

Acute Bilateral Venous Thromboembolism in a Collegiate Long-Distance Runner: A Case Report

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Abstract

Venous thromboembolism (VTE) is uncommon in the young, healthy athlete. Signs and symptoms of VTE may be masked by comorbid musculoskeletal pathology leading to missed diagnoses. Team physicians should maintain a high index of suspicion when managing this vulnerable population. Emphasis should be placed on a thorough history and physical examination and proper imaging. We describe a case of extensive bilateral iliofemoral thromboses and pulmonary emboli in a young female collegiate runner presenting with musculoskeletal complaints who was managed with mechanical thrombectomy and anticoagulation.

Keywords: Venous thromboembolism; Deep vein thrombosis; Pulmonary embolism; Thrombosis; Distance running

Introduction

Venous Thromboembolism (VTE), including Deep Vein Thrombosis (DVT) and Pulmonary Embolism (PE), is typically associated with physical inactivity [1,2]. While the incidence of VTE in athletes has not been well documented, there has been an increasing number of cases reported over the past decade [2-5]. Location of DVT has been shown to vary according to sport, with upper extremity DVT diagnosed more frequently in overhead ball sports and weight training, and lower extremity DVT diagnosed more frequently in endurance athletes such as long-distance running [6]. In cases of lower extremity DVT concomitant PE has been reported 32% of the time [6]. Although athletes are generally thought to be at low risk for developing VTE, several acquired risk factors may increase their risk, including increased travel time for competitions, repetitive microtrauma causing

vascular injury, and high-force trauma associated with contact sports [4,7,8]. High-intensity training seen among competitive athletes has been shown to disrupt homeostatic mechanisms and increase prothrombotic and fibrinolytic markers involved in clot formation [9]. For endurance athletes such as long-distance runners who train for extended periods of time, repetitive venous compression by surrounding structures has been associated with endothelial vessel microtrauma and activation of the coagulation cascade [9]. Additional factors such as dehydration and hemoconcentration, injury and inflammation, and oral contraceptive use in female athletes, further increase the risk for VTE [1,5]. Signs and symptoms of VTE include swelling, pain, cyanosis, or difficulty breathing in the case of PE. A diagnosis of DVT can be made with ultrasound and venography, and PE with CT angiography; athletes, however, pose a unique diagnostic challenge in that many present with comorbid musculoskeletal complaints that may mask symptoms [6]. For this reason, it's imperative that team physicians remain vigilant and have a low threshold for suspicion when it comes to VTE in athletes. Here we report a case of a young female collegiate long-distance runner presenting with extensive bilateral DVT the day after being evaluated by her orthopedic physician for symptoms suggestive of musculoskeletal pathology.

Case Presentation

A 22-year-old female Division-1 cross country and track and field athlete (body mass index 18.65) presented to the athletic training room with complaints of right hip and gluteal pain that had been progressively worsening over the past four weeks despite de-escalation of training. Pain was worse at night and localized deep to the right hip joint with additional pain felt in the right gluteal region and lower back. She was unable to run or walk without pain. Past medical history was significant for Polycystic Ovarian Syndrome (PCOS) for which she was taking combined oral contraceptives for the past 4 years. No prior orthopedic history including fractures. Physical examination revealed an antalgic gait with tenderness to palpation of bilateral paraspinous muscles, right hip joint and gluteus medius. Range of motion of the right hip did not reproduce pain and demonstrated full hip flexion, 45 degrees of internal rotation and 25 degrees on external rotation with the hip flexed to 90 degrees. FABER test was negative. Sensation and motor function were grossly intact. Single leg standing was symmetric, and there was no gross deformity of the right lower extremity. Lower extremity pulses were palpable, and toes were warm and well perfused. X-rays were negative for definite fracture. MRI right pelvis was recommended given high suspicion for stress fracture.

The next morning, patient woke up with right lower extremity pain, swelling and cyanosis, and was taken to the emergency department. She denied any shortness of breath, chest pain, numbness or tingling of the lower extremities. No family history of coagulopathies, or recent COVID-19 illness or exposure. Patient was a non-smoker. In the ED, vital signs were within normal limits. She was Covid negative. ESR and CRP were 39 and 6.1, respectively. Venous Ultrasound (US) and CT venogram demonstrated occlusive thrombus in the right iliofemoral venous circulation and left internal iliac veins, and bilateral pulmonary emboli (**Figure 1**).

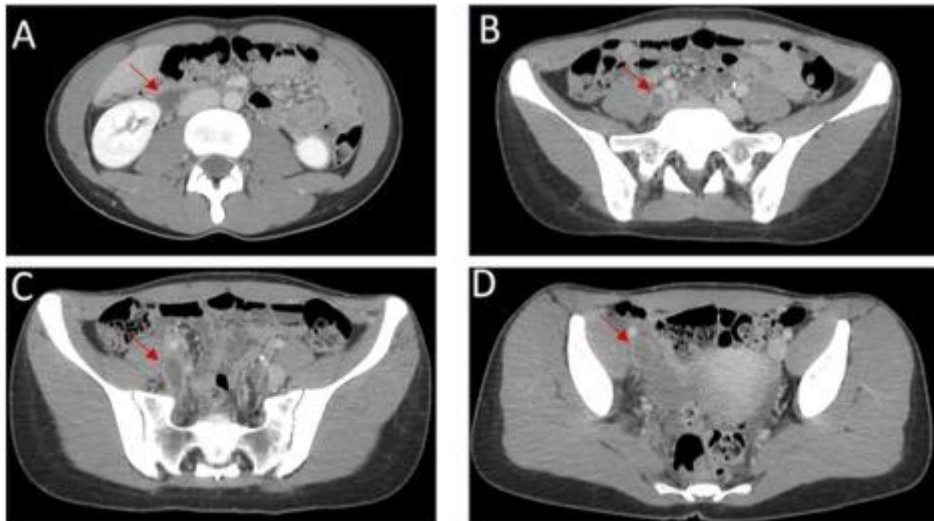


Figure 1: CT venogram demonstrating no thrombus in the IVC (A) occlusive thrombus within the bilateral internal iliac veins (B-C), partial occlusion of the left common iliac vein due to propagation of the internal iliac thrombus, complete occlusion of the right common iliac and external iliac veins (C-D).

Oral contraceptives were discontinued and therapeutic heparin infusion was started. Vascular surgery was consulted and patient underwent urgent mechanical thrombectomy with immediate resolution of symptoms. Post-operative duplex US showed vessel patency and resolution of thrombi. Hematologic workup was negative for underlying coagulopathy and US revealed normal vascular anatomy. MRI pelvis demonstrated focal bone marrow edema of the sacral aspect of the right sacroiliac joint, mild hyperintense intrasubstance edema involving the proximal to mid right piriformis and the right mid gluteus maximus muscle, and mildly increased signal at the insertion of the bilateral hamstrings suggestive of tendinosis (**Figure 2**). There was no evidence of fracture or stress reaction.

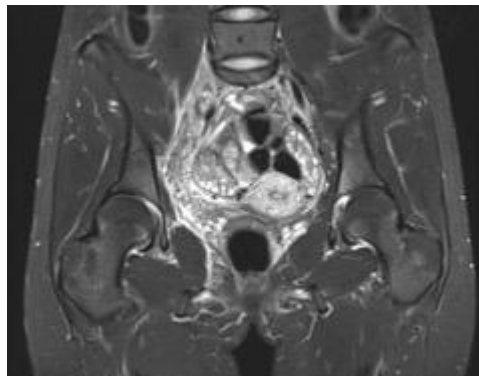


Figure 2: MRI pelvis without contrast demonstrating focal bone marrow edema of the sacral aspect of the right sacroiliac joint, mild hyperintense intrasubstance edema involving the proximal to mid right piriformis and the right mid gluteus maximus muscle, and mildly increased signal at the insertion of the bilateral hamstrings suggestive of tendinosis.

The patient was seen in the athletic training room one week after surgery with resolution of symptoms. Follow up doppler US with vascular surgery two months later demonstrated resolution of thrombus and vessel

patency. She was cleared to return to sport and has been following a guided exercise program. Hematology recommended lifelong anticoagulation. Informed consent was obtained prior to publication.

Discussion

Our patient presented with a four-week history of progressively worsening hip and gluteal pain followed by acute onset lower extremity pain, swelling and cyanosis. Although her initial presentation was concerning for stress fracture, she was ultimately diagnosed with extensive iliofemoral Deep Vein Thrombosis (DVT) requiring vascular surgical intervention. The pathophysiology of DVT is best explained by Virchow's triad of venous stasis, endothelial injury, and hypercoagulability [8]. In the absence of known trauma or immobility, lower extremity DVT in the otherwise healthy athlete is uncommon. DVT can often go undiagnosed in competitive athletes due to the presence of other musculoskeletal complaints, physical conditioning, and high pain tolerance [1,6]. Lower extremity DVT can present with pain, swelling, and skin discoloration, all of which were present in this patient. In the emergency department, the Wells Criteria is often utilized to stratify the risk of DVT to determine the appropriate management [3,8]. However, Zaleski et al. [3] report a limited utility for this scoring system in athletes, with a 100% failure rate in identifying DVT/PE. While the population size in this study was very small, the results suggest a need for more vigilance in this special population and a need for more accurate rating scales, as well as thorough history and physical exam. Our patient's initial presentation with focal, deep hip pain, coupled with the fact that she is a female, competitive long distance-runner with a low BMI all raised suspicion for stress fracture. Although her initial X-ray was negative, stress fracture in the setting of risk factors should not effectively be ruled out without additional imaging [10]. MRI of this patient demonstrated bone marrow edema of the sacral aspect of the right sacroiliac joint, which may reflect underlying bony pathology such as a stress fracture or reaction. It should be noted that DVT was not on the differential diagnosis based on the initial history and physical exam. DVT in the setting of stress fracture has been reported, as orthopedic injury may serve as a nidus for thrombus formation [11]. Irrespective of orthopedic injury, there have been cases of DVT in long-distance runners due to repetitive microtrauma and exercise-induced elevation of coagulation factors [5,12,13]. Additional risk factors that placed our patient at risk for DVT include underlying PCOS and oral contraceptive use. Bird et al. [14] reported a two-fold increased risk of VTE among women with PCOS taking oral contraceptives and a 1.5-fold increased risk among those with PCOS not taking oral contraceptives. It's important to rule out underlying coagulopathy or anatomic vascular defect as these can also explain unusual presentations of DVT in young active women [9]. Additionally, while our patient tested negative for COVID-19 and reported no known contacts or previous illness, COVID-19 has been associated with VTE and therefore should be considered as a potential risk factor [15,16].

Conclusion

This case demonstrates an atypical presentation of VTE in a young, athletic female and reinforces the need for increased awareness and better screening tools when managing athletic populations. A thorough history and physical exam should be done to evaluate for subtle signs and symptoms of VTE in this seemingly low-risk population.

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References

1. [Hull CM, Hopkins CL, Purdy NJ, Lloyd RC, Harris JA. A case of unprovoked venous thromboembolism in a marathon athlete presenting atypical sequelae: What are the chances? Scand J Med Sci Sports. 2015;25\(5\):699-705.](#)
2. [LeBlanc M, Cooper T, Chopra P. Unexpected Populations for Deep Vein Thrombosis: Presentation in an Endurance Athlete. Cureus. 2021;13\(8\):e17495.](#)
3. [Zaleski AL, Taylor BA, Pescatello LS, Thompson PD, Denegar C. Performance of wells score to predict deep vein thrombosis and pulmonary embolism in endurance athletes. Phys Sportsmed. 2017;45\(4\):358-64.](#)
4. [Bishop M, Astolfi M, Padegimas E, DeLuca P, Hammoud S. Venous Thromboembolism Within Professional American Sport Leagues. Orthop J Sports Med. 2017;5\(12\):2325967117745530.](#)
5. [Hull CM, Harris JA. Venous Thromboembolism in Physically Active People: Considerations for Risk Assessment, Mainstream Awareness and Future Research. Sports Med. 2015;45\(10\):1365-72.](#)
6. [Hilberg T, Ransmann P, Hagedorn T. Sport and Venous Thromboembolism—Site, Accompanying Features, Symptoms, and Diagnosis. Dtsch Arztebl Int. 2021;118\(11\):181-7.](#)
7. [Grabowski G, Whiteside WK, Kanwisher M. Venous thrombosis in athletes. J Am Acad Orthop Surg. 2013;21\(2\):108-17.](#)
8. [Hummel C, Geisler PR, Reynolds T, Lazenby T. Posttraumatic Deep Vein Thrombosis in Collegiate Athletes: An Exploration Clinical Case Series. J Athl Train. 2018;53\(5\):497-502.](#)
9. [Menon D, Onida S, Davies AH. Overview of venous pathology related to repetitive vascular trauma in athletes. J Vasc Surg Venous Lymphat Disord. 2019;7\(5\):756-62.](#)
10. [Fredericson M, Jennings F, Beaulieu C, Matheson GO. Stress fractures in athletes. Top Magn Reson Imaging. 2006;17\(5\):309-25.](#)
11. [Feldman AB, Saint-Phard D. Femoral neck stress fracture complicated by deep venous thrombosis and complex regional pain syndrome: a case report. PM R. 2009;1\(6\):584-6.](#)
12. [Fleming A, Frey D. Extensive venous thrombosis in a runner: progression of symptoms key to diagnosis. Phys Sportsmed. 2005;33\(1\):34-6.](#)
13. [Sanz de la Garza M, Lopez A, Sitges M. Multiple pulmonary embolisms in a male marathon athlete: Is intense endurance exercise a real thrombogenic risk? Scand J Med Sci Sports. 2017;27\(5\):563-6.](#)
14. [Bird ST, Hartzema AG, Brophy JM, Etminan M, Delaney JA. Risk of venous thromboembolism in women with polycystic ovary syndrome: a population-based matched cohort analysis. CMAJ. 2013;185\(2\):E115-20.](#)
15. [Suh YJ, Hong H, Ohana M, Bompard F, Revel MP, Valle C, et al. Pulmonary Embolism and Deep Vein Thrombosis in COVID-19: A Systematic Review and Meta-Analysis. Radiology. 2021;298\(2\):E70-e80.](#)

16. [Kollias A, Kyriakoulis KG, Lagou S, Kontopantelis E, Stergiou GS, Syrigos K. Venous thromboembolism in COVID-19: A systematic review and meta-analysis. Vasc Med. 2021;26\(4\):415-25.](#)

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