The Heart Surgery Forum #2011-1157
15 (3), 2012 [Epub June 2012]
doi: 10.1532/HSF98.20111157

Online address: http://cardenjennings.metapress.com

Rescue Transcatheter Aortic Valve Implantation and Simultaneous Percutaneous Coronary Intervention on Cardiopulmonary Bypass in a Patient with an Extreme Risk Profile

Miralem Pasic, MD, PhD, Stephan Dreysse, MD, Evgenij Potapov, MD, PhD, Axel Unbehaun, MD, Semih Buz, MD, Thorsten Drews, MD, Giuseppe D'Ancona, MD, PhD, Katrin Schäfer, Marian Kukucka, MD, Alexander Mladenow, MD, Roland Hetzer, MD, PhD

Deutsches Herzzentrum Berlin, Berlin, Germany

ABSTRACT

We report on successful emergency transcatheter aortic valve implantation combined with percutaneous coronary revascularization in a polymorbid and preterminal patient in profound cardiogenic shock and with multiorgan failure. The risk scores were almost unbelievably high (Society of Thoracic Surgeons mortality score, 83.9%; Society of Thoracic Surgeons morbidity and mortality score, 96.8%; logistic EuroSCORE, 96.7%). Two and a half years after the procedure, the patient is doing very well.

INTRODUCTION

Transcatheter aortic valve implantation (TAVI), although introduced as a treatment option for high-risk patients with severe aortic valve stenosis, has been considered contraindicated for patients at very high risk [Leon 2010]. We report successful TAVI treatment in such a patient in an extreme situation. The mortality and morbidity risk scores were almost unbelievably high.

CASE REPORT

A 71-year-old male patient with multiple morbidities was transferred from abroad by ambulance airplane to our institution on December 12, 2008. Approximately 2 years before, he had experienced a myocardial infarction, and his condition had worsened steadily. During the 3 months before admission, he experienced persistent dyspnea at rest, occasional chest pressure with pain, and leg edema. He became immobile and was mostly bedridden. A coronary angiography examination performed 1 year before admission demonstrated diffuse triple-vessel coronary artery disease. An echocardiographic examination revealed a depressed left ventricular function, severe aortic valve stenosis with severe mitral valve insufficiency, and mild mitral valve stenosis. The patient's history included peripheral arterial disease, chronic venous insufficiency after deep venous thrombosis in 1988, bilateral pulmonary artery thromboembolism in 2003, chronic atrial fibrillation, arterial hypertension, severe chronic obstructive pulmonary disease, cerebrovascular accident, a myocardial infarction in 2006, diabetes mellitus type II, chronic renal failure, chronic esophagitis and chronic gastroduodenitis after previous gastric ulcus, a cholecystectomy in 1986, definitive artificial anus after rectal resection due to carcinoma of the rectum in 1992, and rheumatic fever in childhood. In the hospital abroad, the patient had been assessed several times for conventional aortic valve replacement and had been repeatedly refused for surgery because of a very high risk profile, including terminal valvular heart failure. It was decided to perform solely conservative treatment. Therefore, the patient was sent to our institution for reevaluation of his surgical options.

On admission, the patient had dyspnea of New York Heart Association class IV, unstable angina with a blood pressure of 78/51 mm Hg, chronic low cardiac output with acrocyanosis, impaired liver function, renal failure (serum creatinine, 3.3 mg/dL; blood urea nitrogen, 190 mg/dL) with oligouria, and anasarca with ascites, pleural effusions, and severe leg edema. An intra-aortic balloon pump (IABP) was implanted, and pharmacologic therapy was supported via continuous intravenous administration of nitroglycerin and catecholamines. Noninvasive ventilation and continuous venovenous hemodiafiltration were started. A transthoracic echocardiography examination revealed aortic valve stenosis with an aortic valve area of 0.5 cm2, a maximal transvalvular gradient (P) of 41 mm Hg, and grade I aortic regurgitation; a calcified mitral valve with a valve area of 2.7 cm2, a P of 4.7 mm Hg, and mitral valve insufficiency of grade II to III; and grade I tricuspid valve regurgitation. The left ventricular function was poor, with global hypokinesia and akinesia of the septum and the anterior left ventricular wall after the previous anterior myocardial infarction. The left ventricular ejection fraction (LVEF) was 10%, and the right ventricle was dilated with an ejection fraction (RVEF) of 30%. The patient had pulmonary hypertension with a pulmonary arterial pressure of 70/38/50 mm Hg and a wedge pressure of 22 mm Hg. Initially, the patient experienced clinical stabilization with the conservative therapy, which was also observed in the chest radiographs. On the fourth day after admission, however, the

Received October 21, 2011; accepted February 21, 2012.

Correspondence: Professor Miralem Pasic, Deutsches Herzzentrum Berlin, Augustenburger Platz 1, D-13353 Berlin, Germany; 49-30-4593-2108; fax: 49-30- 4593-2018 (e-mail: pasic@dbzb.de)

patient's hemodynamic situation worsened progressively, and increasing doses of epinephrine became necessary. The cardiac index slowly decreased. The patient became cyanotic and disoriented, and his condition was regarded as having reached the preterminal phase. Finally, the cardiac index was between 0.9 and 1.1 L/min per m2, and a blood gas analysis revealed a base excess of –22 mmol/L and a blood pH of 6.9. We were faced with the dilemma of either leaving the patient to die or performing TAVI as the ultima ratio. The risk scores calculated were almost unbelievable: the Society of Thoracic Surgeons (STS) mortality score was 83.9%, the STS morbidity and mortality score was 96.8%, and the logistic EuroSCORE was 96.7%. We could not believe these values and assessed the scores several times, but the results were always the same.

We decided to act. The patient was immediately transferred to our hybrid operating room. Emergency femorofemoral normothermic cardiopulmonary bypass (CPB) was instituted to stabilize the hemodynamic situation [Pasic 2010c]. We then performed a transapical TAVI procedure [Pasic 2010b] with an Edwards Sapien 26-mm valve (Edwards Lifesciences, Irvine, CA, USA) on the beating heart while the heart was completely unloaded (Figure 1). Rapid pacing was not applied so as to prevent possible ventricular fibrillation. Next, we carried out a selective coronary angiography evaluation, which showed multiple high-grade lesions in the dominant right coronary artery. The lesions were treated with stent implantation in the mid and distal parts of the right coronary artery (Figure 2). The unloaded heart was additionally reperfused on CPB for myocardial recovery while the IABP was restarted. The patient was weaned slowly and gradually from CPB with epinephrine (0.35 µg/kg body weight per minute) and nitroglycerin support without any problems. The total CPB time was 81 minutes.

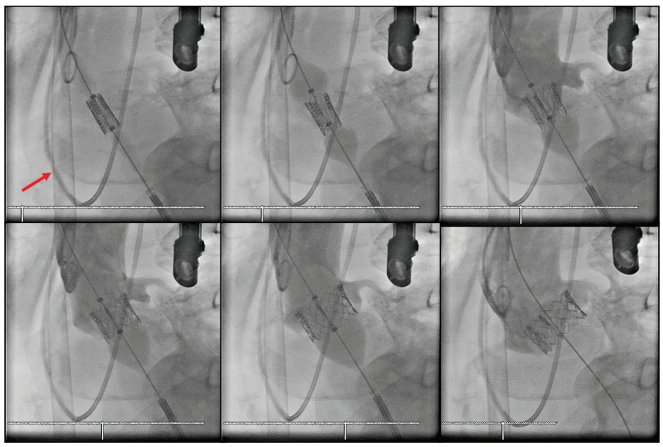

Figure 1. Transapical aortic valve implantation with the Edwards Sapien 26-mm valve (Edwards Lifesciences, Irvine, CA, USA) was performed with normothermic femorofemoral cardiopulmonary bypass (CPB) on the beating heart while the heart was completely unloaded. Rapid pacing was not applied in order to prevent possible ventricular fibrillation. Arrow indicates venous cannula for CPB placed in the right atrium and caval veins.

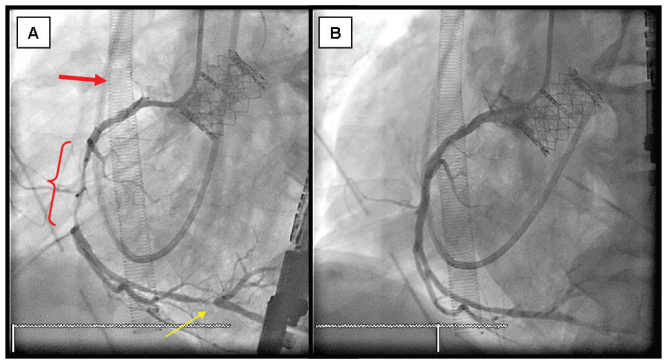

Figure 2. A, Image of selective coronary angiography performed after valve implantation showing multiple high-grade lesions in the dominant right coronary artery (yellow arrow and bracket). Red arrow indicates venous cannula for cardiopulmonary bypass placed in the right atrium and caval veins. B, Image of selective coronary angiography evaluation performed after stent implantation in the mid and distal parts of the right coronary artery, demonstrating good results.

The postoperative hemodynamic situation was stable under slow catecholamine reduction. The IABP was weaned and explanted on the eighth postoperative day. The patient developed pneumonia, and a tracheostomy was performed for slower and controllable weaning from the ventilator. The patient was transferred from the intensive care unit to the normal ward on the 22nd postoperative day. At discharge, on the 31st postoperative day, echocardiographic examinations showed a LVEF of 40% to 45%, a RVEF of 60%, an absence of mitral insufficiency, and an excellent valve function with a Pmean of 10 mm Hg (Pmax, 16 mm Hg). After rehabilitation, the patient recovered excellently. At the recent clinical examination at our institution, 26 months after the TAVI procedure, the clinical and echocardiographic examinations (Figure 3) confirmed the previous results.

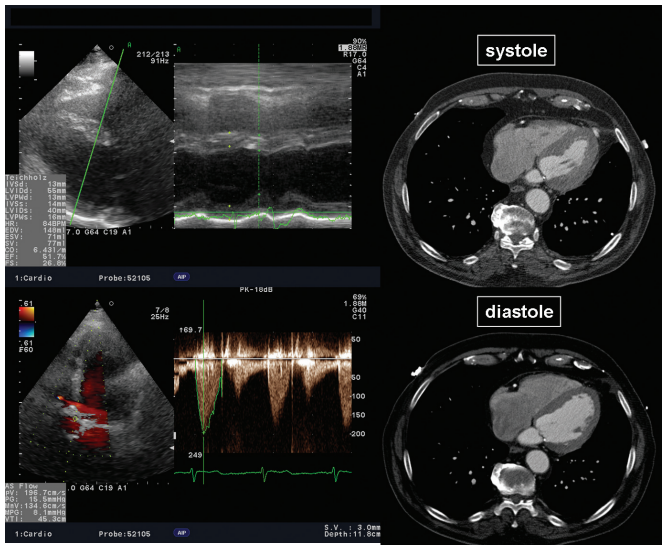

Figure 3. Computed tomography and transthoracic echocardiography examinations performed 26 months after surgery. The results demonstrated good myocardial recovery and low pressure gradients across the prosthesis.

DISCUSSION

This report shows that patients with terminal heart failure should never be considered too sick for a causal therapy. Modern procedures, such as the combination of TAVI and percutaneous coronary intervention, enable successful treatment, even in a dying patient like the one described in this report. In our experience, the majority of high-risk patients with aortic valve stenosis can undergo their operations conventionally with the same operative results as with TAVI; however, we believe that the patient we have described would not have survived conventional aortic valve replacement in the presence of profound shock and an extreme situation. He was our 60th TAVI patient, and at that time we had only limited experience in this field. Nowadays, after having performed >500 TAVI procedures, we would not hesitate to perform a TAVI in such a patient (unlike with the reported patient). The PARTNER Trial [Leon 2010] clearly demonstrated that conservative therapy including balloon dilatation of the native stenotic valve is an option inferior to TAVI. Our impression is that the most important advantage of TAVI is rapid postoperative recovery with a usually shorter stay on the intensive care unit. Therefore, we consider TAVI the truly appropriate option for high-risk patients [Pasic 2010a, 2010b, 2010c]. The decision for TAVI treatment should be made on an individual basis after precise evaluation. When a similar patient is proposed as a very high–risk surgical candidate for aortic valve replacement, he or she should be referred for TAVI more promptly.

ACKNOWLEDGMENTS

Prof. Pasic and Drs. Unbehaun, Drews, Buz, and Dreysse have been proctors to Edwards Lifesciences since July 2009. We thank Anne Gale for editorial assistance and Rosemarie Gunther for secretarial help.

REFERENCES

Leon MB, Smith CR, Mack M, et al, for the PARTNER Trial Investigators. 2010. Transcatheter aortic-valve implantation for aortic stenosis in patients who cannot undergo surgery. N Engl J Med 363:1597-7.

Pasic M, Buz S, Dreysse S, et al. 2010. Transapical aortic valve implantation in 194 patients: problems, complications, and solutions. Ann Thorac Surg 90:1463-70.

Pasic M, Dreysse S, Drews T, et al. 2010. Improved technique of transapical aortic valve implantation: "the Berlin addition." Ann Thorac Surg 89:2058-60.

Pasic M, Unbehaun A, Dreysse S, et al. 2010. Transapical aortic valve implantation in 175 consecutive patients: excellent outcome in very high-risk patients. J Am Coll Cardiol 56:813-20.