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Combined Transapical Aortic Valve Replacement and Minimally Invasive Direct Coronary Bypass Grafting—A New Concept for Selected High-Risk Patients

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ABSTRACT

Background: Transcatheter aortic valve implantation and minimally invasive direct coronary artery bypass (MIDCAB) procedures are both off-pump treatment options for a subset of higher-risk patients. We present a new, minimally invasive surgical concept involving combining the procedures and performing them through the same thoracic access in a patient with a vascular disorder.

Case Report: We report on a 78-year-old patient with symptomatic calcified aortic stenosis and a critical lesion of the left anterior descending coronary artery. In addition, Rendu-Osler-Weber disease was diagnosed. He was successfully treated with combined off-pump transapical, transcatheter aortic valve implantation and MIDCAB grafting. The initial postoperative recovery was good; however, the patient died 3 months postoperatively from septic complications.

Conclusion: This combined procedure performed through the same anterolateral incision was technically feasible and may be a promising, minimally invasive approach for selected patients.

INTRODUCTION

Transcatheter aortic valve implantation shows promise as an off-pump valve-replacement technique in selected patients with severe aortic stenosis [Walther 2008]. In the presence of coronary artery disease of the left anterior descending artery (LAD), a combined transapical, transcatheter aortic valve (THV) implantation and minimally invasive direct coronary artery bypass (MIDCAB) grafting procedure through a left anterolateral thoracotomy may represent a feasible alternative for a subset of high-risk patients.

Our patient presented with Rendu-Osler-Weber disease, otherwise known as hereditary hemorrhagic telangiectasia (HHT), which is an uncommon autosomal dominant vascular disorder that causes multiorgan vascular dysplasia [Radu 1992]. Clinical symptoms can include anemia and nosebleeds, hemoptysis and hemothorax (pulmonary arteriovenous malformations), hematemesis, melena and/or hematochezia (gastrointestinal involvement), and brain abscess and stroke (cerebral lesions) [Guttmacher 1995; Galliteli 2006].

The outcome and complications of cardiac surgical procedures in HHT patients are unpredictable, most probably because of the substantial risk of hemorrhagic complications and adverse hemodynamic consequences with the use of cardiopulmonary bypass (CPB) [Radu 1992].

CASE REPORT

In January 2009, a 78-year-old man presented with symptomatic (New York Heart Association class III) calcified aortic valve stenosis (opening area, 0.7 cm^2; median pressure gradient, 52 mm Hg). A coronary angiography examination revealed a critical LAD lesion.

HHT was diagnosed in this patient approximately 25 years ago in conjunction with worsening periods of nosebleeding, leading to surgical closure of the nose. Since then, the patient's bleeding has been mainly due to angioectasia of the upper gastrointestinal tract. Despite repeated argon plasma coagulation, regular transfusions of 4 units of packed red blood cells have been necessary every 3 to 4 weeks.

Perioperative risk was assessed with the logistic EuroSCORE and the Society of Thoracic Surgeons (STS) score, and although the predicted risk for death appeared to be moderate (logistic EuroSCORE, 18.32%; STS score, 5.8%), conventional surgery had to be rejected because of the distinctive HHT-related risk of bleeding or hemodynamic instability.

Alternative transfemoral THV implantation would have required interventional treatment of the LAD stenosis with consecutive antiplatelet medication, which is contraindicated in HHT patients. Therefore, a combination of off-pump transapical THV implantation and MIDCAB operation was justified.

After informed consent was obtained, the combined intervention was performed with the patient under general anesthesia. A small left anterolateral thoracotomy in the fifth intercostal space was somewhat medially enlarged to expose both the apex and the LAD and to harvest the left

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internal mammary artery (LIMA). Under direct vision, the full length of the LIMA was taken down, and the LIMA-to-LAD anastomosis was created after the beating heart was stabilized.

After measurement of the LIMA graft flow, 2 purse-string sutures were placed in the apex of the left ventricle, approximately 2 cm caudal to the anastomosis. After aortic valvuloplasty, we successfully deployed the chosen 26-mm Sapien™ THV (Edwards Lifesciences, Irvine, CA, USA). Final aortography and echocardiography evaluations both confirmed excellent valve function and competence, with a low transvalvular gradient (median, 6 mm Hg) and the absence of perivalvular leakage.

Finally, bypass graft patency was again confirmed, and the thoracotomy was closed.

The patient was extubated the following day. The patient experienced a worsening renal insufficiency, however, with a transient need for hemofiltration and a susceptibility for pleural effusion. The patient subsequently developed multiple wound-healing disorders with consecutive systemic inflammation incidents and a progressive need for blood transfusions. The situation was further aggravated by methicillin-resistant *Staphylococcus aureus* sepsis with progressive respiratory failure and a need for a tracheotomy. The patient died 103 days postoperatively from septic shock.

DISCUSSION

Rendu-Osler-Weber disease is a rare vascular disorder with variable clinical manifestations. Hemoglobin-relevant epistaxis and/or recurrent gastrointestinal hemorrhage are common problems. Because of the severe bleeding tendency, cardiosurgical interventions on CPB may be inappropriate for HHT patients. Hence, reports of successful, usually isolated, procedures are rare [Sakata 1992; Ishikawa 2004; Seike 2005]. The prevalence of bleeding complications in HHT patients, however, indicates a clear need for off-pump surgical techniques.

Transcatheter aortic valve implantation may be a viable alternative to conventional surgery with CPB in high-risk patients [Svensson 2008]. Furthermore, MIDCAB for revascularization of the LAD has shown excellent short- and long-term success rates [Holzhey 2007]. A combination of these procedures performed through the same thoracic access, represents a new concept and the logical treatment option for a subset of critically ill patients.

Recently, Cheung et al [2008] reported on combined THV and MIDCAB procedures in 3 high-risk patients and described good procedural results; however, all patients died within 2 months of follow-up from complications related to their unfavorable comorbid risk profiles.

In our HHT patient, both of the applied risk-stratification systems predicted at least a moderately increased risk of mortality with conventional surgery. Vascular lesion–related diseases, however, are not considered contributing risk factors in either of the 2 evaluation systems. Therefore, after interdisciplinary discussion, we selected a combined off-pump procedure for the patient.

Although the minimally invasive approach with avoidance of CPB led to excellent hemodynamic results and the patient's rapid initial recovery, serious postoperative complications associated with the underlying diseases led to an unfavorable outcome. Recent work has suggested that the transfemoral approach is slightly superior in terms of morbidity and mortality [Himbert 2009; Gerckens 2010], whereas the transapical approach has been associated with a negative trend in outcomes [Himbert 2009]. Therefore, an alternative, almost nonsurgical option with interventional treatment of the LAD stenosis with a bare-metal stent and transfemoral THV might have been a more favorable solution in this particular case. Vascular complications, however, may be seen as the main cause of severe morbidity with a transfemoral approach using the Sapien THV device, owing to the larger sheath diameters [Himbert 2009]. The use of this device might have led to an even higher risk of bleeding in our HHT patient. Alternatively, implantation of the other clinically approved transfemoral THV device (CoreValve™ revalving system; Medtronic, Minneapolis, MN, USA), which can be used with considerably smaller sheaths, might have decreased the risk of vascular complications or bleeding. Because of its unique design with a nitinol frame (stent) partly covering the coronary ostia, however, antiplatelet medication at least would have been a point of discussion in the postoperative course [Grube 2007], which, again, would have promoted the risk of HHT-related bleeding. In view of these concerns, the transapical procedure was chosen.

Our case indicates that even with surgical off-pump techniques, the comorbidity of HHT patients presents great challenges for postoperative treatment. Nevertheless, we have shown a combined THV and MIDCAB approach to be a feasible minimally invasive concept for a subset of selected high-risk patients.

REFERENCES

Cheung A, Wong DR, Ye J, Webb JG, Lichtenstein SV. 2008. Combined off-pump transapical transcatheter aortic valve implantation and MIDCAB revascularization. ISMICS 2008 Annual Scientific Meeting Abstracts-Video. Innovations 3:115.

Gallitelli M, Pasculli G, Fiore T, Carella A, Sabbà C. 2006. Emergencies in hereditary haemorrhagic telangiectasia. QJM 99:15-22.

Gerckens U, Mudra H, Schuler GC, et al. 2010. Comparison of transfemoral and transapical aortic valve replacement: results of the German registry on transcatheter aortic valve implantation. J Am Coll Cardiol 55:A216.E2053.

Grube E, Schuler G, Buellesfeld L, et al. 2007. Percutaneous aortic valve replacement for severe aortic stenosis in high-risk patients using the second- and current third-generation self-expanding CoreValve prosthesis: device success and 30-day clinical outcome. J Am Coll Cardiol 50:69-76.

Guttmacher AE, Marchuk DA, White RI Jr. 1995. Hereditary hemorrhagic telangiectasia. N Engl J Med 333:918-24.

Himbert D, Descoutures F, Al-Attar N, et al. 2009. Results of transfemoral or transapical aortic valve implantation following a uniform assessment in high-risk patients with aortic stenosis. J Am Coll Cardiol 54:303-11.

Holzhey DM, Jacobs S, Mochalski M, et al. 2007. Seven-year follow-up after minimally invasive direct coronary artery bypass: experience with more than 1300 patients. Ann Thorac Surg 83:108-14.

Ishikawa S, Oshima K, Aizaki M, Takahashi T, Hasegawa Y, Morishita Y. 2004. A second mitral valve replacement in a patient with hereditary hemorrhagic telangiectasia (Osler's disease). Jpn Heart J 45:885-8.

Radu C, Reich DL, Tamman R. 1992. Anesthetic considerations in a cardiac surgical patient with Osler-Weber-Rendu disease. J Cardiothorac Vasc Anesth 6:461-4.

Sakata Y, Anzai T, Iijima T, et al. 1992. Mitral valve replacement in a patient with hereditary hemorrhagic telangiectasia [in Japanese]. Kyobu Geka 45:1024-6.

Seike Y, Sato H, Nagashima M, et al. 2005. Aortic valve replacement for the patient with Osler-Rendu-Weber disease [in Japanese]. Kyobu Geka 58:1141-4.

Svensson LG, Dewey T, Kapadia S, et al. 2008. United States feasibility study of transcatheter insertion of a stented aortic valve by the left ventricular apex. Ann Thorac Surg 86:46-54; discussion 54-5.

Walther T, Chu MW, Mohr FW. 2008. Transcatheter aortic valve implantation: time to expand? Curr Opin Cardiol 23:111-6.

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