

Two-Stage Procedure for Infected Aortic Graft Pseudoaneurysm

10-Year Follow Up after Omental Prosthesis Wrapping

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Abstract

Prosthetic graft infections with mediastinitis following aortic surgery are rare, yet represent grave complications yielding high morbidity and mortality. We present the case of a 57-year-old female patient with past history of emergent surgery for iatrogenic Type A dissection treated by supracoronary ascending aortic replacement. Four months after the initial surgery, a sternal fistula had formed and due to severe bleeding emergent reoperation was required. Imaging and pathology on admission revealed an infected pseudoaneurysm at the distal aortic prosthesis and mediastinitis with methicillin-resistant *Staphylococcus aureus*. Rescue surgery was performed by means of a two-stage approach, with extensive debridement, graft replacement and continuous antiseptic lavage in a first step and an omental wrapping of the new prosthesis in a second stage 24 hours later. During 10 years of follow-up, no recurrent infection occurred. The operative approach and general considerations for management of infected pseudoaneurysms are discussed.

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Key Words

Pseudoaneurysm • Omental wrapping • Graft infection • Aneurysm • Aorta • Carotid artery

Introduction

Prosthetic infection following aortic surgery is a rare but grave complication, which yields an early

mortality as high as 25%–42% [1]. In coexistence with prosthetic pseudoaneurysm, chest entry for reoperation is complicated due to the potential danger of aortic injury [2]. Current treatment of choice for infected prosthetic pseudoaneurysm includes aggressive graft resection with extensive debridement and negative-pressure wound therapy [1, 3]. Utilization of omental wrapping has also been described and can be performed with and without concomitant graft replacement [4, 5]. Surgery for omental prosthesis coverage, however, usually requires the patient to be in stable condition. We herein describe the case of a 57-year-old female patient who underwent successful treatment by means of a two-stage approach with aortic prosthesis replacement, extensive debridement and antiseptic lavage in a first step, followed by an omental flap wrapping of the new graft in a second step 24 hours later. The operative approach and general considerations for arterial cannulation prior to re-sternotomy are discussed.

Case Presentation

A 57-year-old female patient was referred to our clinic from a tertiary care center in poor general condition due to a sudden sternal bleeding.



Four months prior to this incident, the patient underwent emergent surgery due to an iatrogenic Type A dissection after an unsuccessful angioplasty revascularization attempt of a chronically occluded right coronary artery. At the time, supracoronary aortic replacement and a single venous bypass originating from the ascending prosthesis were performed. During this first operation the right subclavian artery was used for arterial cannulation. Postoperatively two re-explorations were mandated: due to significant pericardial effusion on postoperative day 11 and mediastinitis on postoperative day 14. Pathology identified methicillin-resistant *Staphylococcus aureus* (MRSA) as the causative pathogen. After antiseptic irrigation and parenteral antibiotic treatment with vancomycin the patient could be discharged with normal wound condition, no signs of infection and negative pathology for MRSA.

Upon admission the patient was in hypovolemic shock and unconscious. Computed tomography prior to transportation indicated an infected pseudoaneurysm of the ascending aortic graft at the distal anastomosis forming a sternal fistula (Figure 1). After adequate fluid and vasopressor administration on the cardiac intensive care unit the patient regained consciousness just before emergent reoperation. Intubation was not required preoperatively. Relevant heart valve involvement was ruled out by means of transesophageal echocardiography.

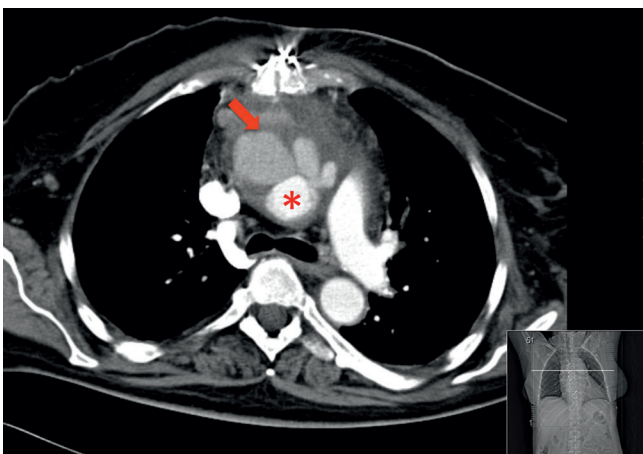


Figure 1. Preoperative computed tomography. (Red asterisk) Ascending aortic prosthesis. (Red arrow) Infected aortic prosthesis pseudoaneurysm with adjacent hematoma.

As safety precaution prior to median re-sternotomy—due to the impending danger of pseudoaneurysm rupture and adjacent adhesions of the right subclavian artery—in addition to the femoral artery the right carotid artery was surgically exposed for direct cannulation.

Cardiopulmonary bypass (CPB) was then established via arterial perfusion through the right carotid and the femoral artery. Venous cannulation was via the right femoral vein. After cooling to an esophageal temperature of 18°C, femoral perfusion was discontinued. During low flow antegrade perfusion via the carotid artery, median re-sternotomy was performed. The sternal bone structure showed good blood supply and no signs of infection. The old hematoma was carefully removed and the pseudoaneurysm at the distal anastomosis of the aortic prosthesis identified. Upon inspection partial detachment of the prosthesis due to suture dehiscence was evident. Owing to mediastinal adhesions, the brachiocephalic vein sustained injury and was repaired using a small pericardial patch. Cold cardioplegia (Bretschneider HTK solution; Köhler Chemie, Alsbach-Hähnlein, Germany) was administered into the left coronary ostium and into the venous bypass graft to the right coronary artery. The right coronary ostium was obliterated.

The infected prosthesis was removed and sent for pathology, isolating MRSA again as the underlying pathogen. After completion of the distal anastomosis and before finishing the proximal anastomosis, the prosthesis was clamped (22 mm Dacron, Hemashield Platinum, Flagstaff, Arizona, USA) and the rewarming process initiated. Circulatory arrest time under hypothermia was 20 minutes. The venous bypass graft was reinserted into the ascending prosthesis. Total CPB time was 194 minutes including 75 minutes of ischemia. After extensive wound debridement and antiseptic surgery site irrigation (Povidon-Iod, Betaisodona, Mundipharma GmbH, Limburg, Germany), drainage tubes for continuous lavage were inserted and the sternum was closed.

Twenty-four hours later, the second look followed. At that time the mediastinal swab taken during the first operation did not show bacterial growth. The sternum was reopened and old hematoma removed. Again, wound debridement was performed. Through an epigastric median laparotomy, the greater omentum was

exposed along the transverse colon and gastric portion. The omentum was then translocated as a pedicle retrosternally into the mediastinum and wrapped around the ascending aortic prosthesis (Figure 2). After placement of drainages the sternum was closed.

The postoperative course was uneventful without neurologic sequelae. The antiseptic lavage was continued for 72 hours postoperatively and changed to clear irrigation solution for additional 48 hours. The drainage tubes were then removed four days later after consecutive negative pathology results. The patient was discharged on postoperative day twelve. Computed tomography 3 days and 3 years postoperatively revealed a patent aortic prosthesis with no signs of recurring infection or aneurysm (Figure 3). At the last routine follow-up 10 years after the first surgery the patient was in good health, suffering only from mild dyspnea due to unrelated comorbidities.

Discussion

Formation of pseudoaneurysm after aortic surgery is a known complication warranting a carefully planned approach for reentering the chest during reoperation in order to circumvent free perforation [2, 6]. Graft infection and mediastinitis—also rare complications following aortic surgery—represent additional challenges for the re-operating surgeon in their own right [1, 3]. In case these conditions

coincide, a coherent surgical approach is mandatory for successful surgery.

Reoperation for an aortic pseudoaneurysm becomes necessary after up to 0.5% of all cardiovascular surgical cases, and the initial approach for re-entering the chest is of major importance [2]. In our case the right carotid artery was used for direct arterial cannulation and antegrade cerebral perfusion. The possibility of being incapable of safely exposing the right subclavian artery due to pronounced adhesions and furthermore not being able to clamp the innominate artery without endangering the pseudoaneurysm located in the near vicinity—and subsequently failing selective cerebral perfusion—led to this decision.

Successful re-sternotomy using comparable pre-emptive techniques for selective cerebral perfusion in patients with large pseudoaneurysms have already been described [2, 7]. Although in some cases—where direct carotid cannulation was used for selective cerebral perfusion—adverse neurologic events were reported, our patient did not suffer from any neurological deficit, neither temporary nor permanent.

Another important comment concerning hypothermic arrest prior to entering the chest is hypothermia induced ventricular fibrillation. Although this complication did not occur in our patient, it may potentially lead to left ventricular distension due to volume overload, causing permanent cardiac damage.

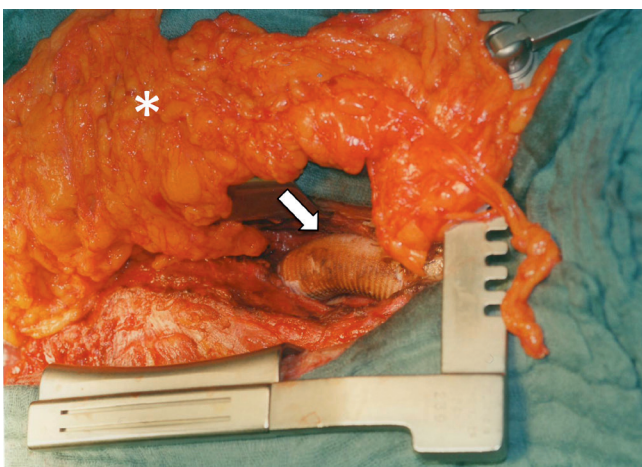


Figure 2. Intraoperative picture during omental wrapping procedure. (White asterisk) The mobilized omentum. (White arrow) Exposed new ascending aortic graft.

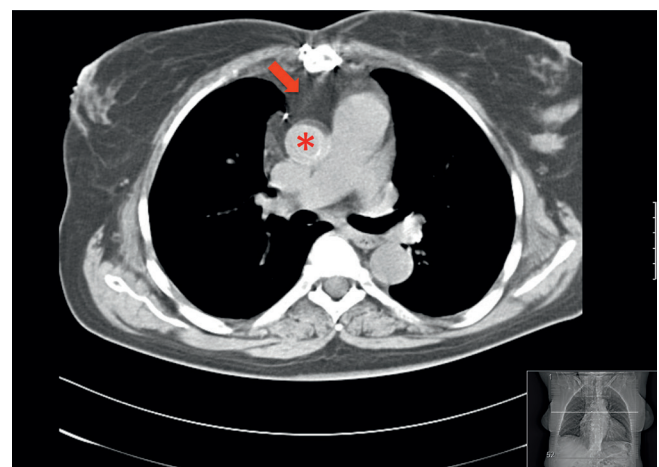


Figure 3. Computed tomography 3 years postoperatively. (Red arrow) The omental wrap. (Red asterisk) The new aortic prosthesis covered by the omentum.

To prevent this, emergency vent placement into the left apex—analogueous to the transapical transcatheter approach for valve implantation—represents a feasible option [8].

Current recommendations for a therapeutic algorithm of vascular graft infections include wound debridement, vacuum assisted closure therapy and subsequent myoplastic reconstruction if necessary [3]. In cases with abscess or pseudoaneurysm, early graft replacement should be performed [1], preferably using biological tissue grafts. It has been shown that graft coverage by means of the greater omentum may function as a feasible alternative to graft removal for patients with graft infection and mediastinitis in stable condition [1, 4, 5]. Owing to the patient's critical condition prior to and during the initial reoperation and resection of the infected prosthesis, we chose to perform the omentum-plasty in a second stage. A variation of our strategy may have been to leave the thorax open after the first stage. Due to the good condition of the sternum we decided in favor

of a primary sternal closure giving more stability and effectively ensuring continuous antiseptic lavage between stages.

The described two-stage procedure for an infected aortic graft pseudoaneurysm is a feasible method for rescue surgery of critically ill patients. Primary carotid artery cannulation for antegrade selective cerebral perfusion during hypothermic circulatory arrest plus extensive prosthetic replacement with situs irrigation, followed by an omentum flap, wrapping the new prosthesis in a second stage, may yield excellent long-term results in highly selected patients.

Conflict of Interest

The authors have no conflict of interest relevant to this publication.

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EDITOR'S QUESTIONS

1. **Do you feel that a laparotomy is necessary for omental harvest? We sometimes do the harvest through the diaphragm at the bottom of the sternotomy incision. Please comment.**

Omentum harvest through the diaphragm is an elegant and less invasive approach feasible in

many patients. However, as depicted in figure 2, the dimension of the patients' omentum was quite big. Such an omentoplasty would have been very difficult or impossible to perform without a laparotomy. The surgeon in charge of that operation (Battellini RR) has been 10 years an abdominal surgeon before coming

into cardiac surgery and deemed the presented approach appropriate in this case.

2. Please comment on what role homograft and tubed pericardium may play in such cases.

Replacement of infected prostheses using aortic homografts are regularly used in these cases at our institution and could have given a complete solution without the need for a second stage omentoplasty. The first emergency operation, however, was done at

3 am in the morning. At this time a homograft suitable in size for the patient was not available.

3. Do you think one day was enough time to assure sterility before the definitive omental wrapping?

The mediastinal swab from the first operation was still sterile 24 hours later. Since the patient was in stable condition a second look with a new wound debridement, situs irrigation and omentoplasty seemed logical.