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PII: S2666-2507(22)00545-4
DOI: https://doi.org/10.1016/j.xjtc.2022.10.019
Reference: XJTC 1278

To appear in: JTCVS Techniques

Received Date: 10 October 2022
Revised Date: 25 October 2022
Accepted Date: 25 October 2022

Please cite this article as: Schmiady MO, Savic V, Vogt PR, Carrel T, Two cases of ascending aortic aneurysm following recurrent repair of aortic coarctation with extra-anatomic bypass, JTCVS Techniques (2022), doi: https://doi.org/10.1016/j.xjtc.2022.10.019.

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Two cases of ascending aortic aneurysm following recurrent repair of aortic coarctation with extra-anatomic bypass

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Key words: Coarctation of the aorta, Recoarctation, Late complication, Aortic Aneurysm, Reoperation, Follow-up

Word count: 738

Compliance with ethical standards:
All procedures performed in this cases were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from the two patient included in this work.

Declaration of Conflicting Interests
All authors declared no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

Funding
None of the authors received financial support for research, authorship, and/or publication of this article.

Central message
Life-long follow-up examinations are required in patients who presented with complicated/recurrent coarctation to prevent life-threatening complications.
Central Picture Postoperative Computed tomography angiography (CTA) showing the newly implanted ascending aorta graft connected side-to-end with the extra-anatomic bypass graft.

Abstract
Coarctation of the aorta is a common congenital anomaly. Patient survival following surgery in the childhood has dramatically improved while the number of patients that reach adulthood is steadily increasing. Nevertheless, postoperative complications may occur and require for long-term imaging. We present two cases with ascending aortic aneurysm or pseudo-aneurysm formation following recurrent repair for re-coarctation, both cases with an extra-anatomic bypass.

Introduction
Coarctation of the aorta accounts for 5-10% of all congenital heart defects. Since surgical repair became available, survival of patients has continuously improved but recurrent coarctation remains a common problem. We present two cases of ascending aortic aneurysm following repeated surgical repair using extra-anatomic bypass, because of re-coarctation.

Case Presentation

Case 1
A 64-year-old asymptomatic patient was referred with a progressive aneurysm of the ascending aorta found at routine echocardiography. He had received coarctation repair with end-to-end anastomosis at the age of 7 and a 20mm interposition graft because of recurrent coarctation 12 years later. Because of a restenosis at the level of this graft, an extra-anatomical bypass with a 18mm graft was performed at the age of 44 to improve lower body perfusion. Follow-up echocardiography shows an aneurysm of the ascending aorta that was confirmed by computed tomography angiography (CTA) with a diameter of 56mm (Figure 1A).

Case 2
The second patient was a 54-year-old and received coarctation repair with end-to-end anastomosis in the first year of life. At the age of 22 years, he presented with a combined aortic valve dysfunction, a subaortic membranous stenosis and a recurrent coarctation. Redo-surgery through sternotomy included resection of the membranous subaortic stenosis, the implantation of a mechanical valve and the implantation of an extra-anatomic ascending to supra-celiac bypass 22mm. He complained about chest pains and imaging showed a large ascending aortic aneurysm (65mm) and a pseudo-aneurysm at the level of the proximal anastomosis of the conduit with the ascending aorta (Figure 2A and 2B).

Operative Technique
Operation was performed through a median re-sternotomy using moderate hypothermic (28°C) cardiopulmonary bypass. In case 1, central cannulation, in case 2, peripheral cannulation, was performed. In both cases, the extra-anatomic bypass was cannulated in order to achieve optimal perfusion of the lower body part. At the target temperature, the ascending aorta and the extra-anatomical bypass graft was clamped (once with clamp, once with balloon) (Figure 2C). A single-shot 100ml Cardioplexol® (Swiss Cardio Technologies, Bichsel, Interlaken) cardioplegic solution followed by antegrade blood cardioplegia into the coronary ostia was administered. The aneurysm was excised and the aorta replaced using a 26mm dacron tube.
graft in the first case, respectively a 32mm tubular graft in the second case. The extra-anatomic bypass was reinserted end-to-side directly (Case 1, Figure 1B, 1C and 2D) or following extension to avoid tension into the ascending graft using 4-0 Prolene. Postoperative course was uneventful and both patients were discharged at day 8 and 11 after surgery. Follow up CTA demonstrated regular perfusion through the new graft of the ascending aorta as well as the extra-anatomic bypass (Case 1, Figure 1D). IRB approval was not required, per institute, but informed consent was obtained.

Discussion

Aortic coarctation is a common congenital cardiovascular defect that may be associated with other congenital defects including patent ductus arteriosus, bicuspid aortic valve, ventricular septal defect and mitral valve abnormalities. While the majority of these patients reach adulthood, life expectancy is not as normal as in unaffected peers. Re-coarctation leading to hypertension is the most common indication for aortic reintervention. Mechanisms of re-coarctation include inadequate growth, residual ductal tissue close to the anastomosis as well as narrowing of the anastomotic site, and shrinkage of enlargement patches. Extra-anatomic bypass between the ascending and descending aorta has been described as useful alternative to in-situ multiple repair and allows to avoid re-exploration in a previously operated location. The present cases illustrate a typical complication after extra-anatomic repair of aortic coarctation and emphasizes the importance of cardiovascular follow-up. Multimodality imaging plays an essential role for diagnosis and optimal operative planning in those complex patients. Re-do surgery may be challenging with regard of adhesions, optimal perfusion as well as brain and myocardial protection.

Conclusion

Life-long follow-up examinations are required in patients who presented with complicated/recurrent coarctation to prevent life-threatening aortic complications. Multimodality imaging, is essential for diagnosis and proper surgical planning. Intraoperatively, optimal perfusion of the upper and lower body parts is essential and special attention must be paid to intraoperative neuro-and myocardial protection.

References


**Legends**

**Figure 1.** Preoperative Computed tomography angiography (CTA) showing aneurysmatic formation of the ascending aorta (Fig.A asterisk) and anatomy of the extra-anatomic bypass (Fig.A arrows). Intraoperative picture showing the aortic aneurysm (asterisk) and cannulation for the heart lung machine (Fig.B). Picture of the postoperative situs showing the newly implanted ascending aorta graft connected side-to-end with the extra-anatomic bypass graft (Fig.C). Postoperative CTA reconstruction (Fig.D).

**Figure 2.** Preoperative Computed tomography angiography (CTA) showing a large ascending aortic aneurysm (65mm) and a pseudo-aneurysm at the level of the proximal anastomosis of the conduit with the ascending aorta (Fig.A and B arrows). Intraoperative picture showing Balloon occlusion of the extra-anatomic graft (Fig. C, asterisk). Final result showing the newly implanted ascending aorta graft connected side-to-end with the extra-anatomic bypass graft (Fig.D)