» **Case Report** «

Recurrence of Aneurysm of the Ascending Aorta after Patch Repair: The Fate of an Aortic Patch

Masato Tochii, MD, PhD, Kentaro Amano, MD, Yusuke Sakurai, MD, Hiroshi Ishikawa, MD, Michiko Ishida, MD, PhD, Yoshiro Higuchi, MD, PhD, and Yasushi Takagi, MD, PhD

Pseudoaneurysm of the ascending aorta is a rare but life-threatening complication after aortic cannulation and cardiovascular surgery, and it has the potential to rupture. We experienced a rare case of recurrence of aneurysm of the ascending aorta 7 years after patch repair of a small aneurysm at an aortic cannulation site. The repaired aorta had been wrapped with a Teflon felt strip during the previous surgery, and the wrapped aorta had become thin with deterioration of the normal structure of the aortic wall.

Keywords: aortic aneurysm, pseudoaneurysm, patch repair

Introduction

Pseudoaneurysm of the ascending aorta is a rare but potentially fatal complication after cardiovascular surgery, and it can result in rupture. A small, localized saccular pseudoaneurysm of the aorta is often treated with quick patch repair rather than tube graft replacement. Because of the high incidence of aneurysm recurrence and the high rate of reoperation, tube graft replacement is recommended for saccular aneurysms of the aortic arch.¹⁾ We report a case of reoperation of the ascending aorta 7 years after patch repair for an aneurysm at previous aortic cannulation site, where the previous patch was successfully replaced with a tube graft.

Case Report

A 68-year-old woman had previously undergone two cardiovascular surgeries through median sternotomy in our department. The first surgery was performed for right

ventricular myxoma when the patient was 42 years old under cardiac arrest with ascending aortic cannulation and aortic cross clamping. The second surgery was performed for a 30 mm saccular aneurysm of the ascending aorta at the previous aortic cannulation site when the patient was 61 years old. In the second surgery, the aneurysm was resected and the defect of the ascending aorta was closed with a 20 × 20 mm round polyester patch. The aortic wall was covered with three pieces of Teflon felt strip reinforcement, which was 10 mm width and was placed with 5 mm gap each (Fig. 1). Histopathological examination of the aortic wall showed inflammatory changes of the aneurysm and continuity of the medial elastic fibrous tissue inside the aneurysm. We have already reported²⁾ this rare case in *Surgery Today* in 2007. The patient was closely monitored by our department every 2 months, and computed tomography taken every year revealed recurrence of the ascending aortic aneurysm at the previous site that had been repaired with a polyester patch. The patient had no obvious history of mediastinal infection and no history of chest trauma. The aneurysm of the ascending aorta was 50 mm in diameter and was distorted; therefore, surgical treatment was indicated (Fig. 2).

After induction of general anesthesia, the chest was carefully reopened without major hemorrhage despite strong adhesions. Cardiopulmonary bypass was established with left axillary arterial and left femoral arterial cannulation and venous drainage. The patient was cooled down to 25°C and the aneurysm was incised following systemic circulatory arrest. Antegrade selective cerebral perfusion was established with direct cannulation of the brachiocephalic artery and left common carotid artery. The ascending aorta was replaced with a 24-mm polyester tube graft using an open distal anastomosis. Histopathological examination of the resected aortic aneurysm demonstrated aneurysm of the aorta and thinning of the aortic wall beneath the Teflon felt. The normal structure of the aortic wall was not maintained inside the Teflon felt strip reinforcement, and most of the adventitia and media of the aortic wall had disappeared just beneath the Teflon felt (Fig. 3).

Department of Cardiovascular Surgery, Fujita Health University, Toyoake, Aichi, Japan

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Corresponding author: Masato Tochii, MD, Department of Cardiovascular Surgery, Fujita Health University, 1-98 Dengakugakubo, Kutsukake, Toyoake, Aichi 470-1192, Japan
Tel: +81-562-93-9255, Fax: +81-562-93-7370
E-mail: masato26@fujita-hu.ac.jp

Fig. 1 CT scan taken soon after the previous surgery. The orifice of the aneurysm was closed with a 20 × 20 mm round polyester patch. The aortic wall was covered with three pieces of Teflon felt strip (arrow), which was 10 mm width and was placed with 5 mm gap each.

Discussion

Pseudoaneurysm of the ascending aorta is a rare but life-threatening complication after aortic cannulation and cardiovascular surgery, and it has the potential to rupture. It usually occurs at the previous aortic cannulation site, the needle vent site, the proximal graft anastomosis after coronary artery bypass grafting, the suture line of the aortotomy, or the aortic clamp site.^{3,4)} Predictive factors predisposing to the development of an aortic pseudoaneurysm following cardiovascular surgery include dissection of the native aorta, history of infection, connective tissue disorders, aortic cannulation, and blowout of the aortotomy.⁴⁾ The patient in the present study had no obvious history of infection and no history of a connective tissue disorder or chest trauma.

Some reports have demonstrated the possibility of late aneurysm formation after polyester graft patch repair for aortic coarctation.⁵⁻⁷⁾ Aebert et al. reported that 27 (35.1%) out of 90 patients with aortic coarctation showed significant dilatation at the repaired portion and 15 patients (19.5%) required reoperation for the aneurysm after patch repair.⁵⁾ Ala-Kulju and Heikkinen found

that aneurysm formation occurred in 27% of patients during the first 2–14 years after Dacron patch repair for aortic coarctation.⁶⁾ Okita et al. reported the late outcome of patch repair for a saccular aneurysm of the aortic arch.¹⁾ Among 38 early survivors, recurrence of the aneurysm after patch repair occurred in seven patients (18.4%), with freedom from reoperation of 91.7% ± 8.0% at 5 years and 38.2% ± 28.1% at 9 years. They also recommended because of a high incidence of pseudoaneurysm after patch repair for a saccular aneurysm of the aortic arch, patch repair should be indicated for a saccular small aneurysm with orifice diameter of aneurysm being less than one third of the total circumference of the normal aorta.

One potential cause of aneurysm formation of the aorta after patch repair is that the attached stiff patch may cause a drastic change in the stress on the elastic aortic wall. McGiffin et al. demonstrated that the maximal concentration of aortic wall stress occurred opposite the patch.⁸⁾ The tension of the suture line of the anastomosis is more heterogeneous in polyester patch repair compared with end-to-end tubular graft anastomosis. Suture line pseudoaneurysm may occur frequently after patch repair for the aortic arch, in which the suture line is more oblique in relation to the transverse forces in the aortic lumen compared with an end-to-end tubular graft anastomosis.

External wrapping of the aorta offers excellent results with low mortality and morbidity, and it can be regarded as a safe and effective method for the treatment of ascending aortic aneurysm in selected patients.^{9,10)} However, they also concluded the patients should be carefully monitored for redilatation after the procedure. Although this wrapping method is also used to ensure hemostasis and to reinforce the anastomotic site, previous reports have demonstrated that using non-biodegradable grafts to wrap the aorta leads to aortic wall thinning.^{11,12)} The Teflon felt strip used in this patient's previous surgery was supposed to reinforce the aorta; unfortunately, the aortic wall structure was destroyed inside the Teflon felt maybe due to excessive stress from too small Teflon felt strip. One of the factors of aortic thinning after wrapping is an ischemic change in the media due to compression of the vasa-vasorum. Therefore the wrapping procedure should be done without tight compression. Most of the adventitia and media disappeared and only a part of the vascular wall remained. The most likely causative mechanism for this type of aneurysm is thought to be compliance mismatch between stiff patch and soft native aorta. Furthermore the felt strip width was too small to cover the patch repair site; the aortic wall beneath the Teflon felt was deranged. Too small width and too short length felt caused obstruction of the blood supply from the vasa vasorum of the aortic wall. We recommend tubular graft replacement is better for the saccular

Fig. 2 Pseudoaneurysm of the ascending aorta. The diameter of the aneurysm was 50 mm and it was distorted. (a, b: arrow)

Fig. 3 Three strips of Teflon felt were used to wrap the repaired aorta using a polyester patch (a). The aortic wall wrapped with Teflon felt (arrow) became significantly thin (white arrow head) compared with the unwrapped aortic wall (black arrow head) (b). Histopathological examination revealed thinning of the aortic wall inside the Teflon felt reinforcement (Elastica van Gieson stain).

aneurysm of the aorta and Teflon felt strips be avoided for aortic wall reinforcement because excessive stress may lead to inflammatory changes that destroy the structure of the vascular wall.

Conclusion

Graft replacement of the aorta is recommended for thoracic aortic aneurysms if the orifice of the aneurysm exceeded more than one third of the total circumference of the normal aorta. This is due to the high incidence of pseudoaneurysm after patch repair for saccular aneurysms of the ascending aortic arch. In addition, Teflon felt strips should not be used for aortic wall reinforcement.

Consent

Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Disclosure Statement

The authors declare that they have no competing interests.

Authors' Contributions

All authors critically read, discussed, and approved the final draft of the manuscript.

Study conception: YT

Data collection: KA, YS

Analysis: HI

Investigation: MT, MI, YH

Writing: MT

Critical review and revision: all authors

Final approval of the article: all authors

Accountability for all aspects of the work: all authors

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