

Correspondence

Thrombus aspiration from an ectatic coronary artery using SOPHIA plus catheter during primary angioplasty for acute myocardial infarction

To the editor,

Coronary artery ectasia (CAE) is defined as focal diffuse dilatation of the coronary artery up to 1.5 times the contiguous normal segment of the vessel. It is differentiated from coronary artery aneurysm (CAA) by width to length ratio of the dilated coronary segment (CAE: >1.5 times and width: length < 1 ; CAA: >1.5 times and width: length > 1). Based on the extent and number of vessels involved, it is further classified into four types by Markis et al. [1]. Diffuse CAE involving a single vessel is classified as Type III and is one of the most frequent types, commonly involving the right coronary artery (RCA) [1]. CAE can present as acute coronary syndrome (ACS) with or without any underlying atherosclerotic plaque rupture and can advance into acute myocardial infarction (AMI). It complicates primary percutaneous coronary intervention (PPCI) because of the high thrombus burden that can cause distal embolization leading to no-reflow. Hence, the success of PPCI in CAE is suboptimal due to organized thrombus, slow flow during the procedure, and floating stent struts causing recurrent vessel closure in the ectatic segments [2] (see Figs. 1, 2, Table 1).

A 50-year-old male smoker presented with a 4 h history of the left arm and jaw pain, associated with diaphoresis and nausea. It was not associated with breathlessness, or syncope and no conventional risk factors were present for coronary artery disease (CAD). His prior functional class was good without any angina or angina equivalent features.

In the emergency triage, he was pale and anxious, with a pulse of 100 beats/min and blood pressure of 100/60 mmHg. His oxygen saturation at room air was 99% with no other pertinent clinical findings. The electrocardiogram (ECG) showed inferior ST-segment elevation myocardial infarction (STEMI). He was promptly transferred to the catheterization laboratory after loading with 300 mg of aspirin, 600 mg of clopidogrel, and 40 mg of atorvastatin. Transthoracic echocardiography showed basal and mid-inferior wall hypokinesia and no mitral regurgitation with an ejection fraction of 40%. Coronary angiogram via right radial access revealed a large ectatic RCA occluded from the proximal course and critical mid-course disease in the ectatic left anterior descending (LAD) artery at the junction of the big diagonal branch.

The RCA was cannulated with a 6-Fr Judkins right 3.5 guiding catheter. Repeat cine after crossing the RCA lesion with a balanced middleweight floppy wire and semi-compliant balloon (NC Emerge PTCA dilatation catheter, Boston Scientific, USA.) at 18 atm revealed a large ectatic vessel with a high thrombus burden. Repeated balloon inflations and manual aspiration thrombectomy using a thrombuster II (Kaneka Corp., Japan.) failed to clear the thrombus. He was given intracoronary Tirofiban and adrenaline. At that time there was an episode of ventricular tachycardia which settled with electrical cardioversion. On repeat cine the thrombus was still persistent. Our previous experience with SOPHIA Plus catheter (MicroVention Inc., Tustin, CA,

USA.) for thrombus retrieval from cerebral arteries in stroke patients prompted us to use it in this case.

The SOPHIA Plus has numerous features as an aspiration thrombectomy catheter including a 0.070" inner lumen for capturing large clots, a remarkable soft distal tip (190 mm) that allows smooth bypass of the friable cerebral arteries, a hybrid coil and braid design for 1:1 push response, a shapeable tip and torqueable shaft for steering the distal tip past difficult lesions, and enhanced kink resistance that maintains proximal and distal lumen integrity. After pushing the SOPHIA Plus catheter in RCA and under road map guidance, it was advanced to a position immediately before the thrombus. During manual aspiration with a 50-cc syringe, the SOPHIA Plus catheter was gently advanced into the occluded segment while negative pressure was maintained through the 50-cc syringe. The catheter was moved back and forth under negative pressure and the catheter was advanced gently into the thrombus. Nicorandil and adenosine were given selectively into the RCA through the SOPHIA Plus catheter. Back and forth movements were repeated three times and then under negative pressure, the SOPHIA Plus catheter was completely removed to achieve a TIMI II flow. The patient's chest pain was relieved immediately and the ECG showed significant ST-segment resolution.

The patient was monitored in the coronary care unit for 48 h while receiving intravenous Tirofiban infusion for 24 h. Seeing the result of the last picture, stent placement was not considered given the large-caliber vessel with a tough, possibly organized clot. The patient had an uneventful recovery and was discharged on Aspirin (75 mg), Clopidogrel (75 mg), and Rivaroxaban (2.5 mg), he is pain-free at 1-month follow-up and refused further coronary angiogram for re-assessment and possible stenting of the lesion.

A large thrombus burden and no-reflow phenomenon are often seen in the late presentation of STEMI. In addition, degenerated vein grafts and CAE with acute vessel closure are major causes of resistant thrombus formation. Irrespective of the thrombus burden, CAE causes slow flow by releasing inflammatory mediators in the coronaries [3]. Managing thrombus pharmacologically with intracoronary medicines and stenting can restore flow in conditions of no-reflow without large angiographically visible thrombus. However, large organized and fixed clots as seen in this case are difficult to crush with balloon angioplasty or stenting alone. Special aspiration thrombectomy catheters are required to clear such thrombus. EXPIRA trial has reported a low incidence of cardiac death after manual thrombectomy with Export catheter in the infarct-related artery during PPCI [4]. This is an aspiration catheter that delivers consistent, high aspiration power, restoring flow in arteries with a large thrombus burden. Technically, this technique appears to be controlled as it is over the wire, hence there is no loss of coronary access. Papadimitriou et al. has reported a case of primary left main coronary

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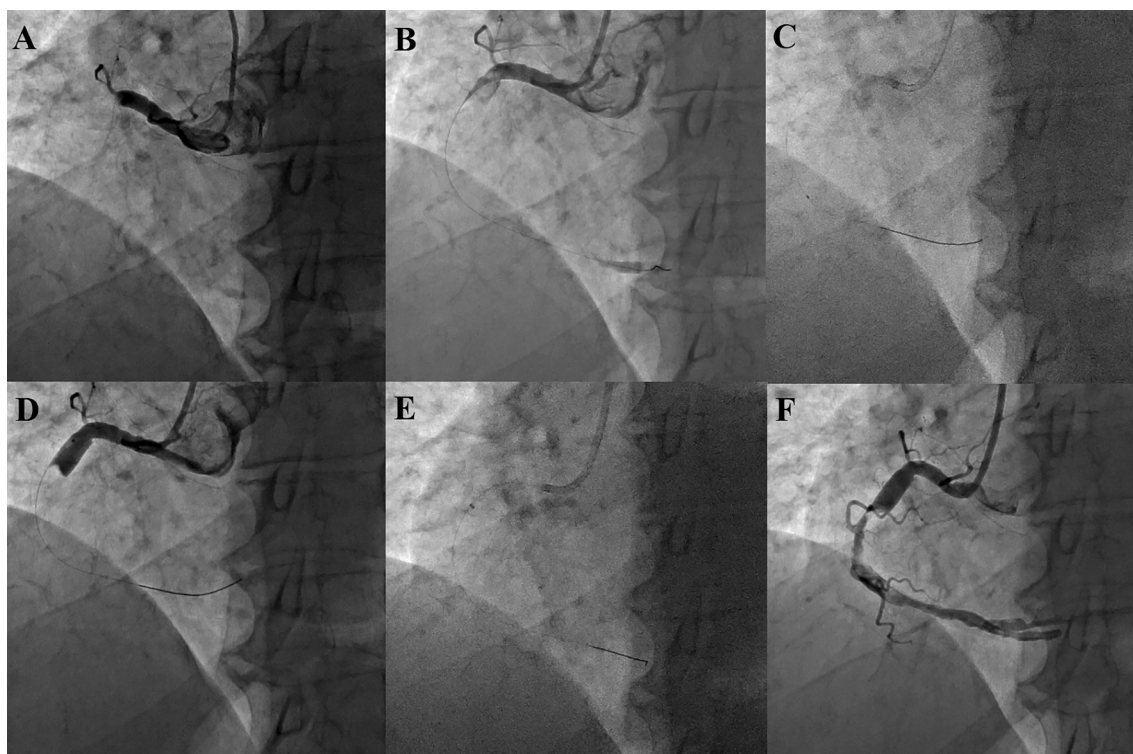


Fig. 1. (A) occluded proximal right coronary artery; (B) No flow after multiple balloon inflations; (C) thrombuster II tip at mid-right coronary artery; (D) Proximal right coronary artery ectasia with a large thrombus; (E) SOPHIA Plus distal tip positioned in mid-right coronary artery with a negative pullback pressure from a 50-cc syringe; (F) Final result after multiple pullbacks of SOPHIA Plus.

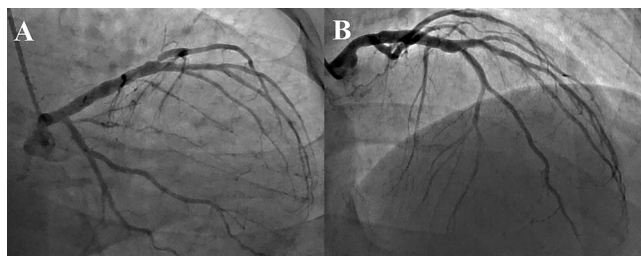


Fig. 2. Left coronary arteries in caudal and cranial view showing critical disease in left anterior descending at the bifurcation of major diagonal branch
Consent: The authors confirm that written consent for use of the patient information in an anonymized form was obtained prior to the submission of this manuscript in line with COPE guidance and the study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki.

artery thrombus aspiration as a stand-alone treatment [5]. This case expands our understanding regarding the optimal therapeutic approach of large thrombus in the left main coronary artery and suggests that manual aspiration thrombectomy is feasible in large vessels with or without CAE.

When extensive thrombi are seen in aneurysmal coronary arteries, they are treated with triple therapy with aspirin, P2Y12 receptor inhibitors, and warfarin or novel oral anticoagulants (NOACs) [6]. Rivaroxaban is approved for use in pulmonary embolism, treatment and prevention of DVT, and non-valvular atrial fibrillation for prevention of stroke. In recent ACS, guidelines suggest the use of low-dose Rivaroxaban to reduce the risk of death and re-occlusion of the target vessel. Since thrombus formation has both platelet and the coagulation factor component, a triple therapy was chosen.

Retrospectively it appears that a thrombus aspiration catheter would have succeeded with fewer attempts than the conventional thrombuster II system but it also involves the risk of coronary artery dissection in the

Table 1
Timeline.

Time	Events
Prior to the index event	Asymptomatic, smoker
Day 1	<ul style="list-style-type: none"> ■ Acute chest pain for 4 h duration <li style="padding-left: 20px;">Inferior STEMI in electrocardiogram <li style="padding-left: 20px;">Coronary angiogram showed occluded proximal right coronary artery <li style="padding-left: 20px;">PPCI demonstrated a large coronary artery ectasia with refractory thrombus <li style="padding-left: 20px;">Intracoronary Tirofiban and adrenaline induced ventricular tachycardia <li style="padding-left: 20px;">Thrombus aspirated using SOPHIA Plus catheter to establish TIMI II flow <li style="padding-left: 20px;">24 h Tirofiban infusion under CCU monitoring
Day 2	<ul style="list-style-type: none"> ■ Repeat electrocardiogram showed settled ST-segment elevation <li style="padding-left: 20px;">No chest pain
Day 3	<ul style="list-style-type: none"> ■ Discharged on dual antiplatelets
1-month follow-up	<ul style="list-style-type: none"> ■ Asymptomatic

proximal normal RCA segment. However, a soft tip of SOPHIA Plus makes it suitable for tracking through cerebral as well as coronary arteries as demonstrated in this case. The type of maneuver used for clearing a high thrombus burden can be associated with the composition of the clot. Silvain et al. has reported that total ischemia time increases the fibrin composition of the clot and in our case, while the total ischemia time was not long, we presume the clot to be more fibrin rich due to its organized nature [7]. The stasis of blood associated with CAE could have contributed to the fibrin-rich composition of the clot early in AMI. This mechanism can be explained by the similar stasis-related fibrin-rich clot formation in deep venous thrombosis. Furthermore, the majority of the successfully extracted thrombus from cerebral arteries is

red and fibrin rich, hence we presume that this system works best for friable and platelet-rich clots.

Thrombus aspiration is the first-line treatment to restore cerebral artery flow after ischemic large vessel stroke but the same is not true with acute coronary vessel occlusion causing STEMI. TASTE trial has shown that thrombus aspiration before PCI as compared with PCI alone did not reduce 30-day mortality among patients with STEMI [8]. However, thrombus aspiration in CAE followed by conservative treatment seems to be a more feasible option in select cases as in this report. Angiographically visible thrombus that is refractory to intracoronary medications and plain balloon angioplasty can be successfully managed using a SOPHIA Plus aspiration thrombectomy catheter used in patients with ischemic stroke. To our knowledge, this is the first reported case of the successful use of SOPHIA Plus for thrombus aspiration from an ectatic coronary artery.

Limitations.

We want to acknowledge a few limitations to this report. First, we use clopidogrel for dual antiplatelet therapy, as other potent P2Y12 inhibitors are not available at our institute. Secondly, we routinely use thrombus aspiration, contrary to international guidelines, because it confers a better outcome in our experience. However, a randomized controlled trial is needed in our population cohort for assessment of adverse cardiac outcomes.

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CRedit authorship contribution statement

Waleed Abbasi: Data curation. **Asim Javed:** Supervision. **Atif Nazir:** Supervision. **Khurram Niazi:** . **Jahanzeb Malik:** . **Talal Almas:** .

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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