

## CASE REPORT

# Paradoxical Embolism in a Patient with Patent Foramen Ovale; a Case Report

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**Abstract:** Patent foramen ovale (PFO) is usually asymptomatic; however, it could be quite dangerous for patients with right side clot in which thrombus can transmit the PFO and paradoxically emboli to systemic circulation. Here we present a patient with ankle fracture and paradoxical embolus to the brain, who was successfully treated with emergent thrombectomy, inferior vena cava (IVC) filter placement and anticoagulation therapy. Despite the high rate of mortality in these patients, fortunately our patient survived with surgical treatment.

**Keywords:** Venous thrombosis; pulmonary embolism; embolism, paradoxical; patent foramen ovale; thrombolytic therapy  
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## 1. Introduction:

Simultaneous occurrences of cerebrovascular accident and pulmonary embolism (PE) demonstrates the presence of paradoxical embolism according to the Johnson criteria (1). In 25–30 percent of individuals presenting with paradoxical embolism a patent foramen ovale (PFO) could be detected (2). Inter-atrial septum has two parts; septum primum and secundum. There is a slit-like opening between the two parts called a PFO. Because of low pressure in both atria and anatomical position of the septum secundum there is no significant left-to-right shunting and little shunting in general; however, when the right atrial pressure rises during a physiological condition like as straining, Valsalva maneuver or coughing this slit like flap separates and allows right to left shunting, this type of shunting may become more marked in cases with raised right atrial (RA) pressure due to pathologic conditions such as PE. There is also a “so-called” “flow phenomenon” that describes a preferential blood flow from the inferior vena cava towards the atrial septum as a part of the fetal circulation.

Far less than 1% have a stroke or other outcome that results in the need to have the PFO closed. There are some case reports of coexistence of paradoxical emboli with PE systemic embolism and DVT, especially in patients with “hybrid defect”, which is defined as fenestrated secundum atrial septal defect with septal aneurysm (3).

## 2. Case presentation:

A 60-year-old female was admitted to our hospital for left ankle and right knee fracture. She underwent orthopedic surgery and was discharged in stable medical condition with administration of low molecular weight heparin (LMWH) on a daily basis. She was asymptomatic and was in healthy medical condition, she denied any symptoms such as dyspnea associated with postural change. She was bed ridden at home, with irregular LMWH injection. Forty five days later she presented with convulsion, right side hemiplegia, aphasia and decreased level of consciousness. Her past medical history included systemic hypertension and she was not on any regular medication.

On admission she was confused, had tachypnea and tachycardia and a pulse rate of 120 beats per minute. Her blood pressure was 105/75 mmHg. The oxygen saturation was reduced at 85% in room air. She had total loss of strength in right upper and lower extremities and was aphasic. A neuro-

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**Figure 1:** Clot straddled in patent foramen ovale in trans-esophageal echocardiography (TEE) bicaval view.

logical examination showed aphasia and Babinski's sign on the right side. Heart and lung examination were unremarkable. Electrocardiogram showed right axis deviation and inverted T waves in the anterior leads (V1-V3).

Echocardiography imaging revealed mild right ventricular (RV) dilatation and mild impaired RV systolic function and large thrombus crossing the RA to the left atrium (LA) via inter-atrial septum. A trans-esophageal echocardiogram revealed a large RA clot extending through a PFO into the LA, entrapped in foramen ovale as well as right pulmonary artery thrombus (Figure 1). Atrial septal aneurysm and pulmonary hypertension with pulmonary arterial pressure of 45mmHg were evident. The chest computed tomography (CT) angiography showed a massive thrombus in the main right and left pulmonary artery. Doppler study of her lower legs showed signs of deep vein thrombosis in right superficial femoral and anterior tibialis vein. Brain CT scan demonstrated hypodensity in left frontal, temporal and parietal lobes consistent with middle cerebral artery related stroke. Patient underwent emergent surgical removal of RA, LA, right and left pulmonary arteries and surgical closure of PFO. To reduce the risk of further emboli, the temporary IVC filter was replaced. She had an uneventful postoperative course and was discharged eight days after surgery. Our patient is alive but aphasic and hemiplegic one year after surgery. Patient had signed informed consent to be presented as case report.

### 3. Discussion

Less than 2% of all cases of systemic arterial emboli are paradoxical (4). As high as 35% of the general population have a PFO, which is the most common cardiac defect in association with paradoxical embolism (5). There are some reports, which demonstrate that presence of PFO is an important predictor of adverse outcome and LA dysfunction, which leads to thrombi formation in LA (6, 7). When a patient

presents with multi-vascular arterial embolism, not only the transthoracic echo, but also the trans-esophageal and even intra-cardiac echocardiography is essential to differentiate between PFO, flat ASD and hybrid defects.

There are no clear guidelines based on randomized trials for treatment of paradoxical embolism. Surgical embolectomy with exploration of the right chambers and the pulmonary arteries under complete cardiopulmonary bypass is the classic treatment; however, there are reports (7-9) of successful medical treatment of RA and LA clot questioning whether mechanical closure of PFO should be indicated. Since older patients are more prone to rapid change of right heart pressure, we decided to send our patient to the operating room considering the large clot burden, contraindications to thrombolytic, her age, and the risk of relapse. According to previous reports, in-hospital mortality is as high as 44.7 % (10-12).

### 4. Conclusion:

We described the diagnosis and successful surgical treatment of a severe form of venous thromboembolic disease with thrombi in transit getting complicated by paradoxical embolus to cerebral arteries in an aged woman. However, there are no clear guidelines based on randomized trials for therapy of paradoxical embolism. Clot removal by cardiopulmonary bypass surgery as shown in our case, could be considered in treatment of paradoxical embolism.

### 5. Appendix

#### 5.1. Acknowledgements

None.

#### 5.2. Author's contribution

All authors passed the four criteria for authorship contribution based on recommendations of the International Committee of Medical Journal Editors.

#### 5.3. Conflict of interest

None.

#### 5.4. Funding

None.

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