Achilles' heel of coil occlusion procedure: Anticoagulant therapy

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Introduction

The left internal mammary artery (LIMA) is often used for the revascularization of the left anterior descending (LAD) coronary artery because of its long-term patency (1). In this report, we present a case of coil reocclusion of the unligated thoracic side branch of the LIMA in which recanalization occurred following coil occlusion procedure performed 4 years ago in a patient consuming warfarin owing to aortic valve replacement (AVR).

Case Report

A 64-year-old man who had undergone coronary artery bypass grafting (LIMA to LAD) and AVR in 2000. Afterwards, a cardiac pace maker was implanted because of 3rd degree atrioventricular block. He had diabetes and hypertension. He underwent coronary angiography in 2010, and he was detected with a branch arising from the proximal segment of the LIMA, which was not occluded during the surgery (Fig. 1a). A coil occlusion procedure was applied via three piece of coil (Boston Scientific Corporation; 3 mm x 3 cm) (Fig. 1b, Video 1). After this coil occlusion procedure was successfully performed in 2010, he was symptom-free and only consumed warfarin owing to AVR.

He was admitted to the coronary intensive care unit with unstable angina after 4 years of the first coil procedure. Hypokinesia was detected on the anterior wall of the left ventricle with transthoracic echocardiography (LVEF, 45%). Coronary angiography revealed that the bypass graft was patent but recanalization was seen on the LIMA (Fig. 1c). Myocardial perfusion scintigraphy showed ischemia on the anterolateral wall (Fig. 1d). Percutaneous coil reocclusion was attempted on the side branch of the LIMA. Warfarin was ceased before the procedure, and bridging therapy with enoxaparin was initiated. LIMA was selectively cannulated with a left 6-F Judkins catheter; accordingly, a microcatheter was advanced over the guidewire into the side branch. Two coils were released into the appropriate position (Tornado®, Cook Medical; 2 mm x 4 cm and 3 mm x 6 cm). During the third coil implantation, an attachment apparatus was detached from the proximal part of the hinge point in the LIMA (Tornado®, Cook Medical; 5 mm x 7 cm) (Fig. 2a). We attempted to push the detached part into the side branch via a pusher and catch the detached part of the coil via a micro-snare, but none of our attempts was successful. During the procedure, severe vasospasm was seen on the LIMA, and the patient suffered from angina. Implantation of everolimus-eluting stent (3.0 x 23 mm) into the LIMA next to the unligated side branch was considered with an aim to fix the detached part of the coil (Fig. 2b). After the procedure, the flow of the side branch of the LIMA was ceased and the detached part of the coil was trapped between the stent and vessel wall (Fig. 2c, Video 2). Warfarin was reinitiated 2 days after the procedure. Following coil occlusion and stenting, ischemia on the anterolateral region disappeared on scintigraphy (Fig. 2d). The patient was mobilized without any complication following the procedure.

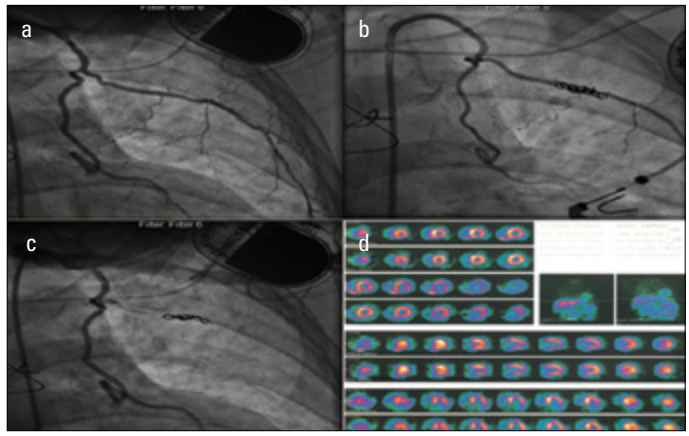

Figure 1. a-d. A large side branch originating from the left internal mammary artery (a), cessation of the side branch of the left internal mammary artery flow (b), recanalization of the side branch of the left internal mammary artery (c), a figure showing ischemia on the anterolateral region before the procedure (d)

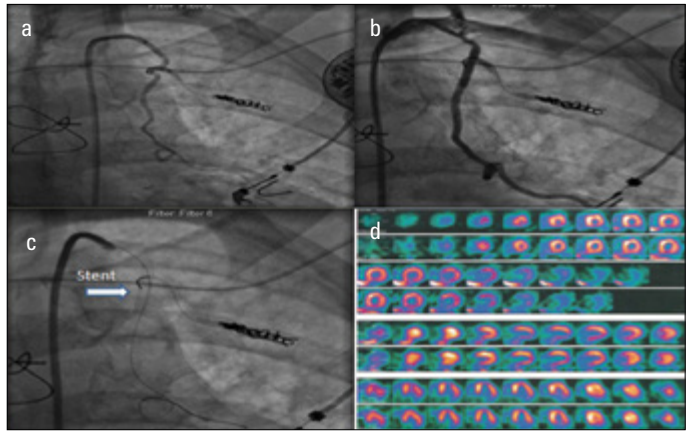

Figure 2. a-d. Detachment of the proximal part of the coil attachment apparatus (a), implantation of drug-eluting stent (b), cessation of the side branch of the left internal mammary artery flow (c), disappearance of ischemia following coil occlusion on myocardial scintigraphy (d)

Discussion

Side branches of the LIMA to the chest wall have been identified both preoperatively and postoperatively in 10%–20% of patients (2-5). Recanalization after the coil occlusion of the unligated side branch of the LIMA has not been reported so far. Several methods of side branch occlusion have been described including embolization, use of gelatin particles, use of vascular plugs, and the combined use of drug-eluting and covered stents (6).

In our patient, platinum coils were used that are easily detected radiographically, feature synthetic fibers that promote thrombogenicity, and are ideally suited for tapering vessel situations. There are no data in the literature regarding the recanalization rates of occluded side branches of the LIMA. Enriquez et al. (7) reported a recanalization rate of 20.4% in 142 patients with occluded gastroduodenal artery, and they found that the distance between the exit of the gastroduodenal artery and coils is an important predictor of recanalization. As a result, the potential factors of recanalization in occluded side branches of the LIMA are the distance between the coil and the exit of the vessel, the number of coils used, and the diameter as well as the feature of coils. Also, an essential component of coil occlusion procedure is thrombus formation. Although early procedural success is satisfactory, recanaliza-

tion could occur because of the long-term use of anticoagulant therapy. Hence, in our patient, warfarin was responsible for the recanalization of the side branch. There is no case of recanalization of the unligated side branch of the LIMA after successful coil occlusion in patients who consumed warfarin owing to valve replacement.

The data is scarce regarding the treatment of recanalization of the side branch of LIMA in patients who consume warfarin. If the recanalization of the side branch was detected in these patients, different options may be considered such as vascular plugs, graft stents, gelatin sponge particles, combined drug-eluting and covered stents. As our patient's LIMA diameter was relatively small for placing the vascular plug and graft stent, a coil reocclusion procedure was preferred. We used numerous large-sized coils to complete the occlusion of the vessel. The final angiographic view was satisfying with respect to total vessel occlusion.

Conclusion

Eventually after coil occlusion procedure, patients with admitted angina consuming warfarin should be considered in terms of recanalization. In cases when a coil occlusion procedure is preferred, the final result of procedure should be satisfactory in terms of total mechanical occlusion of the vessel using a coil rather than only stopping the flow.

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Video 1. A large side branch originating from the left internal mammary artery and cessation of the side branch of left internal mammary artery flow with coil occlusion.

Video 2. Recanalization of the side branch of the left internal mammary artery, detachment of the proximal part of the coil attachment apparatus, implantation of the drug-eluting stent, and cessation of the side branch of left internal mammary artery flow with coil reocclusion.

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Transcatheter ventricular septal defect closure: Should we feel comfortable after many years?

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Introduction

Ventricular septal defect (VSD) is the most common congenital heart defect. Indicated closure is performed either by surgery or by using a transcatheter route in eligible patients (1). Although closure rates are similar in the transcatheter and surgical VSD closure, both the transcatheter closure of a VSD and surgery are not a complication-free procedure (2, 3). The occurrence of a complete atrioventricular block (CAVB) is one of the major complications of transcatheter closure, particularly in perimembranous-type VSDs. CAVB may occur acutely during the procedure or after a few days or months of the transcatheter closure (3-8). Late development of CAVB is an alarming complication because of the risk of sudden death. According to our knowledge, the longest interval between the procedure and the occurrence of CAVB in the literature is 20 months (5). Herein, we report the case of an 8-year-old girl who developed CAVB at 51 months after an uneventful closure of muscular VSD located just below the membranous septum (known as high-muscular VSD).

Case Report

Transcatheter VSD closure was performed in the patient at the age of 3.5 years and weighed 15 kg. She had no significant medical problem other than VSD. Her ECG did not show any conduction abnormality. The size of the defect was measured to be 5.5 mm via transesophageal echocardiography (TEE). VSD was closed in a standard manner under the guidance of TEE and fluoroscopy. A 6-mm membranous VSD occluder (Amplatzer) was used. Hemodynamic measurements showed that the Qp/Qs ratio was 3 and the mean pulmonary artery pressure was 28 mm Hg. The intervention was uneventful, and there was only right bundle branch block (RBBB) without any atrioventricular conduction abnormality after the procedure. Transthoracic echocardiography (TTE) performed on the following day showed a complete closure of the defect with good device position (Fig. 1). Routine follow-ups were performed with ECG, TTE, and Holter monitoring at 1, 3, and 6 months as well at every 6 months after the procedure, thereafter. At her last follow-up visit, she was aged 7.5 years. Her ECG, TTE, and Holter monitoring did not show any abnormalities, except RBBB. She experienced a brief syncopal episode at 51 months after the transcatheter VSD closure. She was urgently referred to our clinic because of significant bradycardia. Upon arrival, her ECG showed CAVB with a ventricular rate of 35/min (Fig. 2). Clinical studies showed no obvious reason for CAVB. Transvenous transient endocardial pacemaker was urgently placed and permanent endocardial pacemaker was implanted without any complication.

Discussion

A major concern for percutaneous perimembranous VSD closure is the risk of CAVB. The frequency of this alarming complication in