CASE REPORT

A rare case of paradoxical embolism causing myocardial infarction: Successfully aborted by aspiration alone

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Summary A 58-year-old male presented with severe substernal chest pain along with bilateral lower extremity pain. He was tachycardic, tachypneic, and hypoxic with tender right calf. Electrocardiogram showed ST elevation in anterior-lateral leads. Emergency coronary angiography revealed widely patent proximal left anterior descending (LAD) artery and total distal occlusion with an abrupt cut-off. The remaining coronary arteries did not have significant disease. An Export aspiration catheter was used and thrombus was aspirated from the LAD with return of TIMI flow grade 3 and normalization of the ST elevations. Doppler ultrasound revealed deep vein thrombosis; transthoracic echocardiogram using agitated saline echocontrast showed a patent foramen ovale.

Nearly 5% of patients with ST elevation myocardial infarction do not have demonstrable atherosclerosis by coronary angiography; paradoxical coronary embolism is among the leading causes in such cases. Paradoxical embolism to the coronary tree is under diagnosed and its antemortem diagnosis is difficult. Information regarding appropriate management of myocardial infarction due to coronary embolism is scant. Aspiration of intracoronary thrombus provides good clinical results, avoiding clot fragmentation and balloon injury associated with angioplasty. We present a rare case of antemortem diagnosis of paradoxical embolism to the coronary artery successfully treated with aspiration alone.

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Case report

A 58-year-old male smoker presented with severe substernal chest pain of 4-h duration with pain in both of his lower extremities for the previous 2–3 days. He was tachycardic, tachypneic, and hypoxic. Physical examination was significant for absent distal pedal pulses and tender right calf. His cardio-pulmonary examination and other review of systems were otherwise unremarkable. Initial blood work up showed creatinine phosphokinase 34 units/L and troponin 0.01 ng/ml. His arterial blood gas on room air showed PO2 55 mmHg, PCO2 28 mmHg, pH 7.51, and SpO2 88%, with an A-a gradient of 59.7 mmHg (expected 14.9 mmHg) showing hypoxemia with acute respiratory alkalosis. Electrocardiogram showed sinus rhythm with ST elevation most prominent in anterior-lateral precordial leads. He underwent emergent coronary angiography for suspected acute myocardial injury.

Ventriculography revealed a left ventricular systolic pressure of 96 mmHg, with an end diastolic pressure of 30 mmHg, mild left ventricle dysfunction with an estimated ejection fraction of 45%, and apical akinesis. Coronary angiography revealed widely patent right coronary artery and circumflex artery. The left anterior descending (LAD) artery was widely patent proximally but had a total distal occlusion with an abrupt cut-off and TIMI 0 flow (Fig. 1). A 0.014-in. Choice floppy wire (Boston Scientific, Natick, MA, USA) was advanced into the LAD distally. An Export aspiration catheter (Medtronic, Minneapolis, MN, USA) was then advanced over the wire into the distal LAD (Fig. 2). Extensive aspiration was performed twice, collecting thrombus. After thrombectomy, the distal LAD occlusion resolved with restoration of TIMI flow grade 3, and no residual stenosis was noted (Fig. 3). There was immediate cessation of the chest pain and normalization of the ST elevations in the electrocardiogram. He was treated with eptifibatide for 18 h and remained free of anginal symptoms throughout the rest of his hospital course.

Duplex of the right lower extremity demonstrated an acute deep vein thrombosis within the right common femoral vein. A transthoracic
Myocardial infarction due to paradoxical embolism treated with aspiration

Figure 4 Transthoracic echocardiogram with intravenous agitated saline echocontrast showing interatrial communication consistent with patent foramen ovale.

echocardiogram demonstrated apical and septal wall-motion abnormalities. Intravenous injection of agitated saline echocontrast revealed an interatrial communication with the emergence of echocontrast in the left atrium and ventricle within three cycles consistent with a patent foramen ovale (PFO) (Fig. 4). Right ventricular systolic pressure was elevated at 30—40 mmHg. Left atrial size was normal and no other source of intracardiac embolism was identified. Further laboratory evaluation did not demonstrate an identifiable hypercoagulable predisposition.

The patient presented with ST elevation myocardial infarction with findings consistent with intracoronary thrombus and minimal other angiographic findings of atherosclerotic coronary artery disease. Further studies revealed concomitant presence of an acute deep venous thrombosis with supportive clinical evidence for probable pulmonary embolism. Echocardiogram revealed the presence of a PFO. The body of evidence in this case supports an acute deep venous thrombosis with paradoxical coronary embolus through a PFO.

Discussion

Approximately 6% of all ST elevation myocardial infarctions do not have atherosclerosis demonstrable by coronary angiography or autopsy [1] and in these cases coronary vasospasm, in situ thrombosis, coronary embolism, and coronary artery dissection are among the leading causes. Myocardial infarction secondary to coronary artery embolism is not infrequent, seen in about 10—13% in autopsy series. However, paradoxical embolism (PDE) to the coronary tree is rare and is seen in about 5—10% of all PDE phenomena. An autopsy series of 1050 patients with myocardial infarctions by Prizel et al. [2] did not find a single case of PDE among the 55 patients identified with coronary embolism.

The prevalence of PFOs is reported to be 25—30% based on autopsy studies and 5—31% in healthy volunteers based on echocardiography [3—5]. Crump et al. [6] found no increase in prevalence of PFO among patients presenting with myocardial infarction who were found to have normal coronary arteries.

As per the criteria suggested by Johnson [7] a PDE can be presumed when: (1) there is an evidence of arterial embolization in the absence of a source in the left heart; (2) there is a source of embolism identified in the venous system; and (3) an abnormal communication between venous and arterial circulations can be demonstrated. PDE to the coronaries have been described in both the young [8] and the elderly. In 2003, Meier-Ewert et al. [9] reviewed a total of eight cases of antemortem diagnosis of presumed paradoxical coronary embolism. Review of the subsequent English literature yields six further probable and one proven cases of PDE, highlighting its rarity and difficulty in diagnosis despite advances in echocardiography and angiography.

Aspiration of intracoronary thrombus is used as an adjunct for the treatment of thrombotic lesions in saphenous vein grafts, no reflow during percutaneous coronary interventions, and acute myocardial infarction caused by plaque rupture thrombi [10]. Its role has been extensively described in coronary syndromes due to atherosclerotic lesions. It seems to offer a small clinical benefit when compared to pre-dilatation with balloon angioplasty prior to stenting [11]. However, only scant information is available about myocardial infarction due to coronary embolism [12]. With PDE, both surgical and thrombolytic approaches have been advocated. Given the high incidence of clot fragmentation and the need for the correction of the defect that allowed systemic transit of the clot, treatment of myocardial infarction in these settings needs to be tailored individually [13]. Aspiration of intracoronary thrombus seems to have a significant role in such cases, more so because the Export catheter reduces the incidence of clot fragmentation and further distal embolization to a great degree. To our knowledge only one such case of successful aspiration of PDE to the coronary artery has been described [10].
In our patient, the specific cause for spontaneous venous thrombosis was not identified. The thrombus was of venous origin and hence warfarin was used. Aspirin and clopidogrel were used for secondary prevention of coronary thrombi. Also, as the patient underwent percutaneous coronary intervention it was deemed that clopidogrel might be beneficial, at least for a short period. Hence a clinical decision was made to start the patient on dual antiplatelet therapy along with warfarin. He will be followed in the clinic and monitored for change in antiplatelet therapy if needed. The efficacy and safety of triple anticoagulation therapy (warfarin + dual antiplatelet therapy) in treatment and prevention of PDE remains unclear at this point.

In summary, embolic myocardial infarction remains under diagnosed [14]. The simultaneous presence of venous thrombosis should raise the suspicion of PDE. We present a rare case of antemortem diagnosis of PDE presenting as acute myocardial infarction successfully treated with aspiration alone. Such a technique appears effective and provides the advantage of avoiding balloon injury with angioplasty.

References