Cardiac tamponade and coronary artery pseudoaneurysm after brachial arterial embolectomy, possible role for an aberrant origin of the right coronary artery

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ABSTRACT
A patient developed hemopericardium shortly after left brachial arterial embolectomy using an embolectomy catheter. Evaluation disclosed evolving pseudoaneurysm of the right coronary artery that was successfully managed by stenting. Misplacement of the embolectomy catheter within the coronary vessel was facilitated by an anomalous origin of the right coronary artery. This complication highlights the importance of correct insertion of the embolectomy catheter using the markers to avoid maladvancement and damage to central vessels. (J Vasc Surg Cases and Innovative Techniques 2018;4:27-30.)

Remote embolectomy catheters introduced by Thomas Fogarty1 in 1961 have revolutionized surgical embolectomy procedures, and this is now the principal method applied for peripheral arterial embolectomies. Initial advancement of the catheter is usually carried out without fluoroscopy unless specific anatomic pitfalls are identified or suspected. Herein we report a case of a patient who developed a right coronary artery (RCA) pseudoaneurysm and hemopericardium after upper limb embolectomy without the use of fluoroscopy. This complication conceivably reflects maladvancement of the catheter into the coronary artery, facilitated by its aberrant anatomic origin. The patient gave consent for the publication of her case.

CASE REPORT
An 83-year-old obese patient with chronic atrial fibrillation and large B-cell lymphoma in remission presented with sudden onset of severe pain in the left upper extremity associated with pallor, absent pulses (axillary, brachial, and radial), and loss of capillary filling. Computed tomography (CT) angiography demonstrated an embolic occlusion of the left brachial and axillary arteries. The patient underwent an urgent left transbrachial arterial embolectomy using a 3F Fogarty catheter (Edwards Lifesciences, Irvine, Calif) under local anesthesia and under full heparinization. The procedure was completed uneventfully with evidence of restoration of perfusion to the left hand. Nevertheless, within 30 minutes after the procedure, the patient developed profound hypotension and signs of shock. A clinical diagnosis of cardiac tamponade was confirmed by echocardiography. The patient underwent emergent pericardiocentesis with the removal of 300 mL of blood (hematocrit, 30%) from the pericardial space with rapid hemodynamic improvement. She experienced transient right hemiparesis that was believed to reflect transiently reduced cerebral blood flow because CT of the head and chest was unremarkable, other than the remnants of pericardial effusion. Aortic dissection was also excluded. After pericardiocentesis, the patient remained stable; the pericardial catheter was removed with no evidence of recurrence of pericardial effusion. During the next 5 weeks, the patient developed weakness associated with mild fever, cough, and shortness of breath. She was hospitalized twice with presumed (although not clinically confirmed) diagnoses of congestive heart failure and respiratory infection. C-reactive protein concentration was elevated. Chest CT without contrast medium revealed bilateral pleural effusions more prominent on the left, cardiomegaly with mild pericardial effusion, and a new mass in the right atrioventricular groove, compatible with a pseudoaneurysm of the RCA (Fig 1, a). This finding was confirmed by CT angiography (Fig 1, b and c). In light of these findings, the patient underwent coronary angiography, performed through the right common femoral artery. Repeated attempts to cannulate the RCA with several catheters including Judkins right (JR4), Williams, and Amplatz left (AL1) failed because of an anomalous origin of the RCA. After injection of contrast material in the right coronary sinus of Valsalva, the aberrant origin was located at a posterior position with an ostium directed upward (Fig 2). Finally, intubation of the RCA ostium was achieved using a multipurpose (MP) catheter, a catheter with a blunt angle that is directed downward and is used in similar cases of
aberration (Fig 3, a). An aneurysm in the midsegment of the RCA, 3.5 cm in diameter, was demonstrated and successfully excluded by a pericardial covered stent (3.5/27 mm [ITGI Medical, Nir 'Aqiva, Israel]; Fig 3). The pericardial covered stents are highly deliverable, fully covered stents that are used to treat and to seal coronary perforations and aneurysms. The coronary arteries were otherwise normal. The patient was treated with aspirin, clopidogrel, and low-dose apixaban with an unremarkable clinical course until hospital discharge. She was clinically stable for 5 months of follow-up and then died suddenly of unknown cause.

DISCUSSION
The balloon embolectomy catheter, introduced by Fogarty,1 is widely used for the removal of arterial emboli and thrombi. It is a convenient, minimally invasive, and safe method, although complications related to balloon inflation, such as arterial wall dissection, rupture, vessel obstruction, embolic events including stroke, and formation of arteriovenous fistulas, have been reported.3-5

Our patient developed hemopericardium and tamponade within 30 minutes after transbrachial embolectomy that was performed without fluoroscopy. The time of onset of this complication and the absence of pericardial effusion before the procedure as seen on the chest CT scan (Fig 4) strongly suggested an association with the embolectomy procedure; nevertheless, the mechanism of this connection remained unclear because it was not explored at that time. The rarity of this complication contributed to the insufficient workup performed in looking for the cause.

Based on the clinical course during the next month (as described above), we postulated that the hemopericardium was a result of a small perforation of the RCA induced by the embolectomy catheter that was pushed blindly from the brachial artery to the ascending aorta and then into the RCA down to its midsegment. The anomalous anatomy of the RCA ostium directed upward at the base of the right coronary sinus (Fig 2) enabled the undesirable insertion of the catheter into the RCA. In the same way, it was easily targeted by the multipurpose catheter during the coronary intervention.
The multipurpose catheter is a relatively straight catheter with a shape that fairly resembles the embolectomy catheter. This resulted in a small perforation with bleeding into the pericardial space and consequent cardiac tamponade. The elevated pericardial pressure potentially contributed to formation of a clot that was organized around the middle segment of the RCA and prevented ongoing bleeding. However, this process eventually resulted in the subsequent development of the RCA pseudoaneurysm. This hypothesis is also strengthened by the absence of any RCA disease or pericardial effusion on CT that was performed before the embolectomy (Fig 4). The systemic inflammatory reaction that was observed during the period after the tamponade could be attributed to a Dressler phenomenon caused by the presence of blood within the pericardium.

This adverse outcome may have been prevented by attention paid to avoid advancement of the catheter far beyond the estimated length of the thrombosed arterial segment using the catheter markers. Another option is the use of fluoroscopy during the embolectomy procedure to guide the catheter. Nevertheless, the chance for such complication seems exceptionally slim as it requires two improbable scenarios: maladvancement of the embolectomy catheter as well as an anomalous origin of the coronary artery, facilitating advancement of the catheter into the coronary vessel. The operators should strictly assess the anticipated length of catheter insertion, be aware of this possible complication, and be careful during the advancement of the embolectomy catheter to avoid damage to other vessels.

**CONCLUSIONS**

We report a very rare complication of a presumed perforation of a coronary artery and hemopericardium, with subsequent formation of a coronary pseudoaneurysm, attributed to brachial arterial catheter embolectomy. We believe that the anomalous origin of the RCA contributed to this complication.

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