thrombectomy currently represents a valid therapeutic option without the need for lytic therapy and with excellent short and medium-term results. We herein present a technical note through an explicative case of a patient with an FVT located in the left common femoral vein who underwent percutaneous venous mechanical thrombectomy (ClotTriever, Inari Medical, Irvine, CA, USA) under ultrasound guidance without an intravascular ultrasound check. At the end of the treatment, venography and duplex ultrasound scan showed ilio-femoral patency without residual thrombus. No further procedures were needed and the patient was discharged two days post-intervention with oral anticoagulation and compression therapy with stockings.

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Introduction

Floating Venous Thrombus (FVT) is often associated with Deep Vein Thrombosis (DVT) and the risk of embolization increases when it detaches and travels through the bloodstream to the lungs, causing a life-threatening PE.[1-3]

Treatment options for FVT usually implicate anticoagulation therapy to prevent further clot formation, as well as to stabilize the clot and reduce the risk of embolization. In certain cases, interventional procedures may be considered to remove the thrombus or facilitate its dissolution.

Catheter-directed thrombolysis is effective for the rapid removal of clots, but it is associated with bleeding risks and has limited effectiveness in cases of non-acute thrombus.[4,5] Mechanical thrombectomy with the ClotTriever System (Inari Medical, Irvine, CA, USA) represents a valid therapeutic option without the need for lytic therapy, with excellent short- and medium-term results reported.[6]

We herein present a technical note through an explicative case of lower extremity FVT treated with ultrasound typo mechanical thrombectomy. The patient has granted permission for the publication of the case details and images.

Case Report

The technique in an illustrative case

A 75-year-old woman presented to our vascular department with acute left lower extremity edema extending from the proximal thigh to the foot with associated pain described as severe, continuous, and throbbing. The patient had no history of smoking, lower-extremity discomfort and no coagulation disorder. The patient had started three days before low-molecular-weight heparin therapy upon the recommendation of the attending physician, without improvement in symptoms in the following 6 days.

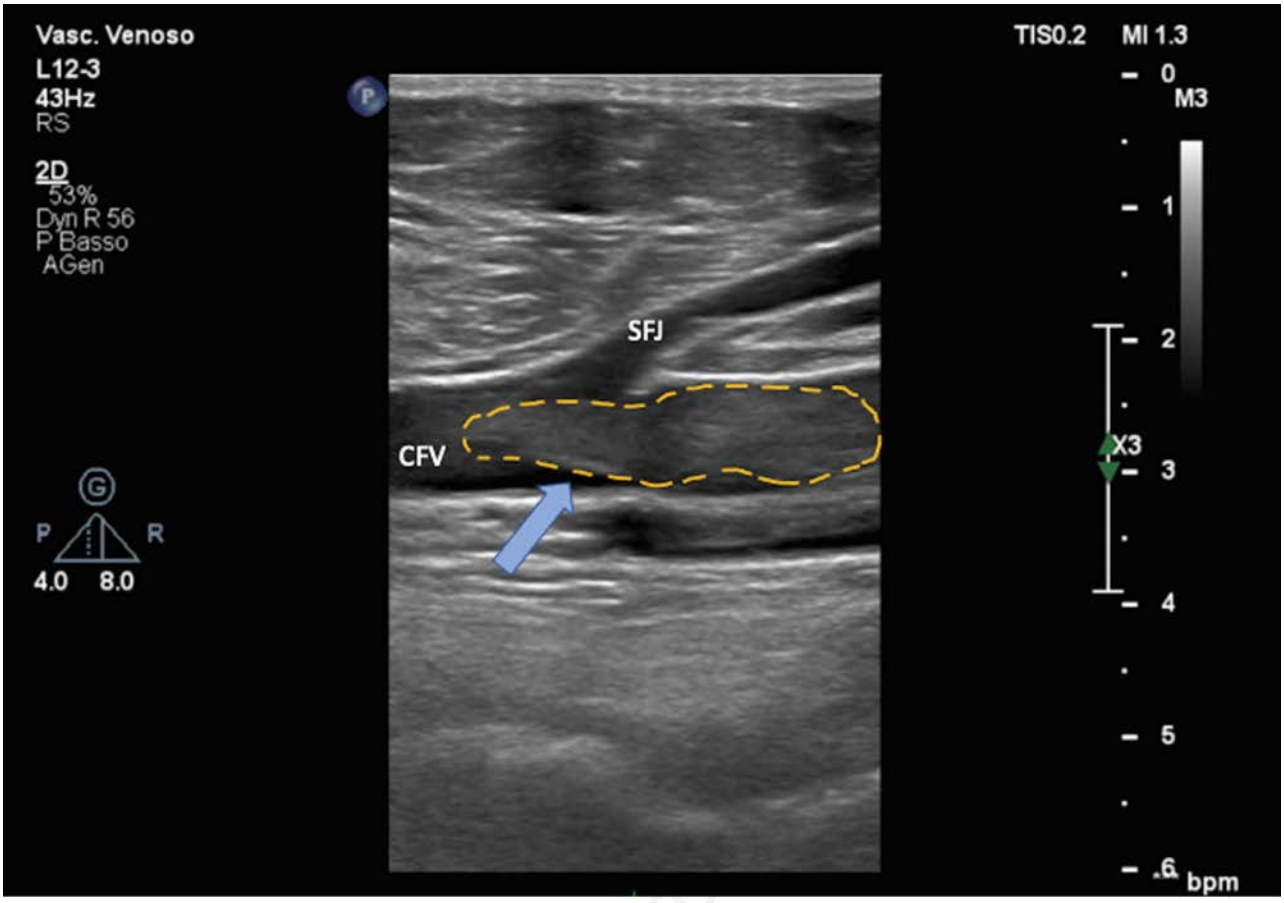

Figure 1. Color Duplex Ultrasound (CDUS) of the lower extremities showed the presence of a Floating Venous Thrombus (FVT) in the Left Common Femoral Vein (LCFV).

Color Duplex Ultrasound (CDUS) of the lower extremities showed the presence of an FVT in the Left Common Femoral Vein (LCFV) (Figure 1). The FVT was localized immediately after the saphenofemoral junction (SFJ) and extended approximately 4 cm towards the femoral vein without involving the Deep Femoral Vein (DFV).

Given the severe symptoms with no improvement and the presence of the FVT on ultrasound, mechanical thrombectomy was pursued after a multidisciplinary evaluation of the case.

Percutaneous access was obtained through the mid femoral vein through a standard 6 Fr introducer sheath (Radiofocus Introducer II; Terumo Corporation, Tokyo, Japan). A preliminary venography was performed (Figure 2). The thrombus was crossed using a luminal technique with a 0.035" guidewire (Glidewire Advantage® Terumo Advantage Guide wire), supported by a 5 Fr Ber catheter (Boston Scientific, Marlborough, USA). Once the thrombus was crossed the guidewire was exchanged for an Amplatz stiff guidewire and the introducer sheath was replaced with a 10 Fr sheath. On the stiff guidewire the 13 Fr ClotTriever sheath was inserted, and its catheter was then advanced over the wire beyond the FVT and deployed (Figure 3a). Primary percutaneous mechanical venous thrombectomy of the LCFV was performed using a pullback technique from the left external iliac vein to the femoral vein access site under CDUS guidance to bring any thrombus present into the funnel on the sheath (Figure 3b). One single pass of the device was performed under CDUS, and the entire FVT was removed from the vein (Figure 3c). Completion

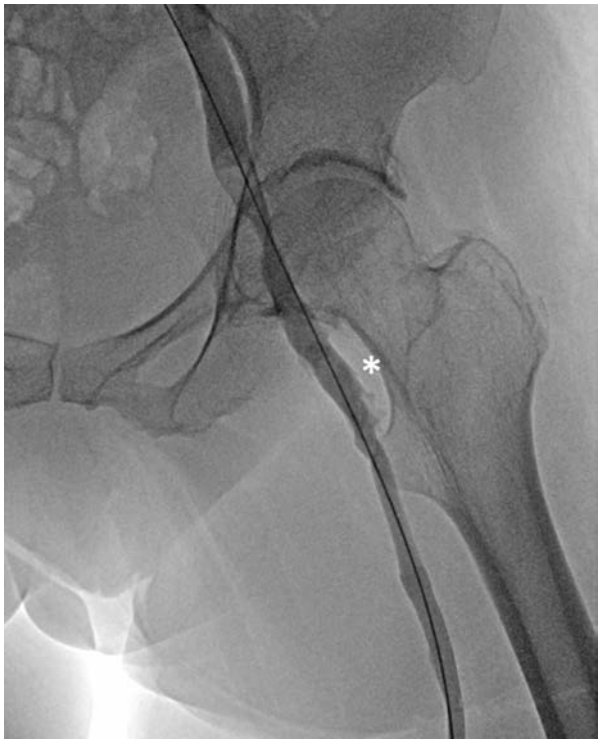

Figure 2. Preliminary venography.

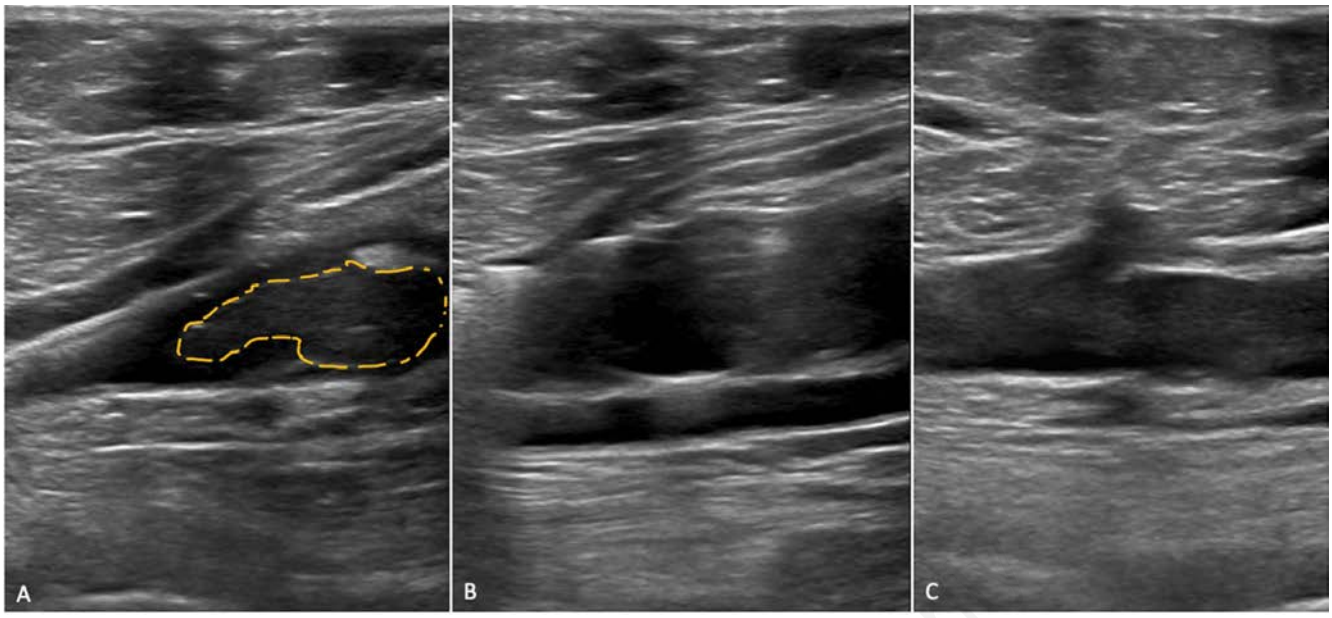

Figure 3. **A**) On the stiff guidewire the 13 Fr ClotTriever sheath was inserted, and its catheter was then advanced over the wire beyond the Floating Venous Thrombus (FVT) and deployed. **B**) Primary percutaneous mechanical venous thrombectomy of the Left Common Femoral Vein (LCFV) was performed using a pullback technique from the left external iliac vein to the femoral vein access site under Color Duplex Ultrasound (CDUS) guidance to bring any thrombus present into the funnel on the sheath. **C**) One single pass of the device was performed under CDUS, and the entire FVT was removed from the vein.

venography showed excellent results with no residual FVT in the LCFV which was confirmed by CDUS (Figure 4).

Following the procedure, the patient did not require monitoring in the Intensive Care Unit (ICU) and was discharged from the hospital 2 days after intervention with no symptoms.

Discussion

Lower extremity FVT is a dangerous phenomenon that carries a high risk of subsequent PE due to the potential of migration or embolization. There are few studies on FVT with varied findings regarding mortality, prevalence, and primary site of occurrence. A study of 44 cases of proximal DVT found an 18% prevalence of FVT, with the highest occurrences at the saphenofemoral junction (38%), the junction of the small saphenous vein (26%), and the external iliac vein (15%).[7] Free-floating venous thrombus may also be present in patients with isolated superficial venous thromboses which can extend to a deep vein.[8]

At present, there is a dearth of literature-based treatment recommendations specifically addressing FVT, leading to significant variations in approaches. These approaches encompass a broad spectrum, ranging from anticoagulation measures, fibrinolytic therapy, and vena cava filters to more invasive interventions like surgical interruption with venous system ligature.

Antithrombotic therapy is the conventional approach for DVT in the lower extremities. However, in cases of FVT, pharmacological intervention alone might not adequately prevent the movement of the blood clot and, as a result, PE.[2] Fibrinolytic therapy additionally decreases the occurrence of post-thrombotic syndrome by dissolving the blood clot. However, it is linked to hemorrhagic complications and has limited effectiveness in cases of non-acute thrombus.[4,5]

Figure 4. Completion venography showed excellent results with no residual Floating Venous Thrombus (FVT) in the Left Common Femoral Vein (LCFV) which was confirmed by Color Duplex Ultrasound (CDUS).

Surgical procedures, such as ligation or Fogarty, are additional options, but associated with high morbidity and mortality rate.[9]

Recent advances in endovascular methods have significantly improved DVT treatment. The ClotTriever System is a catheter-based mechanical thrombectomy device shown to successfully used to remove acute, subacute, and chronic DVT with excellent short- and long-term outcomes.[6,10]

The use of this system often eliminates the need for thrombolytic drugs, and patients typically do not require ICU monitoring after the treatment.[11,12] These advancements offer more effective treatment options for patients with DVT and for those with contraindications to thrombolytic administration. Recently, Dexter et al, assessed the safety and efficacy of the ClotRetriver device. Their primary effectiveness end point was the complete or near complete (75%) reduction in Marder score that was achieved in 91.2% of patients.[10] In our surgical practice, the use of Intravascular Ultrasound (IVUS) is typically employed to confirm the diagnosis, make decisions, verify the appropriate treatment at the end of the procedure, and determine the need for any additional interventions. In this specific case, the FVT was located only within the proximal segment of the common femoral vein, without extension towards the iliac or deep femoral or femoro-popliteal axis, and it was easily identifiable through ultrasound examination alone. For this reason, we decided to perform mechanical thrombectomy, performing thrombus removal under ultrasound guidance, and concluding with a final venography to confirm the absence of any residual thrombotic material. This approach allowed us to avoid the use of IVUS and therefore reduce the costs of the procedure without compromising its safety or effectiveness. Based on this experience, considering the absence of specific guidelines, we have learned that in extremely selective cases, limited removal of a FVT in venous segments where the thrombus is easily accessible, mechanical thrombectomy can be performed without IVUS guidance.

This case aims to shed light on the concept of a FVT, its potential risks, and the importance of early detection and appropriate management to mitigate its adverse effects.

Comprehensive research is essential to advance our understanding of lower extremity FVT, addressing the existing uncertainties in prevalence and optimizing patient care. The varied findings in current studies necessitate a larger, multicenter investigation to establish the true prevalence of FVT and identify potential risk factors associated with its occurrence. Controlled trials are imperative to evaluate the effectiveness of diverse treatment strategies, ranging from conventional anticoagulation to emerging endovascular interventions like the ClotTriever System. Additionally, larger clinical trials with long-term follow-up are crucial to validating the safety and efficacy of these emerging endovascular methods, contributing to our understanding of the benefits and potential risks associated with such innovative devices. Ultimately, synthesizing findings from various research studies will pave the way for evidence-based guidelines, standardizing clinical practice and elevating the quality of patient care.

Conclusions

The mechanical thrombectomy of a floating thrombus in the common femoral vein, performed under ultrasound guidance, appears to be a safe and effective approach. Short-term studies have confirmed excellent results, although a further analysis in the medium and long-term is necessary.

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