CASE REPORT
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Angioplasty with Stenting after Arterial Switch Operation in 7-Year-Old Child

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ABSTRACT

We present the case of a 7 year-old child who underwent angioplasty with a stent for anastomosis site stenosis between a left subclavian artery free graft and the left main coronary artery in an arterial switch operation. **(Korean Circulation J 2006;36:710-712)**

KEY WORDS : Transposition of great vessels ; Coronary artery ; Stents.

Introduction

An arterial switch operation (ASO) has become the treatment of choice in selected infants with complete transposition of the great arteries (TGA).[1)2)] However, the most challenging surgical problem with this procedure is the potential risk of impaired postoperative coronary perfusion due to kinking, distortion, stenosis or compression of the coronary arteries. The long-term success of this operation depends on the continued patency of the reimplanted coronary arteries and development of late coronary stenosis. The subsequent therapy is also still a matter of concern.[3)4)] We report our experience with a stent supported coronary angioplasty in a 7 year-old child with anastomosis site stenosis between a left subclavian artery free graft and the left main coronary artery following an arterial switch operation.

Case

A male infant, born with D-transposition of the great arteries and ventricular septal defect, was treated with an arterial switch operation at 22 days of age. However, an inadvertent injury of the intramural left coronary artery occurred during its mobilization; therefore, he underwent a left coronary artery bypass using a left subclavian artery free graft following reimplantation of the right coronary artery.[5)] There were neither angina symptoms nor newly developed ventricular dysfunction on echocardiography after a followup of 75 months, but significant right pulmonary artery stenosis was observed at the anastomosis site.

Therefore, balloon pulmonary angioplasty was performed for the right pulmonary artery stenosis at the same time as coronary angiography. The coronary angiogram showed critical narrowing at the flap anastomosis site between the proximal left subclavian artery free graft and distal left main coronary artery, but the right coronary artery was normal (Fig. 1).

Following an extensive discussion with the parents and cardiovascular surgeons, percutaneous coronary intervention was proposed. Therefore, the decision was made to proceed with percutaneous coronary intervention on the left main coronary artery. After the right femoral artery had been cannulated with a 6Fr sheath, 75 units of heparin per kilogram of bodyweight was administered. The left coronary ostium was engaged with a 6Fr mammary catheter and the lesion crossed with a 0.014-in wire (BMW®, Guidant). Initially, the IUVS image was obtained using a Clear View IVUS unit (Galaxy®, Boston scientific), which revealed the proximal left subclavian artery free graft to be elliptical, with severe narrowed anastomosis site, but no atherosclerotic plaque within the wall was observed; the distal portion of the left main coronary artery was normal (Fig. 1).

According to the length of the lesion and size of the left main, a 12 mm long, 3.5 mm diameter paclitaxel-

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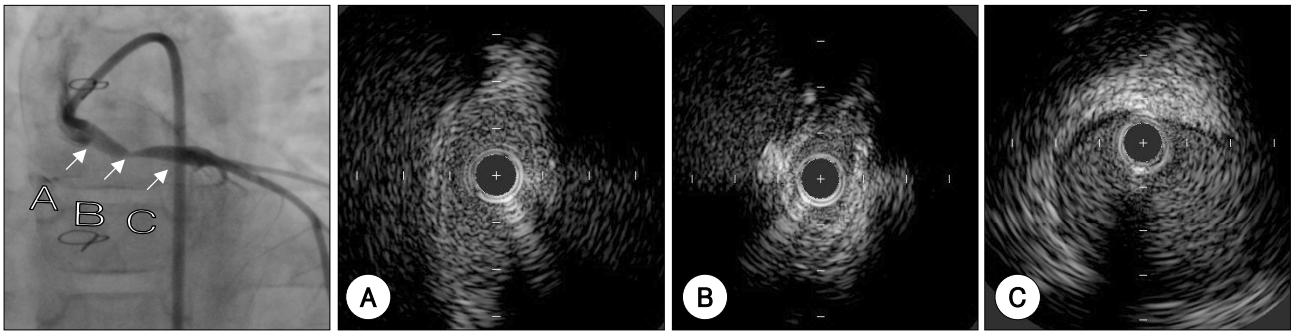

Fig. 1. The coronary angiogram and intravascular ultrasound imaging prior to stent deployment. The arrows show the sites imaged, in cross section, using intravascular ultrasound imaging. Coronary angiography revealed anastomosis site stenosis between a proximal left subclavian artery free graft and the distal left main coronary artery. The proximal left subclavian artery free graft was elliptical (A), with a severely narrowed anastomosis site, but no atherosclerotic plaque was observed within the wall of the coronary artery; the left main coronary artery of the distal portion was normal (C).

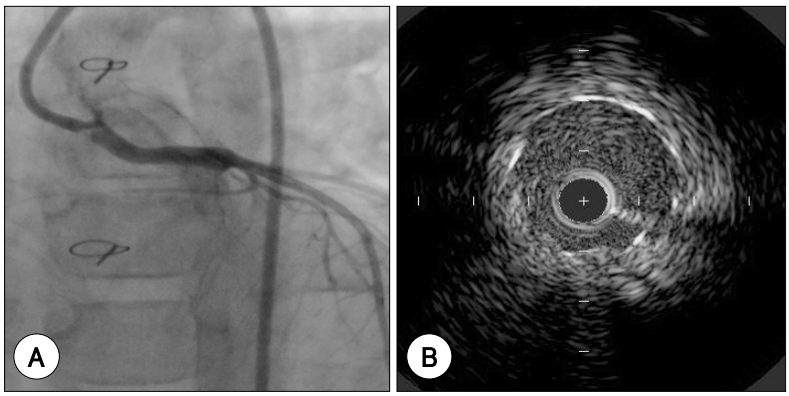

Fig. 2. The coronary angiogram and intravascular ultrasound imaging following stent deployment. Excellent angiographic result (A). The stents is completely apposed against the vessel wall (B).

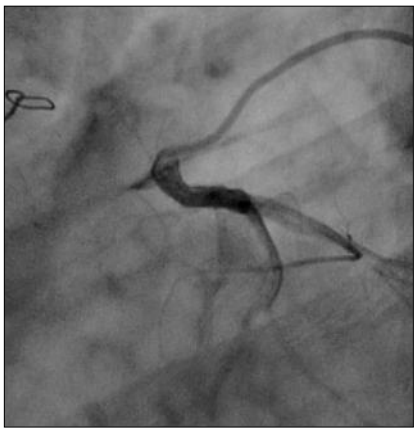

Fig. 3. Follow up coronary angiogram, after approximately 10 months, showed no significant stenosis at the previous stent lesion.

eluting stent (Taxus®, Boston scientific) was selected to cover the stenotic segment. The stent was placed between the proximal left subclavian artery free graft and distal left main coronary artery to cover the whole segment of stenosis, with the balloon inflated at 12 atmospheres for 30 seconds; however, 40% residual stenosis remained. Therefore, an 8 mm long, 3, 5 mm diameter non-compliant balloon (Quantum®, Boston Scientific) was inflated up to 18 atmospheres for 30 seconds. After the procedure, another IVUS image was obtained, which revealed the stent to be completely apposed against the vessel wall (Fig. 2).

No residual narrowing was present after stent deployment, with excellent antegrade flow and no evidence of dissection (Fig. 2).

The patient recovered after the procedure, and was administer 10 months of clopidogrel in addition to aspirin.

After about 10 months, the follow up coronary angiogram showed no significant stenosis at the previous stent lesion (Fig. 3).

Discussion

An arterial switch operation has become the procedure of choice for correction of the transposition of the great arteries (TGA). However, because of variations in the coronary anatomy associated with TGA, especially in the case of abnormalities in the origin or distribution of these arteries, the transfer of the coronary arteries during an ASO may be difficult. Actually, the survival rate after 10 year is 84.5%.[6] Although the midterm outcome of a corrected TGA is acceptable, the long-term success rate is unknown. The long-term

success of this intervention depends principally on the status of the coronary perfusion, and coronary events are an important cause of death. Follow-up studies have demonstrated coronary obstructions in up to 8% of patients, but the vast majority of patients are symptom-free.[7][8] Coronary artery obstructions can be due to the presence of a thrombus, kinking of the coronary arteries or vessel injury, but it seems more reasonable that restenosis can result from scar formation surrounding the proximal part of the surgically mobilized and reimplanted coronary artery. To correct coronary stenosis in young children, plain coronary angioplasty has been reported in this setting, but this can cause intimal laceration of the coronary artery and dissection.[9]

In this patient, angioplasty with stenting was selected because the lesion was significant and discrete. However, we were initially reluctant to place a stent, due to concerns the child may outgrow the stent, and the treatment modality of choice for left main coronary artery stenosis following an arterial switch operation remains to be established. Another treatment option for this child would have been, and may still be, coronary artery bypass grafting. Despite improved short- and intermediate-term results following internal mammary grafting, the long term results of bypass grafting in children this young are unknown.[10] Given the potential significant advantages over surgical bypass grafting, coronary stent implantation could be employed safely to correct coronary stenosis in this child.

Although the exact mechanism of restenosis in the left main coronary artery was unknown, a stricture, rather than the generally observed scar tissue, was demonstrated to be the mechanism in our case. Device sizing in this case was based on intravascular ultrasound (IVUS).

Compared with a bare-metal stent, a drug-eluting stent can dramatically reduce in-stent restenosis; however for children, no data or even reported cases are available. To our knowledge, this case is the youngest child to undergo drug-eluting stent implantation to the left main coronary artery.[11] Therefore, the long-term outcome of drug-eluting stent placement in children having undergone an arterial switch operation for the correction of transposition of the great arteries (TGA) is unknown. However, in our case, excellent patency was observed after 10 months, which will presumably continue long term. We plan to follow the patient by coronary angiography to determine the future need for therapy.

Despite the limited follow-up period, stent-supported angioplasty for stenosis following an arterial switch operation can be an effective therapy, with adequate medium-term results, and at least the surgery can be deferred until the child enters adulthood.

The decision regarding the treatment of pediatric patients with similar problems should be made on an individual basis, depending on both clinical and angiographic factors, as well as the patient age and body size.

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