Patent foramen ovale: Connecting dots from massive pulmonary embolism to acute ischemic stroke

Sir,

We present a rare case of acute paradoxical ischemic stroke from patent foramen ovale (PFO) in the setting of massive pulmonary embolism (PE).

A 69-year-old male presented to the emergency department with signs of shock and questionable gastrointestinal bleeding. The patient was also noted to have a right inguinal mass that was being worked up as an outpatient. On clinical examination, the patient had cardiogenic shock. He underwent computed tomography (CT) chest/abdominal/pelvis for undifferentiated shock. On CT chest, he was noted to have bilateral lobar PE [Figure 1]. The patient was started on unfractionated heparin drip. Formal echocardiogram performed showed severe right ventricular strain and obstructive shock. He continued to deteriorate clinically and subsequently intubated.

On arrival at the intensive care unit (approximately 30 min after intubation), the patient was noted to have bilateral pinpoint pupils. A Stat head CT scan was performed and showed acute basilar artery occlusion [Figure 2]. Interventional neurologist immediately performed mechanical thrombectomy with stent retriever of acute thrombus. Given acute basilar artery occlusion in the setting of PE, we then repeated echocardiogram with bubble study, which demonstrated large PFO with a right-to-left shunt [Figure 3]. The patient continued to deteriorate from hemodynamic standpoint and eventually was made comfort care.

Venous thromboembolism (VTE) is a frequent complication of malignancy and is the second most common cause of mortality in cancer patients. All three mechanisms, such

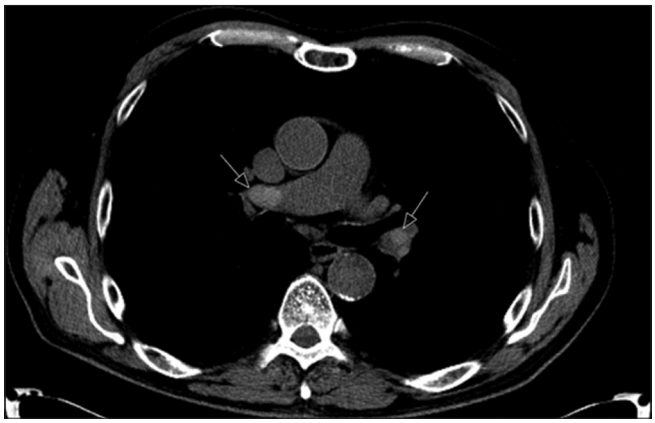

Figure 1: Noncontrast computed tomography axial images (arrows) showing bilateral pulmonary embolism

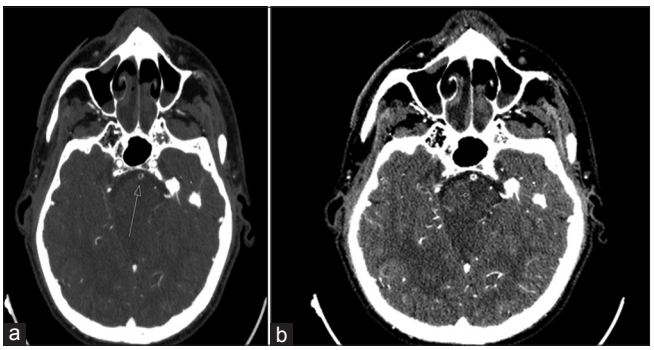

Figure 2: (a) Base of skull angiogram showing acute basilar artery thrombus (b) Pontine infarct due to basilar artery occlusion

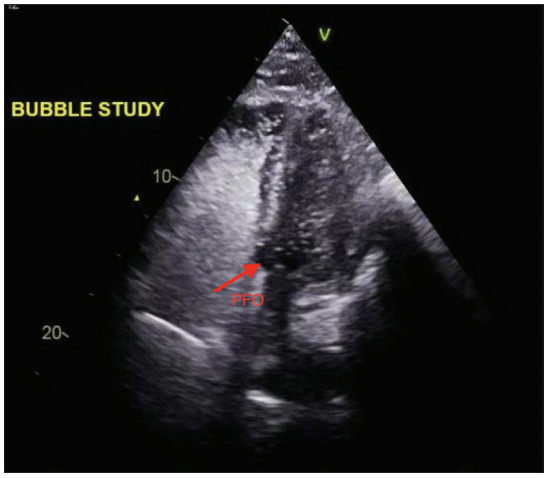

Figure 3: Echocardiogram showing bubble study

as vascular endothelial damage, stasis of blood flow, and hypercoagulation, contribute to the development of VTE.[1] In our patient, pelvic vein compression from testicular carcinoma may have led to venous stasis, VTE, and eventually PE. His hemodynamic compromise and acute onset of right ventricular dysfunction suggests massive PE. Our patient faced a unique dilemma given the presence of PFO, which leads to paradoxical embolism resulting in acute ischemic stroke (AIS).

PFO has a high prevalence of up to 35% in the general population.[2] Although most individuals with PFO are asymptomatic, paradoxical embolism from PFO may result in potentially life-threatening complications, including ischemic stroke, myocardial infarction, or renal infarction.[3] Several studies have confirmed a strong association between PFO and AIS in the setting of acute PE;[4-6] however, the prevention of paradoxical embolism in patients with PFO is still under discussion. Antithrombotics and percutaneous PFO closure are the mainstay of PFO intervention for secondary stroke prevention. Currently, mounting evidence suggests that PFO closure is a more effective strategy than antithrombotic treatment for reducing the risk of stroke, but percutaneous PFO closure was also associated with an increased risk of atrial fibrillation.[7-9]

According to current guidelines, systemic thrombolysis is the central goal therapy in the early management of ischemic stroke (initiated within 4.5 hours of symptoms onset or the time last known to be well).[10] On the other hand, thrombolytic therapy is only indicated for patient with acute massive pulmonary embolism (defined as systolic blood pressure <90mmHg or a decrease in systolic blood pressure by ≥ 40mmHg from baseline).[11] However, due to potential underlying gastrointestinal bleeding and poor functional reserve, we decided that our patient is not suitable for thrombolysis. We performed emergent thrombectomy for basilar occlusion and started patient on anticoagulation. Unfortunately, his condition continued to deteriorate and died from progressive and worsening obstructive shock and renal failure.

There is no definite recommended treatment of coexistent massive PE and paradoxical stroke because the cases are rare. Until now, in our search, there are three case reports of patients with concomitant massive PE and paradoxical embolic stroke successfully treated with thrombolysis within first few hours of stroke.[12-14] In another case report by Naidoo and Hift,[15] unlike the three case reports mentioned above, the patient improved from thrombolytic treatment 4 days after the onset of stroke, but the presence of PFO is not determined. With current evidence, thrombolysis proved to be safe and effective for treatment in patients with coexistent massive PE and stroke. However, all results are from single-center experience, and none of the patients have absolute contraindication to thrombolysis, which happened in our patient.

For massive PE in patients with contraindications for thrombolysis, catheter-directed interventions seem to be promising options.[16-18] On the other hand, mechanical thrombectomy is proven to be safe in patients with large-vessel occlusion stroke unsuitable for thrombolysis.[19] However, until now, there is no report of concurrent mechanical thrombectomy for both PE and paradoxical stroke, and additional research remains difficult due to its rare occurrence. Therefore, in patients with high risk of VTE, early detection of PFO is paramount, as paradoxical embolism may lead to devastating complications, especially in patients with contraindications to systemic thrombolysis. This would certainly improve the outcome of rare but dramatic condition of paradoxical embolism.

In conclusion, PFO is a strong risk factor for paradoxical embolism that may lead to devastating complications such as ischemic stroke. Clinicians should always suspect the possibility of PFO as the culprit for sudden onset of neurological deficits in patients with PE and VTE. Concomitant PE and paradoxical embolic stroke can be treated with systemic thrombolysis, but further research is required to confirm its safety and effectiveness. Percutaneous PFO closures may be a promising approach for secondary prevention of paradoxical embolic stroke.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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