

DEEP VEIN THROMBOSIS FOLLOWING ACUTE ANTERIOR CRUCIATE LIGAMENT RUPTURE

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Abstract

Deep vein thrombosis (DVT) is an uncommon complication following isolated ligamentous knee injuries, such as anterior cruciate ligament (ACL) rupture, particularly in young and otherwise healthy individuals. We report the case of a 38-year-old male who sustained an ACL tear while playing basketball. Two weeks after the injury, during physiotherapy he developed swelling and pain in the left calf.

Duplex ultrasonography confirmed thrombosis of the common femoral and popliteal veins. Laboratory findings were within normal limits, except for a mildly elevated D-dimer level. The patient was treated with therapeutic low-molecular-weight heparin (LMWH) and supportive measures. Follow-up imaging at six weeks demonstrated partial venous recanalization.

This case highlights that ACL rupture alone may predispose patients to venous thromboembolism (VTE), even in the absence of surgical intervention or traditional risk factors. Early recognition and prompt treatment are essential to prevent potentially life-threatening complications.

Key words: deep vein thrombosis, ACL, venous thromboembolism, knee trauma.

Introduction

Venous thromboembolism (VTE) occurs in approximately 2–18% of patients following trauma and is most often initiated by endothelial injury and subsequent activation of the coagulation cascade [1,2]. Deep vein thrombosis (DVT) is a potentially serious complication that may develop after musculoskeletal trauma of the lower extremity.

While it is most commonly associated with major orthopedic surgery and prolonged immobilization, DVT can also occur after isolated ligamentous knee injuries.

The anterior cruciate ligament (ACL) is one of the most frequently injured structures of the knee, particularly in young and physically active individuals.

The early post-injury period is often marked by reduced mobility, local inflammation, and venous stasis, which may predispose patients to venous thromboembolism (VTE). Although the overall incidence of DVT following ACL rupture is considered low, its occurrence in young, otherwise healthy patients without classical risk factors represents a diagnostic challenge. Symptomatic thrombosis typically develops within the first few weeks after trauma, coinciding with periods of limited mobility and altered gait mechanics.

Predisposing factors for DVT include advanced age, obesity, prior thrombotic events, inherited or acquired thrombophilia, oral contraceptive use, smoking, and prolonged immobilization [3]. However, cases may also arise in young, otherwise healthy individuals without classical risk factors, which further complicates timely diagnosis.

Case Report

A 38-year-old male patient presented to the orthopedic outpatient clinic due to a left knee injury sustained two weeks earlier while playing basketball. Initially, he had been examined and diagnosed in another medical institution.

On inspection, the knee demonstrated a positive ballotment test, positive Lachman test, and restricted maximal flexion of the left knee. Magnetic resonance imaging (MRI) revealed a complete rupture of the anterior cruciate ligament (ACL).



Figure 1. MRI Sagittal View Demonstrating ACL Rupture

The patient was immobilized for two weeks and prescribed analgesic therapy and local cryotherapy. He was subsequently referred for physical therapy, with an indication for ACL reconstruction upon completion of the rehabilitation program.

On the second day of physiotherapy, the patient developed swelling and severe pain in the left calf. At clinical evaluation, the left leg appeared swollen, warm, tense and painful with restricted mobility. Due to suspicion of deep vein thrombosis (DVT), the patient was referred for duplex ultrasonography. Common femoral vein (CFV), near the saphenofemoral junction: non-compressible, with organized thrombotic masses in the lumen and visible recanalization flow.

Popliteal vein: enlarged diameter, non-compressible and without flow. Great saphenous vein (GSV): normal dimensions, compressible with compensatory increased flow. Small saphenous vein (SSV)-compressible.

Laboratory Findings -Coagulation profile: Prothrombin Time (PT): 10.3 seconds, Activated Partial Thromboplastin Time (aPTT): 9.1 seconds International Normalized Ratio (INR): 0.8, D-dimer: 0.65 mg/L Complete blood count (CBC) and biochemical parameters: Within normal limits.

The patient was initiated on therapeutic anticoagulation with low molecular weight heparin (LMWH) – *Fraxiparine 0.6 mL (5700 IU)* administered subcutaneously twice daily (2×1 s.c.). In addition, antibiotic therapy was prescribed and local compresses with boric acid were applied to the affected area.

Supportive measures included limb elevation and instructions for continued outpatient monitoring. At the six-week follow-up, duplex ultrasonography of the left lower extremity revealed common femoral vein (CFV): compressible, with approximately 50% organized thrombotic masses in the lumen and visible

recanalization flow. Popliteal vein: enlarged diameter, non-compressible with a small recanalization peripheral flow.

Great saphenous vein (GSV): normal dimensions, compressible with compensatory increased flow. Small saphenous vein (SSV): compressible. The patient received rivaroxaban (Xarelto) 20 mg once daily for three months. At the 3-month follow-up, Doppler ultrasonography demonstrated a compressible common femoral vein (CFV) with normal flow and flow velocities. The popliteal vein was also compressible, with normal flow and flow velocities.

Great saphenous vein (GSV): normal dimensions, compressible.

Small saphenous vein (SSV): compressible. In this patient, conservative non-surgical management of the anterior cruciate ligament (ACL) rupture was continued, with the aim of restoring functional stability through physical therapy activity modification and with a recommendation for regular follow-up at the transfusion medicine department.

Discussion

Several epidemiological studies have demonstrated that common risk factors such as age, sex, and body mass index (BMI) may partially influence the occurrence of deep vein thrombosis (DVT) [4].

Both major and minor trauma confer a significant risk for DVT due to immobilization and local anatomical factors [5]. Deep vein thrombosis is a well-recognized complication in orthopedic trauma; however, it is rarely reported following isolated ligamentous injuries such as anterior cruciate ligament (ACL) rupture in the absence of surgical reconstruction. ACL rupture itself represents a traumatic event and constitutes an important risk factor for DVT [6].

The true incidence of venous thromboembolism (VTE) after ACL injury may be underestimated, as routine duplex ultrasonography is not commonly performed unless clinical symptoms are present. Although limited evidence exists regarding the incidence of VTE following an acute ACL tear without surgery, the reported incidence of VTE after ACL reconstruction is approximately 0.4% [7].

The largest available evidence addressing this issue comes from a recent population-based cohort study by Xiong et al. The authors evaluated the risk of VTE among individuals with ACL tears, with or without subsequent ACL reconstruction, derived from the general population. Patients with ACL rupture who did not undergo reconstruction demonstrated a 6.02-fold increased risk of developing VTE compared with matched controls (95% CI 1.44–24.25), indicating that the injury itself, even in the absence of surgical intervention, significantly elevates thromboembolic risk [8].

Additional evidence is provided by case reports and small case series. Reckelhoff et al. described a young, otherwise healthy male patient who developed multiple DVTs involving the popliteal, posterior tibial, and peroneal veins during the preoperative rehabilitation phase, prior to ACL reconstruction [9].

The patient had been referred for conservative pre-surgical management of a left ACL rupture associated with a medial meniscus injury and presented with knee pain, swelling, and restricted range of motion. Similarly, Baumgartner et al. reported a case series of three patients who developed preoperative DVT following acute ACL rupture before any surgical intervention.

The cases included a 20-year-old female volleyball player, a 22-year-old female snowboarder, and a 36-year-old male recreational basketball player, all of whom required anticoagulation prior to operative treatment [10].

Furthermore, Rahman reported a case involving a 27-year-old female patient undergoing physical therapy for a complete ACL rupture who subsequently developed VTE, further highlighting the potential thrombotic risk during conservative management and rehabilitation [11].

Collectively, these reports support the concept that ACL rupture itself represents a prothrombotic condition, even in young and otherwise low-risk individuals. Although the overall incidence of DVT following isolated ACL injury remains low, clinicians should maintain a high index of suspicion for symptoms such as calf pain, swelling, warmth, and functional limitation during the early post-injury period, particularly within the first 2–4 weeks. Early duplex ultrasonography should be considered in clinically

suspicious cases to facilitate timely diagnosis and prevent potentially life-threatening complications such as pulmonary embolism.

Conclusion

This case underscores that an isolated anterior cruciate ligament rupture can predispose patients to deep vein thrombosis even in the absence of surgical intervention or conventional risk factors.

Heightened clinical awareness during the early post-injury and rehabilitation period is warranted to enable timely diagnosis and appropriate anticoagulant management, thereby reducing the risk of potentially life-threatening complications.

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