

Cardiac Transplantation Complicated by Acute Thrombotic Occlusion of the Right Coronary Artery

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ABSTRACT

We report the case of a 63-year-old male patient undergoing cardiac transplantation due to fourth time aortic valve endocarditis. The postoperative course was complicated by thrombotic occlusion of the right coronary artery (RCA) causing acute right ventricular myocardial infarction, which required extracorporeal membrane oxygenation. The RCA could be reopened by catheter-based intervention and the patient stabilized. In order to avoid further immobilization, a right ventricular assist device was implanted and an aortocoronary bypass to the RCA was performed. After that, the patient stabilized progressively, could be weaned from the assist device, and was discharged home 6 weeks after transplantation. On coronary angiography, which is routinely performed 4 to 6 weeks after transplantation, a fistula from the RCA to the right ventricle was detected which was treated conservatively. Five months after transplantation, the patient is in good clinical condition without signs of recurrent endocarditis. This case shows that intense interdisciplinary cooperation of cardiac specialists allows the successful management of very complex patients in serious clinical conditions.

CASE REPORT

A 63-year-old male patient was referred to our institution. He had undergone aortic valve replacement because of rheumatic degeneration in 1990. In 1994, repeated aortic valve replacement became necessary due to endocarditis of the aortic valve prosthesis. In 2003, he again suffered from endocarditis of the aortic valve prosthesis and thus underwent another aortic valve replacement. Since the ascending aorta appeared aneurysmatically dilated, this was performed as an aortic root replacement with a mechanical valve bearing

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aortic conduit. The highly destructed aortic and mitral annuli were reconstructed by autologous pericardium.

Despite extensive antibiotic treatment, the patient presented with endocarditis again in September 2004. Echocardiographically, large vegetations on the aortic prosthesis were demonstrated, as well as a large paravalvular abscess, fistulating into the left atrium, and a perforation of the anterior mitral leaflet. Due to the extensive destruction of the cardiac skeleton, another conventional operation could not be considered, but the only alternative was seen in cardiac transplantation. The patient was thus listed for transplantation on a highly urgent status.

Four days after listing, the organ of a 21-year-old female patient after brain death following polytrauma including thorax trauma and sternal fracture was available. Echocardiographically, the heart showed a good ventricular function, without wall motion abnormalities. Coronary angiography was not performed due to the young age of the donor. Orthotopic bicaval cardiac transplantation was performed in the modified technique by Lower and Shumway [Antretter 2001, Shumway 1966].

Despite being the fourth cardiac operation, the implantation of the donor heart was surgically uncomplicated. During reperfusion, however, ECG-changes became obvious, the right ventricle as well as the posterior wall of the left ventricle showed impaired function. After further reperfusion, left ventricular function recovered and extracorporeal perfusion could be terminated. The patient was transferred to intensive care unit with high-dose catecholamine therapy. During the first postoperative day, the hemodynamical state progressively deteriorated and ST-elevations became present again. After emergent instillation of an extracorporeal membrane oxygenation system, coronary angiography was performed. It showed complete occlusion of the RCA (Figure 1), morphologically appearing caused by a thrombus. It was possible to reopen the vessel interventionaly and implant a Carbestent™ (Sorin Biomedica, Saluggia, Italy). After that, the patient stabilized progressively.

In order to minimize the risk of further immobilization, a right ventricular assist device (Thoratec®; Thoratec Laboratories Corp., Pleasanton, CA, USA) was implanted on postoperative day 3. Since massive substitution of platelets and coagulation factors was necessary at that time, bypass grafting of the RCA was performed simultaneously in order to mini-

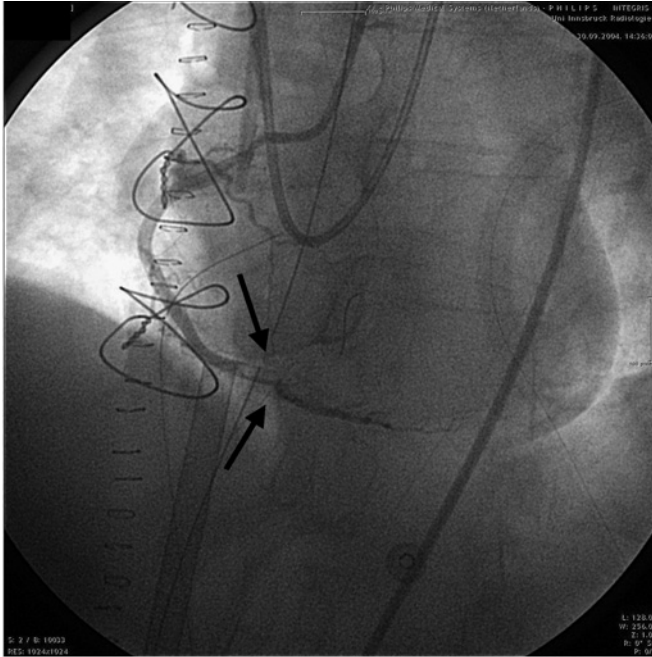


Figure 1. Coronary angiogram of the right coronary artery, completely occluded by an intraluminal thrombus (→).



Figure 2. Coronary angiogram of the right coronary artery fistulating into the right ventricle (→).

mize the risk of acute stent thrombosis. After that, the patient could be further stabilized, weaned from catecholamines and finally be extubated on postoperative day 1 after RVAD-implantation and coronary artery bypass grafting. Mobilization was possible on the 3rd postoperative day. Finally, the RVAD could be explanted on postoperative day 11.

The further postoperative course was uneventful, and the patient was discharged from hospital 30 days after RVAD-explantation. In control echocardiography, a good left and right ventricular function could be shown with a small area of inferior-septal akinesia. Furthermore, a small ventricular septal defect was detected. Six weeks after transplantation, control coronary angiography revealed a fistula from the posterolateral branch of the RCA into the right ventricle, an open saphenous vein graft to the RCA, and a normal left coronary artery (Figure 2). The patient is now, 5 months after cardiac transplantation, in good clinical condition (NYHA I-II) without signs of recurrence of endocarditis. Repeated endomyocardial biopsies were performed during follow-up revealing no episodes of rejection.

DISCUSSION

This case report reviews the—finally successful—course of a patient undergoing cardiac transplantation, which in our opinion is of special interest due to a variety of causes. First of all, endocarditis is a very rare indication for transplantation. Secondly, the transplantation was complicated by perioperative myocardial infarction due to thrombus formation in the RCA, requiring ECMO, RVAD, coronary stenting, and aortocoronary bypass grafting and finally, the patient presents a coronary fistula from the RCA to the right ventricle.

Cardiac transplantation is the treatment of choice for patients with end-stage heart failure. The major indications for cardiac transplantation are ischemic and dilative cardiomyopathy (45.6% each), valvular cardiomyopathy (3.4%), and congenital heart disease (1.6%) [Hosenpud 1999]. Since bacterial endocarditis is usually accompanied by systemic bacteremia, it is frequently seen as a contraindication to transplantation [Steinman 2001]. Reports on endocarditis as indication for cardiac transplantation are rare [Blanche 1994, DiSesa 1990, Galbraith 1999, Park 1993]. The cases reported so far describe a good clinical outcome of the patients undergoing transplantation for endocarditis and also in our case, the patient is free from endocarditis for 5 months after surgery by now.

The initial postoperative course of the patient reviewed in this case was complicated by acute graft failure caused by an intracoronary thrombus. Thrombotic occlusion of the coronary arteries is a common phenomenon during the long-term course after cardiac transplantation, which is suspected to be related to chronic allograft rejection and may account for the occurrence of sudden cardiac death after transplantation [Chantranuwat 1999]. Immediately post- or even intraoperatively, thrombotic occlusion of a coronary artery is very rarely encountered. In literature, 2 cases could be found describing early thrombus of the coronaries, both of which were fatal [Miralles 1996, Pittaluga 1997]. Miralles et al describe the case of myocardial tissue embolization into the RCA, whereas Pittaluga describes thrombus formation due to an LAD muscle bridge. In both cases, diagnosis was made by autopsy. Our case is the first to present a patient surviving initial graft failure by RCA thrombus. The origin of the thrombus is unclear in our patient. Since the organ donor has suffered from

severe thoracic trauma including sternal fracture, a relationship to the trauma seems likely.

After recovery of the patient, a routine coronary angiography was performed, showing a fistula from the RCA to the right ventricle. Coronary fistulas are not uncommon after cardiac transplantation and are usually associated with previous endomyocardial biopsies [Chohan 1998, Drobinski 2002, Gasser 2000, Lazar 1996]. In our patient, the fistula was discovered when the patient had undergone three endomyocardial biopsies. After careful reexamination of the first angiography, when the stent was placed, the fistula was already present at that point of time. This excludes endomyocardial biopsies from causing the fistula. The fistula might thus either be congenital, related to the thorax trauma of the organ donor, or related to the coronary intervention. Fistulae related to coronary interventions as well as those related to trauma are very rare, and reports in the literature are sparse [Bata 1993, Friesen 2000]. A congenital origin of the fistula seems therefore much more likely, incidences reported in the literature range from .1% to 2% of fistulae detected by coronary angiography [Gillebert 1986, Nawa 1996, Vavuranakis 1995]. In the majority of cases, the fistulae of either congenital or iatrogenic origin are small and without hemodynamic significance. Larger fistulae might be occluded interventionaly with good success and acceptable risk [Balanesescu 2001, Eccleshall 1997, Hartog 1993]. Regarding the complicated postoperative course of our patient and the good prognosis of coronary fistulae, a closure of the fistula has not been performed by now. In case of persistence or even enlargement of the fistula on one-year routine coronary angiography, an interventional closure of the coronary fistula will be performed.

In conclusion, this report reviews the unique case of a patient with a rare indication for transplantation, a severely complicated postoperative course due to a rare complication of thrombotic coronary occlusion, and finally presenting with a rare postoperative state due to the coronary fistula. We are convinced that this case could only be managed successfully because of the intense collaboration between cardiac surgeons, cardiac anesthesiologists, and interventional cardiologists.

REFERENCES

- Antretter H, Laufer G. 2001. Surgical techniques for cardiac transplantation. *Eur Surg ACA* 33:17-24.
- Balanesescu S, Sangiorgi G, Castelvechio S, Medda M, Inglese L. 2001. Coronary artery fistulas: clinical consequences and methods of closure. A literature review. *Ital Heart J* 2(9):669-76.
- Bata IR, MacDonald RG, O'Neill BJ. 1993. Coronary artery fistula as a complication of percutaneous transluminal coronary angioplasty. *Can J Cardiol* 9(4):331-5.
- Blanche C, Freimark D, Valenza M, Czer LS, Trento A. 1994. Heart transplantation for Q fever endocarditis. *Ann Thorac Surg* 58(6):1768-9.
- Chantranuwat C, Blakey JD, Kobashigawa JA, et al. 1999. Sudden, unexpected death in cardiac transplant recipients: an autopsy study. *J Heart Lung Transplant* 23(6):683-9.
- Chohan AJ, Kugelmass AD, Kida M, Pennington LR, Sivaram CA. 1998. Coronary artery fistula after cardiac transplantation. *Can J Cardiol* 14(3):463-5.
- DiSesa VJ, Sloss LJ, Cohn LH. 1990. Heart transplantation for intractable prosthetic valve endocarditis. *J Heart Transplant* 9(2):142-3.
- Drobinski G, Dorent R, Ghossoub JJ, et al. 2002. Myocardial infarction after endomyocardial biopsy in a heart transplant patient. *J Interv Cardiol* 15(5):403-5.
- Eccleshall SC, Pitt M, Townend JN. 1997. Transcatheter embolisation of an enlarging acquired coronary arteriovenous fistula in a heart transplant recipient. *Heart* 78(2):203-5.
- Friesen CH, Howlett JG, Ross DB. 2000. Traumatic coronary artery fistula management. *Ann Thorac Surg* 69(6):1973-82.
- Galbraith AJ, McCarthy J, Tesar PJ, McGiffin DC. 1999. Cardiac transplantation for prosthetic valve endocarditis in a previously transplanted heart. *J Heart Lung Transplant* 18(8):805-6.
- Gasser R, Koppel H, Luha O, et al. 2000. Segmental degradation of left ventricular wall motion after persistent coronary fistula in a posttransplantation patient: a case report and short review of literature. *Transplantation* 69(10):2108-11.
- Gillebert C, Van Hoof R, Van de Werf F, Piessens J, De Geest H. 1986. Coronary artery fistulas in an adult population. *Eur Heart J* 7(5):437-43.
- Hartog JM, van den Brand M, Pieterman H, di Mario C. 1993. Closure of a coronary cameral fistula following endomyocardial biopsies in a cardiac transplant patient with a detachable balloon. *Cathet Cardiovasc Diagn* 30(2):156-9.
- Hosenpud JD, Bennett LE, Keck BM, et al for the Society for Heart and Lung Transplantation. 1999. *J Heart Lung Transplant* 18:611.
- Lazar JM, Uretsky BF. 1996. Coronary artery fistula after heart transplantation: a disappearing entity? *Cathet Cardiovasc Diagn* 37(1):10-3.
- Miralles A, Serrano T, Calbet JM, Castells E. 1996. Early graft failure after heart transplantation due to coronary artery embolization with myocardial tissue. *Eur J Cardiothorac Surg* 10(10):916-8.
- Nawa S, Miyachi Y, Shiba T, et al. 1996. Clinical and angiographic analysis of congenital coronary artery fistulae in adulthood. Is there any new trend? *Jpn Heart J* 37(1):95-104.
- Park SJ, Sullivan HJ, Lonchyna V, Hinkamp TJ, Pifarre R. 1993. Heart transplantation for complicated and recurrent early prosthetic valve endocarditis. *J Heart Lung Transplant* 12(5):802-3.
- Pittaluga J, de Marchena E, Posada JD, Romanelli R, Morales A. 1997. Left anterior descending coronary artery bridge. A cause of early death after cardiac transplantation. *Chest* 111(2):511-3.
- Shumway NE, Lower RR, Stofer RC. 1966. Transplantation of the heart. *Adv Surg* 2:265-84.
- Steinman TI, Becker BN, Frost AE, et al. 2001. Guidelines for the referral and management of patients eligible for solid organ transplantation. *Transplantation* 71:1189.
- Vavuranakis M, Bush CA, Boudoulas H. 1995. Coronary artery fistulas in adults: incidence, angiographic characteristics, natural history. *Cathet Cardiovasc Diagn* 35(2):116-20.