CASE REPORT

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A case report of percutaneous mechanical thrombectomy with retrograde approach for the treatment of acute lower limb deep vein thrombosis: Is it safe?

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ABSTRACT

Introduction: Deep vein thrombosis (DVT) is a type of venous thromboembolism. In recent years, an invasive approach with active thrombus removal with an antegrade approach has been suggested as an alternative to conventional medical treatment for acute DVT. Here, we report an uncommon Percutaneous mechanical thrombectomy (PMT) treatment for DVT with a retrograde approach.

Case description: A 28-year-old female presented with pain and swelling in the right leg for 9 days after a 10-hour flight. D-Dimer was elevated (3.24 ng/mL). Doppler USG revealed DVT involving the superficial femoral, popliteal, and peroneal veins, as well as superficial vein thrombosis at the saphenopopliteal junction and small saphenous vein. The patient received heparinization, followed by venogram, IVC filter implantation, and PMT via retrograde femoral vein access with a good clinical outcome. In this case, catheter access via antegrade failed, and retrograde via the right femoral vein was used. The retrograde venous approach also has several advantages, including a shorter procedure time due to the larger diameter of the proximal vein and fewer anatomical variants. There are also disadvantages, namely valve injury, as the direction of access is opposite to the direction of blood flow. IVC filter implantation is performed before thrombectomy with the aim of protection against PE caused in part by thrombus fragmentation during the thrombectomy.

Conclusion: Mechanical thrombectomy can be performed using a retrograde approach. The retrograde approach is safe and effective with no significant difference in technical success.

Keywords: Case report, deep vein thrombosis, percutaneous mechanical thrombectomy, retrograde approach.
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INTRODUCTION

Venous thromboembolism (VTE) refers to the formation of a blood clot within the venous system, which may partially or completely obstruct venous circulation. It most commonly develops in the deep veins of the lower limbs, such as the femoral and popliteal veins, or within the pelvic veins, a condition known as deep vein thrombosis (DVT).[1] The annual incidence of a first symptomatic DVT episode in adults is estimated at 50–100 cases per 100,000 individuals, with risk increasing with advancing age. When a thrombus forms in a vein, blood flow is disrupted, leading to impaired drainage, tissue swelling, and significant pain due to venous congestion.[2]

The most serious complication of acute DVT is pulmonary embolism (PE), which carries a significant risk of mortality. Nevertheless, the consequences of lower extremity DVT extend beyond PE. Venous thrombosis can injure the vessel wall and valves or result in persistent venous obstruction. These chronic alterations may lead to valve incompetence, venous reflux, and sustained venous hypertension. Over time, this pathological process can manifest as edema, pain, varicose veins, venous claudication, and even ulcer formation within one to two years following the acute episode.[3] This condition, referred to as post-thrombotic syndrome (PTS), is a frequent complication of DVT and significantly impairs patients' quality of life.[1]

In recent years, invasive techniques aimed at actively removing thrombi have been proposed as an alternative to standard medical therapy for acute DVT, with the goals of alleviating symptoms, preventing venous reflux and obstruction, and lowering the risk of post-thrombotic syndrome.[1] In percutaneous mechanical thrombectomy (PMT), the choice of catheter insertion access is very important (antegrade or retrograde access). Typically, PMT is performed with an antegrade approach, but the retrograde approach also has some advantages. The objective of this study is to present a case of acute lower limb deep vein thrombosis managed with percutaneous mechanical thrombectomy using a retrograde approach, and to evaluate its safety and feasibility as an alternative when the conventional antegrade access fails.

CASE DESCRIPTION

A 28-year-old female patient presented with chief complaints of pain and swelling in the right leg for 9 days prior and had progressively worsened. Patient with a history of 10 10-hour flight from Germany to Bali. The patient said she was still able to walk 7 days earlier, but now she has difficulty walking due to increasingly severe complaints of pain and swelling. A history of previous trauma was denied, and there was no complaint of fever. The patient had no history of hypertension, obesity, or a sedentary lifestyle. Vital parameters remained stable, and clinical assessment revealed a conscious, oriented female with normal cardiopulmonary findings, a soft abdomen on palpation, and significant edema of the right lower extremity. A comprehensive history and physical assessment indicated a diagnosis of provoked femoropopliteal DVT in the right leg, likely associated with prolonged air travel.

Hematologic analysis demonstrated a leukocyte count of 12.26 × 10^9/L, hemoglobin concentration of 12.8 g/dL, hematocrit of 38.3%, and platelet count of 243 × 10^9/L. Coagulation parameters included a prothrombin time (PT) of 9.5 seconds, partial thromboplastin time (PTT) of 20 seconds, and an international normalized ratio (INR) value of 0.95. D-Dimer was also planned to support the diagnosis, and the results showed an increase of 3.24 ng/mL. Other supporting examinations, such as Doppler USG on the right leg, showed deep vein thrombosis affecting the superficial femoral vein from mid-segment to distal segment, the popliteal vein, and the peroneal vein. In addition, there was also superficial vein thrombosis involving the saphenopopliteal junction and the small saphenous vein. In view of the extensive thrombotic involvement and the presence of marked pain and edema in the right leg, the treatment plan included performing a venogram and subsequent thrombectomy of the affected extremity. Patient is given heparinization management according to the DVT Prophylaxis. Bolus heparin 5000 units is administered and continued with a maintenance dose of 2000 units/24 hours.

Prior to the intervention, the patient was administered general anesthesia, positioned supine on the angiography table, and prepared under sterile conditions. We tried a generalized approach antegrade from the popliteal but failed to wire across the thrombus. We then switched to a retrograde approach, and an ultrasound-guided percutaneous puncture was performed from the right femoral vein access and successfully wired to the mid femoral and popliteal vein. Venography was performed, showing multiple thrombi in the right peroneal, popliteal, and mid-femoral veins (Figure 1). Furthermore, prior to thrombectomy, Inferior Vena Cava (IVC) filter implantation with right femoral access was performed. PMT was performed with an aspiration catheter, an 8Fr indigo system, and continued with thromboembolectomy over the wire, and continued with PTA ballooning with a Mozec balloon 8 mm x 80 mm on the right popliteal and femoral veins.

After the procedure was completed, venography was performed, and the results showed that venous flow in the right peroneus, popliteal, and mid femoral veins had recovered without any thrombus (Figure 2). It was concluded that IVC Filter

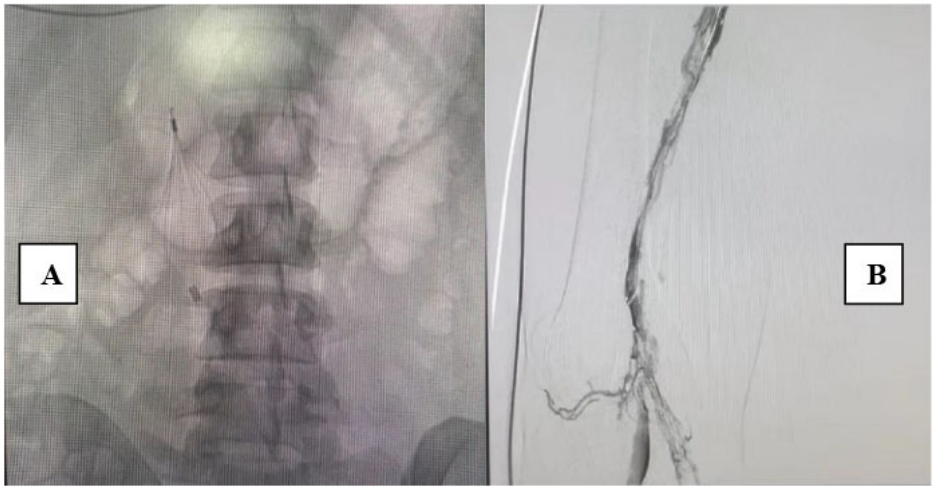

Figure 1. Pre-Operative Venography. A) IVC Filter implantation before PMT procedure. B) Venography showing multiple thrombi on the right peroneal, popliteal, and mid-femoral vein.

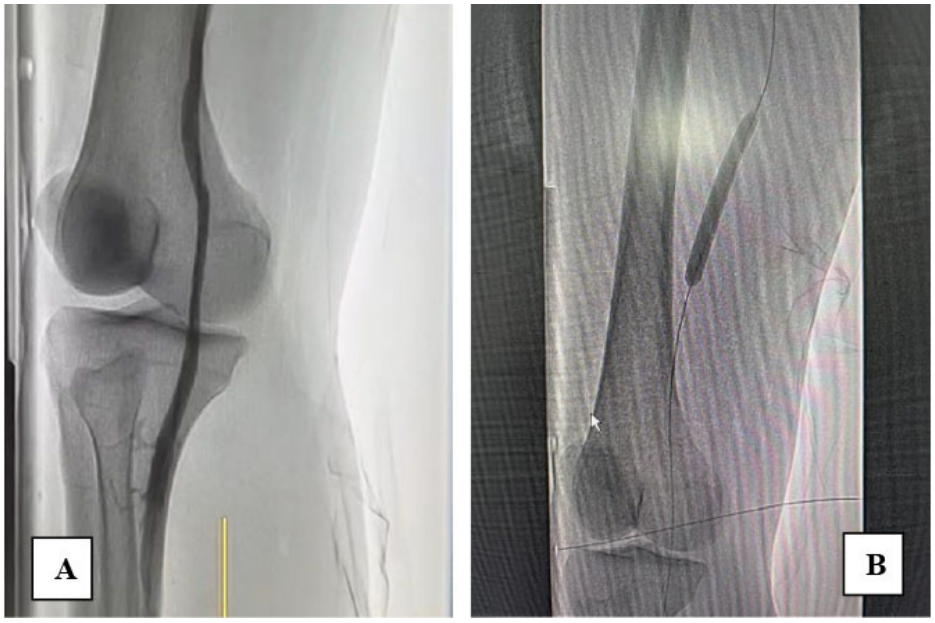

Figure 2. Postoperative Venography. A) PTA Balloon post-thromboembolectomy over the wire. B) There is an improvement in flow from the right peroneal, popliteal, and mid femoral veins.

implantation, PMT, PTA ballooning, and venography were successfully performed with a retrograde approach.

The patient did not require intensive care unit (ICU) admission following the procedure. She was managed in the inpatient ward for two days, during which her symptoms showed continuous improvement after the PMT. Her condition remained stable, and she was subsequently discharged with instructions to continue anticoagulation therapy, consisting of Aspilet 80 mg once daily and Xarelto 15 mg twice daily.

DISCUSSION

Deep vein thrombosis (DVT) denotes an abnormal intravascular clot formation within the venous system, predominantly involving the deep veins of the lower extremities. Patients with DVT often present with pain, swelling, venous ulceration, and a decline in quality of life. For individuals with a Wells score below two, a D-dimer test is usually performed.[4] While the D-dimer assay is highly sensitive for detecting thromboembolic events, its specificity is limited, meaning a positive result (≥500 ng/mL) does not confirm DVT. Conversely, if the Wells score is under two and the D-dimer result is negative, DVT can generally be excluded.[5] When the D-dimer is positive, regardless of the Wells score, ultrasonography is recommended to evaluate the suspected vein for thrombosis. In this case, the patient presented with calf swelling and tenderness along the deep venous pathway, corresponding to a Wells score of two, which falls into the moderate risk category. Accordingly, venous ultrasound was performed and confirmed the presence of thrombosis in multiple veins of the right lower extremity.[6]

Once a thrombus is identified, patients are typically managed with oral anticoagulation therapy, such as low molecular weight heparin (LMWH), direct oral anticoagulants (DOACs), or vitamin K antagonists (VKAs).[7] In more severe or complicated cases of DVT, especially when symptoms are pronounced, additional interventions may be necessary, including catheter-directed thrombolysis, thrombectomy, or inferior vena cava (IVC) filter placement.[2] In the present case, the patient underwent thrombectomy due to the significant thrombus burden accompanied by leg pain and swelling.

Catheter-based interventions for DVT include catheter-directed thrombolysis (CDT), which delivers thrombolytic agents directly into the occluded vein, and percutaneous mechanical thrombectomy (PMT), which fragments and removes thrombus.[8] In this case, an IVC filter was implanted before performing PMT, as temporary filter placement can be beneficial in selected patients, particularly those undergoing stand-alone PMT without adjunctive CDT. The filter serves as protection against PE, which may occur due to thrombus fragmentation during thrombectomy or thrombolytic therapy.[9]

PMT can be performed using either a retrograde or antegrade venous approach, depending on the anatomical considerations and clinical objectives. The chosen access vein must be sufficiently large to accommodate the necessary sheath. The retrograde approach, typically via the femoral or popliteal vein, offers several advantages, such as reduced procedure time due to the larger caliber of proximal veins and fewer anatomical variations.[9] However, it carries certain drawbacks, including potential valve injury from working against the direction of blood flow, incomplete thrombus clearance, and technical challenges related to patient positioning. In contrast, the antegrade approach accessed through the anterior tibial, posterior tibial, or peroneal vein provides better thrombus clearance, easier patient positioning, and less risk of valve damage.[10] Additionally, it is not limited to treating thrombus in the proximal segment. Nevertheless, this method is associated with longer procedural times, as well as difficulties in accessing and evaluating smaller veins with variable anatomy.[11] In this case, a retrograde approach was performed due to failure to access the vein distally. The PMT procedure was accessed through the right femoral vein via an introducer sheath 8 fr 11 cm. The 8 fr Penumbra system was then sent into the thrombus via cable. Specifically, in this patient, the penumbral system retrieved a large amount of thrombus without complications, following thromboembolectomy over the wire and PTA ballooning.

Previous studies have compared thrombectomy using an antegrade and a retrograde approach. The previous study showed that the antegrade approach was associated with significantly longer procedural time than the retrograde approach, but no significant difference in technical success.[12] A study by Xuan et al. (2024) reported no significant differences in three-month venous patency or the incidence of PTS between the antegrade and retrograde approaches, indicating that both techniques are safe and effective for managing acute lower limb DVT.[13] In this case, the patient did not need to be admitted to the ICU, showed improvement in symptoms, and was discharged a few days later with pharmacological management.

This case report explores the retrograde approach in percutaneous mechanical thrombectomy (PMT), which is less commonly reported compared to the conventional antegrade approach. This case report also provides detailed procedural considerations (retrograde access, IVC filter placement) that can guide clinicians when antegrade access is not feasible. Therefore, it evaluates the safety of an alternative technique that contributes to expanding treatment options for complex DVT cases. The main weaknesses of this study are its nature as a single case report with limited generalizability, reliance on short-term outcomes without long-term follow-up, absence of comparative data with standard treatments, and the possibility of publication bias that may overestimate its safety and success.

CONCLUSION

PMT decreased overall morbidity and mortality associated with the intervention to treat DVT. The antegrade venous approach is commonly preferred, as it minimizes flow resistance caused by venous valves and lowers the likelihood of mechanical injury to the valve leaflets. However, on the one hand, the retrograde approach is a safe and feasible technique for the quick therapy of acute femoropopliteal DVT. The patient demonstrated evident symptomatic recovery in the early period following the procedure. Both antegrade

and retrograde approaches are safe and effective with no significant difference in technical success.

AUTHOR CONTRIBUTION

GAM, SA, and PWAW were involved in the conception and execution of the case report, contributed to the analysis and interpretation of findings, and participated in drafting and revising the manuscript.

ETHICAL APPROVAL

Ethical clearance was not mandatory at our institution for publications involving single case reports or limited case series.

CONFLICT OF INTEREST

The authors affirm that they have no competing interests related to this work.

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