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Surgical Considerations for Treatment of Fungal Homograft Endocarditis in Re-re-re-re-do

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Abstract

Fungal endocarditis is associated with high surgical mortality rates. Advanced expertise is required for surgical treatment of this serious condition. In the present report, we describe the homograft replacement in a beating heart during re-re-re-re-do in a 29-year-old female patient with fungal endocarditis. The previous operations included Fallot correction at the age of 1 year, Contegra graft implantation in the right ventricular outflow tract (RVOT) due to severe pulmonary insufficiency, homograft implantation in pulmonary position due to Contegra endocarditis, and on-pump pericardial defect closure after homograft injury during sternal rewiring following wound infection.

Keywords
- fungal endocarditis
- congenital heart surgery
- redo
- homograft

Introduction

Treatment of fungal endocarditis usually includes antimycotic drug therapy and emergency surgery.[1] Herein we report the treatment of fungal pulmonary homograft endocarditis in a 29-year-old female patient, who initially underwent Fallot correction and three consecutive cardiac operations. The patient provided written informed consent for publication of this case report. Approval from the local ethics committee was obtained.

Case Description

The patient was admitted to our department with fever up to 39°C, emesis, and intermittent coughing. Four cardiac operations as well as multiple catheter interventions had been conducted in external hospitals. These included Fallot correction, repeated catheter dilation of the right ventricular outflow tract (RVOT), Contegra graft implantation in the RVOT due to severe pulmonary insufficiency, homograft implantation in pulmonary position due to Contegra endocarditis (*Staphylococcus aureus*), sternal wound infection due to candida, and Vacuum-assisted closure (VAC) therapy as well as homograft injury during sternal rewiring with on-pump pericardial defect closure. Preoperative transesophageal echocardiography showed a hypodense structure close to the bifurcation of the pulmonary artery (transverse diameter of ~14 mm), consistent with a thrombus or vegetation (►**Fig. 1A**) causing obstruction ($V_{max} > 4$ m/s). Positron emission tomography/computed tomography (PET-CT) showed pathological tracer uptake in the homograft region (►**Fig. 1B**).

Urgent operation was scheduled due to severe pulmonary obstruction and possible septic embolization. Arterial cannulation was established via the right subclavian artery as well as the left femoral artery. Both arteries showed a small lumen and use of one alone would not have provided an

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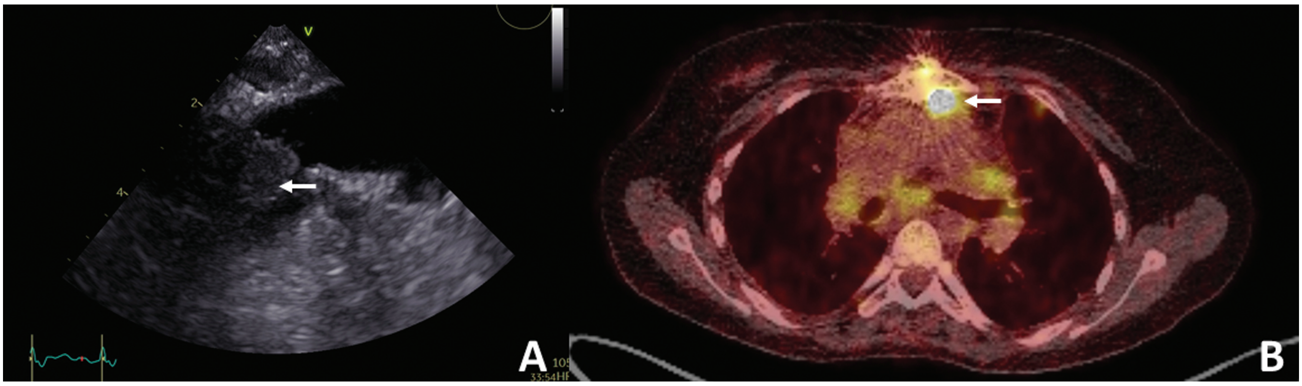

Fig. 1 (A) Transesophageal echocardiography showing a hypodense structure near the bifurcation of the pulmonary artery with a transversal diameter of approximately 14 mm, consistent with a thrombus or a vegetation (*arrow*). **(B)** Fluorodeoxyglucose positron emission tomography/computed tomography (FDG-PET-CT) showing high activity in the right ventricular outflow tract (RVOT) adherent to the sternum (*arrow*).

adequate bypass flow. For the same reason, both arteries were not suitable for direct cannulation. Therefore, two 7-mm silver-coated prostheses were required for arterial connection. Percutaneous venous cannulation was achieved via the left femoral vein and the right jugular vein. The latter was necessary due to a total thrombosis of the superior vena cava and the impossibility of the superior drainage through the femoral cannulation alone. Cardiopulmonary bypass (CPB) connection is depicted in ►**Fig. 2**. After cooling down to 30°C and re-entry, a 6 × 7 cm inflammatory mass adherent to the sternal manubrium was revealed. An abscess cavity opened and unveiled homograft necrosis. The front wall of the prosthesis was destroyed by infection. A 1.3 × 3 cm thrombus totally occluded the homograft valve. This septic thrombus extended into the right pulmonary artery. Homograft and thrombus were carefully removed and local thrombectomy of the right pulmonary artery, using a sucker, was performed. Explanted tissue is depicted in ►**Fig. 3A**. After surgical debridement, the field was irrigated with KerraSol (Crawford Healthcare GmbH, Valley, Germany). Then, a 25-mm Medtronic plc. Freestyle root bioprosthesis (Medtronic plc., Dublin, Ireland) was implanted into the RVOT (►**Fig. 3B**). Ventral anastomosis was established using a bovine pericardial patch. The whole operation was carried out on beating heart. Histology of the explanted homograft showed an active as well as chronic granulating inflammation with extensive mycotic colonization (►**Fig. 3C**). Microbiologic analysis revealed *Candida albicans* in the explanted tissue.

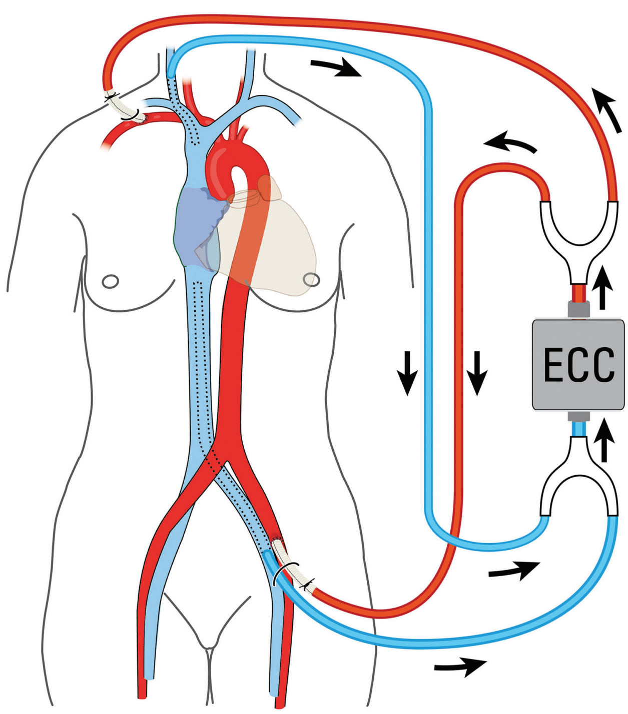

Fig. 2 Schematic drawing of cardiopulmonary bypass connection. ECC, extracorporeal circulation.

Perioperative antifungal medication consisted of caspofungin and was later switched to fluconazole.

The postoperative course was complicated by the onset acute of kidney injury requiring continuous renal replacement therapy, and respiratory insufficiency needing tracheotomy. On postoperative day 46, the patient was discharged. Three months after operation, the patient had to be readmitted because of out-of-hospital cardiac arrest. On admission, electrolyte imbalance (potassium 2.5 mmol/L) was diagnosed. Subarachnoid bleeding and progressive multiorgan failure led to exitus of patient. During the short hospital stay, no signs of infection relapse in echocardiography could be recorded.

Discussion

Even after successful treatment, recurrence of fungal endocarditis occurs in up to 30% of cases.[2] Current guidelines recommend a combination of surgery and drug treatment in fungal endocarditis.[3] In this setting, some surgical aspects deserved more attention. For a safe and reliable perfusion during a fifth operation, CPB was established before sternal re-entry. Due to the small femoral artery, additional subclavian access was necessary. Because of the small caliber, graft prostheses were anastomosed. Due to the thrombosis of the superior vena cava, an additional venous drainage through the jugular vein was necessary (►**Fig. 3**). Beating heart approach was necessary, as massive adherences made the preparation of the aorta for cross-clamping highly

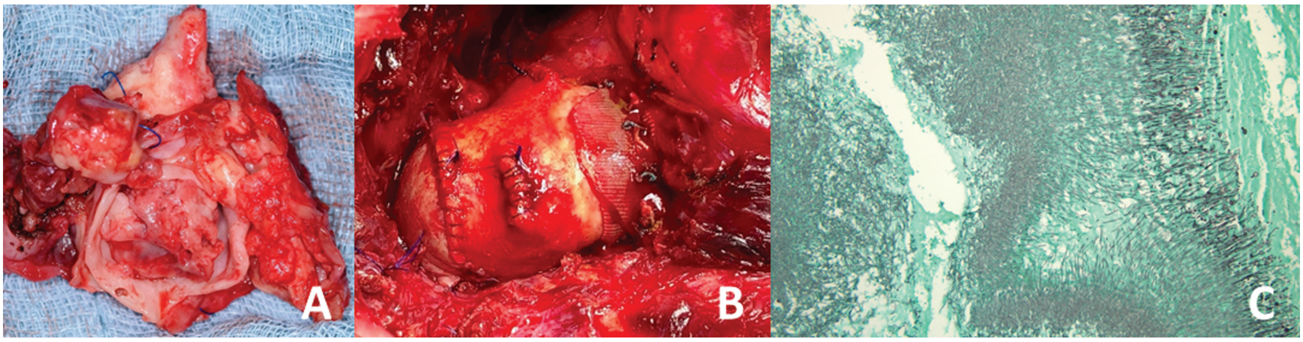

Fig. 3 (A) Explanted homograft and septic thrombus. (B) Reconstructed right ventricular outflow tract (surgeons' perspective). (C) Mycotic colonization inside the explanted tissue (Grocott's staining Obj. ×10).

Table 1 Flowchart showing a checklist of seven planning steps before (and after) a complex cardiac redo surgery

S. No.	Planning step	Workup items for surgical decision-making
1.	Detailed patient history	Indication, temporal planning of surgery
2.	Information from previous surgeries (reports)	Adhesion prophylaxis in place? Which tissue/grafts/patches were used?
3.	Preoperative imaging	Catheterization (depending on patient age), coronary artery imaging, pre-op echocardiography, (PET) CT/MRI, 3D visualization (printing or software)
4.	Interdisciplinary workup and coordination	Cardiac surgeon, perfusionist, anesthesiologist, vascular surgeon, cardiologist: indication, treatment modalities, and perioperative management (e.g., anticoagulation, anti-infective therapy, preexisting diseases, and imaging)
5.	Technical planning	Spatial relation of cardiac and adjacent compartments (aorta, sternum, lung, atria, ventricles, innominate vein, etc.), cannulation strategy, cardiopulmonary bypass before sternotomy, possibility of beating heart approach (intracavitary shunts), modality of aortic clamping, and necessity of concomitant surgery
6.	Careful, detailed, and realistic preoperative discussion	Patient-centered approach and informed consent
7.	Follow-up	Short- and long-term follow-up after surgery

Abbreviations: CT, computed tomography; MRI, magnetic resonance imaging; PET, positron emission tomography; 3D, three-dimensional.

demanding and time-consuming. Medtronic Freestyle prosthesis was chosen due to promising results when implanted into the RVOT as part of a congenital heart surgery.[4] The origins of the coronary arteries were sutured and positioned ventrally to avoid graft kinking. For the same reason, an additional bovine patch was interposed between the upper margin of the prosthesis and the pulmonary bifurcation.

Conclusion

This case shows that a successful treatment of fungal homograft endocarditis during the fourth redo surgery demands a carefully considered surgical concept. ►**Table 1** shows a checklist that can be helpful for planning before a difficult redo surgery. All technical considerations described in this specific case enhanced the feasibility of this highly demanding operation.

Conflict of Interest
None declared.

Acknowledgments
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