An Unusual Case of Pulmonary Embolism in a Young Healthy Female Competitive Rower

KATHERINE M. RAND, CHARLES B. SHERMAN, MD

ABSTRACT
Young healthy women without a genetic predisposition are considered to be at low risk for deep vein thrombosis and pulmonary emboli. We present an unusual case of pulmonary embolism in a 21-year-old female competitive rower likely caused by oral contraception and trauma of the axillary-subclavian vein by extrinsic compression due to repetitive arm movements.

KEYWORDS: Pulmonary Embolism, Effort Thrombosis, Oral Contraception, Elite Athletes, Crew

INTRODUCTION
Pulmonary embolism (PE) affects over 1 in 1,000 Americans each year and has a mortality rate greater than 15% in the first 3 months after diagnosis. The most common risk factors for pulmonary embolism include prolonged immobility, older age, history of smoking, inherited clotting factors, and post-operative states. Additionally, the use of oral contraceptives is understood to introduce an increased risk, often in conjunction with genetic predisposition such as factor V Leiden mutation. Young women without genetic predisposition who are healthy and active are considered to be a low risk population for DVT and PE. We present the unique case of a young woman, a competitive collegiate crew athlete, who developed multiple PE's likely the result of OCP use and repetitive arm movement with effort thrombosis.

CASE REPORT
CR was a 21-year-old female athlete who presented to the emergency department of a local hospital with a 6-week history of increasing muscle fatigue, dizziness and exhaustion. As a competitive National Collegiate Athletic Association Division I crew athlete, she routinely trained over 22 hours per week, with most workouts involving intense repetitive arm and leg movement. During this 6-week period she continued to train at the same high intensity levels, but her performance decreased dramatically. Within six minutes into any workout her legs felt heavy and her breathing became significantly more difficult. With the development of sharp chest pain and more exertional dyspnea, she presented to the emergency department for further evaluation. She denied cough, hemoptysis, wheeze, palpitations, or upper arm or lower leg pain or swelling. Just prior to the development of her initial symptoms she had taken a 3-hour flight home after an intensive training program. In addition, the patient...
had a 16-month history of using the NuvaRing (etongestrel 0.120 milligram [mg] and ethinyl estradiol 0.015 mg per day) and Loestrin 24 LE [norethindrone acetate 1 mg and ethinyl estradiol 20 mcg tablets] for contraception. She was a never smoker without a personal or family history of any clotting disorder.

Her physical exam was remarkable for: BP: 134/60; pulse: 80; respirations: 14; and oxygen saturation on room air: 98%. Her heart and lung exam were normal. She had no swelling or tenderness in upper or lower extremities.

Her laboratory revealed: normal electrolytes and a normal complete blood count; normal non-invasive lower extremity Doppler studies, no evidence of thrombophilia on a comprehensive screen, and a CT angiogram showing extensive pulmonary emboli, left greater than right, [Figure 1] a small, left pleural effusion and left lower lobe airspace disease likely representing a pulmonary infarction [Figure 2].

Her hospital course was remarkable for clinical improvement with the use of fluids and anticoagulation, first with IV heparin and then oral warfarin. She completed 6 months of anticoagulation and remains healthy. She has resumed exercise but has not returned to crew activities. She is currently using the Mirena intrauterine device (IUD) [52 mg levonorgestrel with an initial release rate of 20 microgram [ug] per 24 hours] for contraception.

DISCUSSION

Our female athlete developed multiple PE’s over a 6-week period likely as the result of both OCP use and crew induced repetitive arm movement. Oral contraception is a recognized risk for thromboembolic disease in young women. Estrogen is known to be involved in multiple prothrombotic alterations in proteins associated with coagulation, and OCP therapy has been shown to increase levels of factors II, VII, VIII, X and fibrinogen and decrease levels of antithrombin and protein S.14 Varying doses of estrogen are known to correlate with different levels of risk.15,16 In comparison to the most commonly used estrogen dose (30 μg), oral contraceptives containing 20 μg estradiol were found to be associated with a decreased risk of thrombosis, whereas those containing 50 μg estradiol were found to be associated with an increased risk of thrombosis.16 Given the reduced risk of venous thromboembolic disease with low-dose estrogen, it is likely that additional factors contributed to the development of PE in this patient.

Pulmonary embolism has been reported in other young female athletes using OCP. There have been case reports of PE and OCP in a competitive collegiate gymnast17 and a competitive collegiate cross-country runner.18 Effort thrombosis or Paget-Schroetter syndrome is a condition seen in young athletes due to trauma of the axillary-subclavian vein by extrinsic compression due to sports such as crew that involve repetitive arm movements. External compression of the axillary and subclavian veins by the musculoskeletal components of the thoracic outlet can create pooling of blood in these veins. This may then lead to venous hypertension and chronic stasis, contributing to acute thrombosis.19 Presenting symptoms may include pain or swelling in the upper extremity; however, some patients have no localizing symptoms. A 25-year-old major league professional baseball pitcher presented with only complaints of dizziness and shortness of breath. An angiogram showed segmental PE’s in both the upper and lower lobes and a small infiltrate in the left lower lobe. A lower extremity ultrasound showed no evidence of deep venous thrombosis, yet an ultrasound of upper extremities revealed acute DVT involving the right subclavian and axillary veins.20

It is not possible to absolutely confirm that effort thrombosis contributed to our patient’s PE’s as no upper extremity imaging was performed. However, her lower extremity, non-invasive studies were negative, making leg DVT less likely as a cause for her PE’s. Further, other risk factors such as high dose estrogen OCP, cigarette smoking, and thrombophilia were not present. Finally, effort thrombosis has been detected in patients without complaints or physical findings involving the upper extremity.

It is important for clinicians to recognize repetitive motion as a risk factor for thromboembolic disease in young athletes involved in appropriate sports even without complaints of upper extremity symptoms. Only then can rapid and potentially life-saving interventions be instituted.

References

**Authors**

Katherine Rand is a Clinical Research Associate in the Department of Newborn Medicine at Brigham & Women’s Hospital, Boston, Mass., and a pre-medical student.

Dr. Charles B. Sherman, Clinical Associate Professor of Medicine at The Alpert Medical School of Brown University, is the Director of Field Operations, East African Training Initiative, Tikur Anbessa Hospital and the University of Addis Ababa in Ethiopia and Head of Global Pulmonary and Critical Care Medicine for the Brown University Global Health Initiative.

**Disclosures**

None of the authors has potential conflict of interest with any companies/organizations/ whose products or services may be discussed in this article.

**Correspondence**

Charles B. Sherman, MD, MPH
Coastal Medical
450 Veterans Memorial Parkway, East Providence RI 02806
cbsherman@gmail.com