Successful percutaneous treatment of occlusive spontaneous coronary artery dissection with a ‘pull-back injection technique’: case report

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Background
Spontaneous coronary artery dissection (SCAD) is a rare condition that can cause acute coronary syndrome, typically in young patients without classical cardiovascular risk factors. Although in SCAD the conservative management is preferable, in cases with complete occlusion of the artery an invasive treatment may be required. In such cases, the goal of the percutaneous intervention should be to restore the connection between the true and false lumen recovering the distal flow of the vessel.

Case summary
A young man was admitted with acute chest pain and ST segment elevation in precordial v3–v6 leads. An emergent coronary angiogram showed an abrupt occlusion of middle left anterior descending artery compatible with SCAD. A microcatheter was advanced distally into the artery and pulled back with continuous contrast injection through the catheter, restoring the distal flow with a residual spiroid intimal flap and with relief of the chest discomfort. A computed tomography performed during admission showed complete resolution of the lesion.

Discussion
In SCAD with complete occlusion of the vessel, the ‘pull-back technique’ with continuous vigorous injection of contrast through a distal microcatheter may be effective to restore the distal flow enabling the healing of the artery at follow-up and avoiding the stent implant.

Keywords
Case report • Spontaneous coronary artery dissection • Microcatheter • Pull-back technique • Percutaneous coronary intervention

Learning points
• Although in spontaneous coronary artery dissection (SCAD) a conservative management is desirable, in cases with complete occlusion of the vessel percutaneous intervention may be required. In such scenario, avoiding stent implant may be preferable.
• The pull-back injection technique with vigorous injection of contrast through a microcatheter placed in the distal vessel may be useful to restore the connection between false and true lumen recovering the distal flow.
• Coronary computed tomography is a safe technique to control the evolution of the SCAD, in order to avoid the risk of a second coronary angiogram.

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Introduction

Spontaneous coronary artery dissection (SCAD) is a rare condition that can cause acute coronary syndrome, typically in young patients without classical cardiovascular risk factors. Although in SCAD the conservative management is preferable, in cases with complete occlusion of the artery an invasive treatment may be desirable. Revascularization in the setting of SCAD remains controversial and technically challenging and is associated with high rates of technical failure, dissection extension, and failure to cross the lesion. Stent implantation has been associated with malposition, thrombosis, and events in the follow-up. We describe the case of a young patient, presenting with anterior myocardial infarction and SCAD, in whom a novel and non-aggressive technique with continuous injection of contrast at the distal vessel was successfully used to restore the flow, confirming complete restoration of the artery at the follow-up.

Timeline

| Day 1 | Admitted with anterior ST segment elevation myocardial infarction. Urgent coronary angiogram demonstrating Type 2 spontaneous coronary artery dissection successfully treated with the pull-back injection technique |
| Day 2 | Normal systolic function in echocardiogram |
| Day 3–5 | Doppler ultrasound study of abdominal, supra-aortic, renal, and iliofemoral vessels to rule out fibromuscular dysplasia. Rheumatic disease ruled out |
| Day 7 | Discharged from hospital after computed tomography showing complete restoration of left anterior descending artery |
| Week 4 | Echocardiogram performed 4 weeks after the admission showed no regional wall motion abnormalities with normal systolic left function |
| Month 4 | The patient remains asymptomatic after 4 months of follow-up |

Case presentation

A 47-year-old man without any remarkable cardiovascular risk was admitted with acute chest pain and ST segment elevation in precordial v2–v5 leads. His blood pressure at admission was 110/70 mmHg with a heart rate of 82 b.p.m., and he did not present any signs of heart failure. An urgent coronary angiogram was performed through right radial access, showing an abrupt occlusion of middle left anterior descending artery (LAD) (Figure 1A, arrow and Video 1), without distal flow, suggesting a Type 2 SCAD. The other coronary arteries appeared normal (Video 2). A BMW wire was advanced through the occlusion, without restore of distal flow (Figure 1B). A Finecross microwire (Terumo, Japan) was then placed in distal LAD and pulled back with continuous contrast injection through the catheter (Figure 1C and D and Video 3), restoring the flow with a residual spiroid intimal flapp and with relief of the chest discomfort (Supplementary material online, Video S1). High-sensitivity troponin T raised up to 907 ng/L (normal range > 14 ng/L), with a peak creatinine kinase of 871. Echocardiogram showed apical and distal-anterior akinesia, with mild systolic dysfunction (ejection fraction of 45%). Given the complete occlusion of the artery and the low-risk-bleeding of the patient, medical treatment with aspirin 100 mg/day, clopidogrel 75 mg/day, and 80 mg enoxaparin/12 h was maintained during admission performing a 320-sliced coronary computed tomography (CT) (Toshiba Medical Systems, Japan) 1 week after the procedure to control the evolution of the artery in order to avoid the risk of a second coronary angiogram. The CT showed complete resolution of the intimal flap with restore of the distal flow and a residual image at the SCAD entry point (Figure 2, arrow). Fibromuscular dysplasia was also ruled out during admission with vascular study of iliofemoral, carotid, and intracranial arteries.

Following the recommendations of the European SCAD study that advocate dual antiplatelet therapy during the acute phase the patient was discharged under treatment with 75 mg of clopidogrel, 100 mg of aspirin 100 mg, 20 mg of pantoprazole, and 2.5 mg of bisoprolol with normal systolic function and remains asymptomatic at 4 months of follow-up. Echocardiogram performed 4 weeks after the admission showed no regional wall motion abnormalities with preserved left ventricular function.

Discussion

Although in SCAD the conservative management is preferable, in cases with ST elevation and complete occlusion of the vessel a percutaneous intervention may be required.

Luminal obstruction in SCAD is caused by compression of the artery due to a haematoma placed within the vessel media or by dissection of the intima and not by atherosclerotic plaque, therefore the aim of the angioplasty should pursue the restoration of the distal flow by recovering the communication between the false and true lumens. Different strategies have been proposed in this scenario, with a stepwise algorithm that includes plain old balloon angioplasty and cutting balloon dilatation, trying to avoid the stent implantation in these patients.

The use of cutting balloon has also been described to fenestrate the intramural haematom. However, it should be carefully used in order to avoid the extension of the dissection.

Technique description

After carefully catheterization of the coronary ostium with a guiding catheter, complete unfractionated heparin dose was used (weight-adjusted intravenous bolus of 70–100 UI/KG), advancing a non-hydrophilic angioplasty wire (to avoid as far as possible the entrance into the false lumen) through the occlusive SCAD into the distal vessel (Figure 1B). Afterwards, a stainless steel microcatheter (1.8 Fr
Video 1 Abrupt occlusion of left anterior descending artery compatible with spontaneous coronary artery dissection.

Video 2 Normal right coronary artery angiogram.

Figure 1 (A) Abrupt occlusion of left anterior descending artery (arrow). (B) Angioplasty wire advanced into distal vessel. (C) A microcatheter was used to restore the flow, pulling it back while contrast injection. (D) Schematic representation of the technique and final result.
diameter) was advanced over the wire to the distal vessel, retrieving the wire to inject a small amount of contrast through the microcatheter to confirm true lumen position (Figure 1C). Subsequently a vigorous injection of contrast (using a 2 mL syringe connected to the microcatheter) was performed, while retrieving the microcatheter to the proximal part of the SCAD (Figure 1D and Video 3). Although intravascular imaging would have been useful to confirm the diagnosis and to verify the position of the wire in this case, its availability in emergent contexts is limited in our lab. In this scenario, the pull-back technique could have a double advantage, initially confirming the true lumen position of the catheter and enabling the reconnection between the true and false lumen.

The goal of the percutaneous intervention in SCAD should pursue the restoring of the distal flow, but not a ‘perfect’ angiographic result without residual stenosis. In this setting, some authors have proposed a change in the definition of ‘success of the intervention’ in the context of SCAD replacing the residual stenosis by a SCAD-specific definition established by improvement of the vessel flow.2

The presented technique proposes an easy and non-aggressive way to restore the distal flow of the vessel, re-establishing the connection between false and true lumen by vigorous injection of contrast through a microcatheter placed in the distal vessel recovering the flow of the artery and allowing a complete healing during follow-up.

Given the possibility of thrombosis despite the restoration of communication between the true and false lumen, it is advisable to confirm the evolution of the SCAD before hospital discharge, preferably with a non-invasive image technique such as a coronary CT angiography.

**Conclusion**

In SCAD with complete occlusion of the vessel, the ‘pull-back technique’ with continuous vigorous injection of contrast through a distal microcatheter may be effective to restore the distal flow enabling the healing of the artery at follow-up and avoiding the stent implant.

**Lead author biography**

Dra. Leire Unzue acquired her medical degree in Universidad de Navarra in Pamplona and specialization in cardiology and interventional cardiology at Hospital 12 de Octubre in Madrid. Actually, she is an interventional cardiologist working in HM Hospitales and HLA Moncloa in Madrid. Her interests include percutaneous coronary intervention and structural interventional cardiology.
Supplementary material

Supplementary material is available at European Heart Journal - Case Reports online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The authors confirm that written consent for submission and publication of this case report including images and associated text has been obtained from the patient in line with COPE guidance.

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