THE HEART'S SECRET PASSAGE: PE REVEALS INCIDENTAL PFO

Catherine McCormick, OMS-IV[1], Taras Tsyapa, MD[2], Jessica Rosskam, DO[2], Hemanth Neeli, MD[2]
1. Department of Medicine, Philadelphia College of Osteopathic Medicine, Philadelphia, PA
2. Division of Internal Medicine, Suburban Community Hospital, Norristown, PA

Suburban Community Hospital
Extraordinary People. Extraordinary Care.

Background

Venous thromboembolism (VTE) is a commonly seen diagnosis in the setting of stasis, hypercoagulability, and endothelial insult, known as "Virchow's Triad". VTE can present peripherally as a Deep Vein Thrombosis, or more centrally as a Pulmonary Embolism in the pulmonary circulation, which can be life threatening if not managed correctly . A multitude of morbidities following PE are possible without strict intervention and close monitoring, one common morbidity being acute stroke. In the case below, we discuss presentation, management and hospital course of a patient who presented with a massive PE. Subsequently, we discuss paradoxical emboli to the kidneys, revealing the discovery of a PFO in this 68-year-old patient.

.

Case Report

A 68-year-old male presented in severe respiratory distress with circulatory collapse following an episode of unprovoked dyspnea at home. Patient has PMHx of hypertension, hyperlipidemia, and Hashimoto's thyroiditis. He had right ankle surgery 4 weeks prior and was non-weight-bearing. Recently stopped Aspirin 162mg/day after new onset of hematuria. Patient was found cyanotic at home and EMS was called. CPAP was initiated en route for SpO2 68%. In ED patient was intubated and started on vasopressor. Admission ABG positive for worsening metabolic acidosis with respiratory compensation. Lactate 8.1 and D-dimer 10.5. CTA revealed diffuse extensive PEs, right heart strain and right renal infarct. ICU course was complicated by multiple episodes of first- and third-degree heart block on EKG. Lower extremities doppler revealed left popliteal DVT. ECHO via TAPSE on day 1 displayed right heart strain with resolution the following day. Bubble study was ordered for paradoxical embolization of right kidney and PFO was confirmed. For worsening hemodynamic instability, patient received 100mg tPA in ICU and heparin drip was initiated. Patient continued to improve on heparin and was successfully weaned from both vasopressors and respiratory support. He displayed confusion and paranoia when emerging from sedation, resolving over 24 hours. He was discharged on Apixaban 2.5 mg BID for 6 months. He will follow with cardiology for anticoagulation management and repair of PFO.

Vitals/Labs

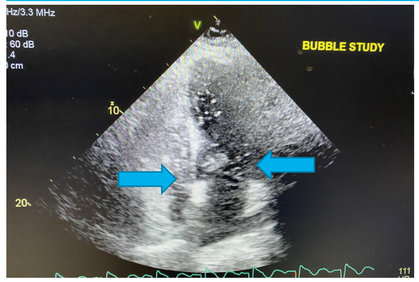
Initial vital signs: BP- 86/53, HR- 115, RR- 23, pox- 88%

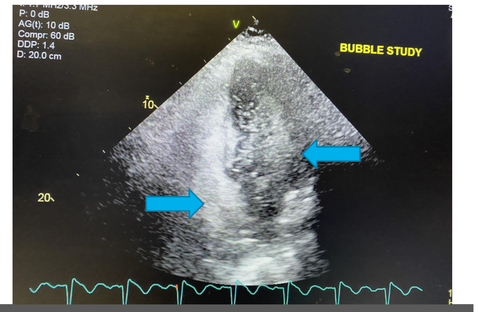
Initial ABG: pH 7.348, pCO2 28.8, pO2 42.7, HCO3 23.5

Initial labs:

- Na 134, K 3.4, CO2 19, Cr 1.6, glucose 292
- AST 86, ALT 98, alk phosphatase 123
- Ferritin 612
- Lactic acid 8.1
- Troponin 0.181
- WBC 16.00

Labs/Imaging





References

1. Stein PD, Beemath A, Matta F, et al. Clinical characteristics of patients with acute pulmonary embolism: data from PIOPED II. Am J Med. 2007;120(10):871-879. doi:10.1016/j.amjmed.2007.03.024
2. Lio KU, Kumaran M, Rali P. Patent foramen ovale: Connecting dots from massive pulmonary embolism to acute ischemic stroke. *Lung India*. 2019;36(6):564-566. doi:10.4103/lungindia.lungindia_276_19
3. Goliszek S, Wiśniewska M, Kurnicka K, Lichodziejewska B, Ciurzyński M, Kostrubiec M, Gołębiowski M, Babiuch M, Paczynska M, Koć M, Palczewski P, Wyzgał A, Pruszczyk P. Patent foramen ovale increases the risk of acute ischemic stroke in patients with acute pulmonary embolism leading to right ventricular dysfunction. Thromb Res. 2014 Nov;134(5):1052-6. doi: 10.1016/j.thromres.2014.09.013. Epub 2014 Sep 21. PMID: 25282541.
4. Le Moigne E, Timsit S, Ben Salem D, Didier R, Jobic Y, Paleiron N, Le Mao R, Joseph T, Hoffmann C, Dion A, Rousset J, Le Gal G, Lacut K, Leroyer C, Mottier D, Couturaud F. Patent Foramen Ovale and Ischemic Stroke in Patients With Pulmonary Embolism: A Prospective Cohort Study. Ann Intern Med. 2019 Jun 4;170(11):756-763. doi: 10.7326/M18-3485. Epub 2019 May 7. PMID: 31060047.
5. Le Moigne E, Timsit S, Ben Salem D, et al. Patent Foramen Ovale and Ischemic Stroke in Patients With Pulmonary Embolism: A Prospective Cohort Study. Ann Intern Med.2019;170:756-763. [Epub ahead of print 7 May 2019]. doi:10.7326/M18-3485
6. Schmidt MR, Søndergaard L. Patent Foramen Ovale: A Villain in Pulmonary Embolism?. Ann Intern Med.2019;170:805-806. [Epub ahead of print 7 May 2019]. doi:10.7326/M19-1089
7. Kottoor SJ, Arora RR. Cryptogenic Stroke: To Close a Patent Foramen Ovale or Not to Close?. *J Cent Nerv Syst Dis*. 2018;10:1179573518819476. Published 2018 Dec 16. doi:10.1177/1179573518819476
8. Koutroulou I, Tsivgoulis G, Tsalikakis D, Karacostas D, Grigoriadis N, Karapanayiotides T. Epidemiology of Patent Foramen Ovale in General Population and in Stroke Patients: A Narrative Review. *Front Neurol*. 2020;11:281. Published 2020 Apr 28. doi:10.3389/fneur.2020.00281
9. Kim HJ, Walcott-Sapp S, Leggett K, et al. Detection of Pulmonary Embolism in the Postoperative Orthopedic Patient Using Spiral CT Scans. HSS J. 2010;6(1):95-98. doi:10.1007/s11420-009-9128-5

Discussion

- PE can present with a variety of symptoms, ranging from asymptomatic to catastrophic with multi-system collapse, as seen in the case example. Screening for PE should be done when clinical suspicion arises using the WELLS Criteria for high risk patients and the PERC Rules for low risk/rule out. These ranking systems consider symptom presentation (HR>100; hemoptysis; lower extremity unilateral pain and swelling) in addition to risk factors (active malignancy, recent history of immobilization or surgical intervention, personal history of PE/DVT). Using these criteria to rule out or rule in screening can guide treatment plan.
- Diagnosis of PE by WELLS Criteria is done via D-Dimer assay followed by CT angiography of the pulmonary circulation. The CTA is the gold standard for visualizing the embolism and can guide treatment if targeted therapy becomes necessary.
- Treatment of PE depends on acuity of presentation, symptom profile, and time since onset. Respiratory and hemodynamic status should be evaluated to understand the stability of the patient, and appropriate interventions should be applied where needed. In this case, the patient presented in respiratory distress with circulatory collapse, requiring both respiratory support via mechanical ventilation and circulatory support requiring vasopressor therapy. Following stability assessment, anticoagulation vs mechanical embolectomy or chemical thrombolytic therapy should be considered. In the case, it was deemed appropriate based on the size and distribution of the patient's emboli to use TPA for thrombolysis, followed by heparin for anticoagulation.
- Paradoxical emboli can be found following diagnosis of PE and in the setting of DVT in the presence of anatomic anomalies or dysfunctions. The incidence of stroke following PE is approximately 17%, with the highest risk factor being presence of an incidental patent foramen ovale (PFO). PFO is seen in approximately 25% of the general population, mostly asymptomatic, but increases the risk for stroke via paradoxical emboli if unrepaired. Although the patient in the case did not present with an acute ischemic stroke, the presence of the paradoxical emboli to the renal vasculature prompted investigation and discovery of a PFO. This finding prompted necessity for repair and a higher degree of surveillance for the patient moving forward for his cardiovascular health.
- Interestingly, RCT were previously undecided on the risk vs benefit for stroke prevention in PFO repairs. However, recently the RESPECT and CLOSE trials give more evidence to the benefit of PFO closure in addition to medical therapy to reduce risk of stroke, showing a marked benefit to surgical intervention in addition to medical therapy vs medical anticoagulation alone.

Conclusion

VTE/PE are commonly seen diagnoses following orthopedic procedures. This patient had significant risk factors for VTE including advanced age, stasis, and recent orthopedic surgery. PFO is seen in approximately 25% of the general population, increasing risk for stroke if unrepaired. In the case, renal infarction was likely a "lucky" find, as risk factors for stroke were greatly increased with the anatomic anomaly. Discovery of the PFO and subsequent treatment may help reduce future risk of stroke for this patient.