Case report - Cardiac general

Emergency surgical intervention after unsuccessful percutaneous transluminal angioplasty and stenting of aortic coarctation

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Abstract

Coarctation of the thoracic aorta is an uncommon diagnosis in adults. Catheter-based intervention consisting of primary ballooning and stenting is becoming one of the methods of choice for the treatment of native coarctation. We describe the case of a young adult with coarctation of the aorta treated unsuccessfully with percutaneous transluminal angioplasty and stent implantation that resulted in stent migration into the aortic arch and led to an urgent operative intervention. In one step, we performed the evacuation of the foreign body from the aortic arch as well as the treatment of the aortic coarctation through an extra-anatomical vascular graft interposition between the ascending and descending thoracic aorta. In this article, we discuss the need for emergency surgical intervention in this case.

Keywords: Coarctation; Stent migration; Percutaneous transluminal angioplasty; Extra-anatomical bypass

1. Introduction

Coarctation of the aorta (CoA) is a relatively common defect that accounts for 5–8\% of all congenital heart defects. Often, the diagnosis of CoA is missed or delayed until the patient develops hypertensive leading to congestive heart failure, a condition common in infants, which if uncorrected can also be associated with aortic rupture, myocardial infarction, infective endocarditis, or stroke [1]. Since 1944, various surgical techniques have been used. Catheter-based intervention consisting primary of ballooning and/or stenting became an accepted form for the treatment of native coarctation [2].

In our patient, the CoA was treated initially with primary ballooning and stenting, followed by migration of the stent into the aortic arch, which led to urgent surgical intervention, performed in one step for evacuation of the stent from the aortic arch and repair of the coarctation with a vascular graft interposition between the ascending and descending aorta.

2. Case report

A 19-year-old male with postductal CoA was urgently admitted to our unit from the cardiology department with stent migration into the aortic arch after interventional treatment with percutaneous transluminal angioplasty and stenting of the coarctation with a Smart stent (Cordis S.M.A.R.T. Control Nitinol Stent System, Cordis\textsuperscript{\textregistered}-Corporation, Miami Lakes, FL, USA) of 14 × 60 mm followed by two postdilatations with balloons of 10 × 30 mm and 12 × 20 mm. In this patient, the persistent ductus arteriosus had been ligated at the age of nine months.

The physical examination was within normal limits. A contrast-enhanced computed tomography (CT)-scan of the chest revealed a long narrowing of the descending aorta distal to the origin of the left subclavian artery. The origins of the arch vessels did not show any sign of narrowing. Transesophageal echocardiography demonstrated a CoA with a diameter of 6 mm, a systolic pressure gradient of 60 mmHg across the coarctation, and a mean gradient (MnGr) of 36 mmHg. Angiography confirmed these findings (Fig. 1), demonstrating a systolic pressure gradient of 60 mmHg across the coarctation and showing the migrated stent in the aortic arch.

The patient underwent one-step surgery for evacuation of the migrated stent from the aortic arch, and extra-anatomical bypass grafting from the ascending aorta to the descending thoracic aorta for repair of the CoA through a median sternotomy. The femoral artery and the brachiocephalic trunk were cannulated. Venous drainage was established with a single ‘two-stage’ venous cannula placed into the right atrium and cardiopulmonary bypass was routinely instituted. A ventricular vent was placed via the right superior pulmonary vein. Cooling was commenced. The ascending aorta was cross-clamped. Myocardial protection...
was maintained with an infusion of antegrade crystalloid cardioplegia.

At an esophageal temperature of between 22 and 23°C, the head was placed downward after being packed in ice, and the perfusion was disconnected. The brachiocephalic trunk and left carotid artery were cross-clamped to prevent air embolization of the brain. The aorta was released. Longitudinal aortotomy of the ascending aorta was performed. A migrated stent was found in the aortic arch between the brachiocephalic trunk and the left subclavian artery, and was evacuated. The aorta was de-aired and cross-clamped. The brachiocephalic trunk and left carotid artery were released. Perfusion was reconnected.

The descending thoracic aorta was exposed through the posterior pericardium and was partially side-clamped. An appropriately sized vascular prosthesis (Hemashield 16 mm, Boston Scientific Corporation, Natick, MA, USA; Meadox Medicals) was selected and sewn to the descending thoracic aorta with a continuous 5/0 polypropylene suture, incorporating a strip of felt. After the anastomosis had been checked, the Hemashield graft was de-aired and cross-clamped. The cardiac chambers were de-aired through the aortotomy. The aorta was declamped, and the ascending aorta was side-clamped. The vascular graft was directed behind the left ventricular posterior wall through the sinus transverses under the ascending aorta, and the proximal side-to-end anastomosis was performed in the aortotomy of the ascending aorta using a continuous 5/0 polypropylene suture. The patient was rewarmed to normothermia, the heart was defibrillated, and sinus rhythm was re-established. The patient was weaned off cardiopulmonary bypass. All catheters and cannulas were removed, and hemostasis was ensured. The operation was terminated with a closure of the chest in standard fashion leaving one drain in the pleural space, one drain in the retrocardiac space, and one in the mediastinum.

The patient was extubated six hours after arrival in the intensive care unit. His drains were removed on the third postoperative day. He made uneventful recovery thereafter except for needing some respiratory support from a non-invasive positive continuous airway pressure for treating basal atelectasis.

The patient was discharged on the seventh postoperative day. On routine follow-up, he was in excellent condition and returned to full-time work. At the sixth month of
follow-up, no graft-related complications had occurred, and there was no paraplegia or stroke. The physical examination was within normal limits. A CT-scan was done (Fig. 2), which showed the location of the extra-anatomical graft, and displayed no graft kinking or compression of the tissue. Transoesophageal echocardiography revealed normal heart contractility, and the extra-anatomical bypass was visualized behind the left atrium with a satisfactory bloodflow.

3. Discussion

Surgery has long been considered to be the treatment of choice for CoA in children and adults [3]. Within the last few decades, satisfactory results from the interventional angioplasty techniques used for native CoA in children and in adults have been reported [2]. Wheatley et al. report excellent results with angioplasty and stenting of primary coarctation in adults [4]. Despite these promising results in terms of morbidity and mortality, there have been reports of higher recurrence and reintervention rates with the primary angioplasty and stenting of native adult CoA. Stent migration remains a serious concern in the interventional treatment of CoA, which could most successfully be treated with reintervention and the use of second balloon-expandable stents [5, 6]. In our case, this complication could not be treated interventionally with transcatheter therapy. Therefore, we were able to avoid the expected complications from migration of the stent into the aortic arch, such as endothelial injury, thrombosis, and microembolization toward the brain, with the urgent surgical intervention. We were successful in evacuating the foreign body from the aortic arch and surgically treating the native coarctation in the same step by performing extra-anatomical bypass grafting from the ascending aorta to the descending thoracic aorta.

References


EComment: Trans-pericardial extra-anatomic aortic bypass for coarctation of the aorta

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We read with interest the excellent surgical result reported by Nikolov et al. to salvage a failed angioplasty for aortic coarctation [1]. Catheter based primary balloon angioplasty and/or stenting may be an established therapy for native aortic coarctation, however, the durability and long-term fate of such intervention/stents remain uncertain especially in young adult patients.

Angioplasty is associated with a high reintervention rate for recoarctation and additional risks include possible stent migration. Retrograde stent migration into the distal aortic arch may have occurred in this case due to an inadequate proximal landing zone.

Ascending-descending aortic bypass with the posterior pericardial approach via a sternotomy has been shown to be a safe and effective intervention for complex coarctation with excellent intermediate results [2]. Extra-anatomical aortic bypass with a vascular conduit via a median sternotomy is advantageous in avoiding adhesions from a previous thoracotomy (PDA ligation in infancy in this case). Following completion of the distal anastomosis to the descending thoracic aorta, the vascular graft was routed posteriorly behind the heart through the transverse sinus. This ensures the graft is well protected on future sternal re-entry, however, if there is concern the conduit may be compressed or is likely to kink with this orientation, an alternative route worth considering is to bring the graft infero-posteriorly around the inferior vena cava and right atrium before constructing the proximal aortic anastomosis [3].

References