SciMedCentral

Journal of Cardiology & Clinical Research

Case Report

Fast Valve Degeneration after Transcatheter Aortic Valve Replacement in a Hemodialysis Patient

Carlo Bothner*, Julia Seeger, Wolfgang Rottbauer, Jochen Wöhrle

Department of Internal Medicine II, University of Ulm, Germany

***Corresponding author**

Jochen Wohrle, Department of Internal Medicine II, University of Ulm, Albert-Einstein-Allee 23, 89081 Ulm, Germany, Tel: 49 731 500 45047; Fax: 49 731 500 45029; Email: jochen.woehrle@uniklinik-ulm.de

Submitted: 28 February 2017

Accepted: 23 March 2017

Published: 24 March 2017

Keywords

- Transcatheter aortic valve replacement
- Fast valve degeneration
- Hemodialysis patient
- Deterioration of bioprosthetic Core Valve

Abstract

Transcatheter aortic valve replacement (TAVR) for severe aortic stenosis has been proven to be a safe therapeutic and well-established option in patients at high and intermediate surgical risk. TAVR shows a comparable mid-term durability compared to surgical aortic valve replacement. Only minimal data exist in the long-term survival of dialysis patients after cardiac valve replacement. Long-term function of TAVR devices in patients requiring hemodialysis remains unknown. We are presenting a case of early deterioration of a bioprosthetic CoreValve in a patient undergoing hemodialysis. The patient was scheduled for re-TAVR, unfortunately, the patient´s course deteriorated and cardiopulmonary resuscitation was unsuccessful. The autopsy revealed a severely denaturated CoreValve prosthesis with severe calcifications. In the subset of patients with renal failure however valve performance has to be regularly monitored for early signs of degeneration. Our case shows that the long-term performance of first generation TAVR devices in a patient requiring hemodialysis was limited.

ABBREVIATIONS

TAVR: Transcatheter Aortic Valve Replacement; NYHA: New York Heart Association

INTRODUCTION

Degenerative aortic valve stenosis is the most common valvular lesion in Western countries [1]. Survival without treatment is very poor in symptomatic patients. In 2002, Cribier et al. implanted the first transcatheter valve in the aortic position for the treatment of symptomatic severe aortic stenosis [2]. Data from the PARTNER Trial and the Medtronic Core Valve U.S. Pivotal Investigational Device Exemption trial indicate that survival for extreme-risk patients is superior to best medical therapy and equivalent or superior to surgical aortic valve replacement, although long-term durability remains unknown [3]. Data on long-term durability are scarce. First data comparing TAVR to SAVR are promising. Cardiac hemodynamics and valve performance are stable in both in patients alive at 5 years [4]. In recent years transcatheter aortic valve replacement has become an emerging alternative for high- and intermediate-risk patients with severe aortic stenosis [5,6]. Presumably because of extended use of bioprosthetic valve replacement and ageing of the population, the number of degenerative bioprosthesis will increase in the future. Failure of the bioprosthetic valves is due to relevant stenosis as a result of calcification with deterioration of leaflets or valve thrombosis [7]. In high-risk patients transcatheter aortic valve replacement (TAVR) has replaced surgical bioprosthesis, and in intermediate-risk patients it has proven to be safe and effective. Transcatheter aortic valve replacement (TAVR) for severe aortic stenosis is a safe therapeutic and well established option in patients at high and intermediate surgical risk. The 5-year outcomes of transcatheter aortic valve replacement or surgical aortic valve replacement for high surgical risk patients with aortic stenosis (PARTNER 1) showed no structural valve deterioration in either group [8]. Transcatheter aortic valve replacement (TAVR) for treatment of symptomatic patients with severe aortic stenosis was associated with a lower long-term mortality compared with patients undergoing surgical valve replacement [9]. Thus far, short- and mid-term outcomes have been encouraging but long-term data on clinical outcomes, valve function and durability and structural integrity are limited [10]. Long-term function of TAVR devices in patients requiring hemodialysis is unknown. The aim of this case report is to give information on the long-term performance of a first generation TAVR device in a hemodialysis patient.

CASE PRESENTATION

We report on a severely degenerated Core Valve bioprosthesis early after 33 months post TAVR in a male patient. Only few cases are reported of a degenerative stenosed Core Valve transcatheter aortic bioprosthesis, e.g. after five years (60 months) and after five and a half years (66 months) after TAVR. One in a 74 year old man with an early calcific degeneration of a Core Valve transcatheter aortic bioprosthesis with extensive calcification of the Core Valve´s leaflets [11]. Another in a 92 year old patient who was transferred to hospital with decompensated heart failure (NYHA class IV) [12].

In our case a 63 year old male patient underwent TAVR using a first generation 29 mm Core Valve device (Medtronic, Minneapolis, Minnesota, USA) due to severe aortic stenosis with an aortic valve area of 0.7 cm^2 measured by transthoracic echocardiography and cardiac catheterization. Preprocedural multislice computed tomography showed an aortic annulus diameter of 26.5 mm. This patient suffered from renal insufficiency requiring hemodialysis due to IgA-nephropathia, secondary hyperparathyroidism, pulmonary hypertension, recurrent phlebothromboses, liver cirrhosis Child B with compromised coagulation, thrombocytopenia (21 Giga/l) and diabetes mellitus. TAVR was performed after a 4 weeks period of cardiac decompensation due to severely reduced left ventricular function (ejection fraction 15 %), hemofiltration and therapy with inotropes requiring intensive care. Peri- and post-procedural TAVR course were uncomplicated and the patient was discharged 3 weeks after the procedure.

The patient was admitted to our Chest Pain Unit due to deteriorating dyspnoea (NYHA class III to IV) 33 months after TAVR. Transthoracic and transesophageal echocardiography revealed severely reduced left ventricular function and a severely stenosed Core Valve bioprosthesis with a mean pressure gradient of 38 mmHg (maximum pressure gradient of 61 mmHg) and an aortic valve area of 0.6 cm^2. Cardiac catheterization demonstrated a pulmonary hypertension with a mean pulmonary artery pressure of 52 mmHg (70/35 mmHg), severe aortic stenosis with an aortic valve area of 0.3 cm^2 and a peak-to-peak gradient of 80 mmHg with exclusion of coronary artery disease.

The patient was scheduled for re-TAVR after further recompensation. Unfortunately, the patient`s course deteriorated with acute electromechanical dissociation. Cardiopulmonary resuscitation was unsuccessful. Macroscopy (Figure 1) and histology demonstrated a severely denaturated CoreValve prosthesis (Figure 2a and 2b) with severe calcification. Bacteria or fungae were not demonstrated by Gram stain and PAS stain.

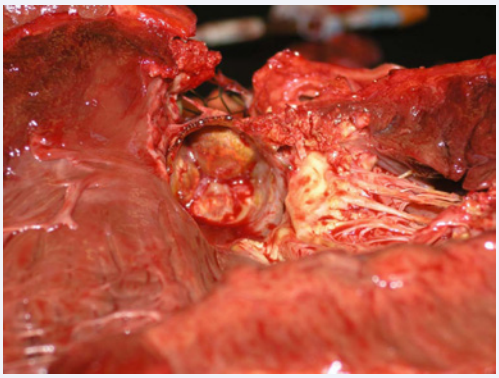

Figure 1 Macroscopic view of the left ventricular outflow tract demonstrating the degenerated CoreValve bioprosthesis.

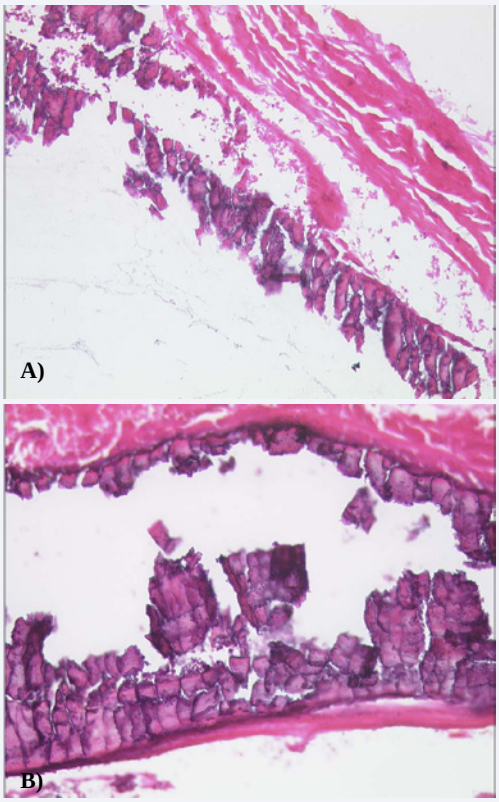

Figure 2 Histological specimen of the CoreValve bioprosthesis demonstrated degenerated cusps (2a) with severe calcifications (2b). Bacteria or fungae were excluded by Gram stain and PAS stain.

DISCUSSION

Chronic kidney disease population is increasing, so is the dialysis population. Reports of early calcific degeneration of aortic bioprostheses discouraged their use in hemodialysis patients. Consequently, the American College of Cardiology / American Heart Association (ACC / AHA) guidelines for valve replacement from 1998 recommended the use of mechanical valves in dialysis-dependent patients because bioprostheses were considered a contraindication in dialysis patients [13]. The AHA / ACC 2006 valvular revised guidelines removed the previous statement (1998) of class IIa recommendation for mechanical valves and class III for tissue valves, in the focus update of 2008 there is still no specific indication for valve selection in dialysis patients. Almost all studies reported no differences in survival between mechanical and biological valves. Taking together, biological valves are considered as a suitable treatment for dialysis-dependent patients [14]. Nowadays comorbidities such as chronic renal insufficiency are no longer contraindications to bioprosthesis [15]. End-stage renal disease patients on regular hemodialysis are at a higher risk for cardiovascular diseases, especially calcified degeneration of the aortic valves [16].

Therefore, calcification of the aortic valve and annulus is frequent in these patients. These lesions often evolve rapidly to the stage of hemodynamically significant aortic valve stenosis. With the ageing population, it is expected that the prevalence of end-stage renal disease and its associated cardiovascular disease would continue to increase and accordingly more patients on hemodialysis would require aortic valve replacement [17]. The majority of valvular lesions observed in end-stage renal disease patients is acquired, mostly secondary to dystrophic calcification of the valvular annulus and the leaflets [18]. The incidence of symptomatic aortic stenosis is 3.3 % per year in hemodialyzed patients. While the age of patients treated by dialysis is increasing constantly, the prevalence of aortic valve calcification and its complications will increase in parallel. In patients with end-stage renal disease the prevalence of aortic valve calcifications is 28 to 55 %, but it occurs 10 to 20 years earlier than in the general population. In degenerative aortic calcification, the lesions are first seen at the site of valve insertion. They extend in the direction of the cusps. Commisural fusion is present only in advanced stages when calcium deposits protrude and fuse the valve leaflets [19]. Renal failure and dialysis superimpose further pathomechanisms. This conclusion is supported by the observation that a correlation is found between duration of hemodialysis treatment and presence of heart valve calcification [20]. The high uremic burden, secondary hyperparathyroidism and the associated disturbances in calcium and phosphate metabolism may be responsible for this calcification, especially of the cardiac valves [21]. The rate of progression of native aortic valve stenosis is more rapid in hemodialysis patients in comparison with non-dialysis patients, with a mean annual reduction of the aortic valve opening area of 0.14 - 0.19 cm^2 / year in hemodialysis patients vs 0.06 - 0.07 cm^2 / year in non-dialysis patients. These changes affect the implanted aortic bioprostheses after aortic valve replacement as well [22]. Age, duration of dialysis treatment, and hyperphosphatemia are the most important risk factors [18]. Only minimal data exist in the long-term survival of dialysis patients after cardiac valve replacement. This case report is in addition to the scarce information on valve durability with bioprosthetic transcatheter valves.

We are presenting a case of early deterioration of a bioprosthetic CoreValve in a patient undergoing hemodialysis. Transcatheter aortic valve replacement (TAVR) for severe aortic stenosis has been proven to be a safe therapeutic and well-established option in patients at high and intermediate surgical risk with a comparable mid-term durability compared with surgical aortic valve replacement. In the subset of patients with renal failure, however, valve performance has to be regularly monitored for early signs of degeneration. Our case shows that the long-term performance of first generation TAVR devices in a patient requiring hemodialysis was limited.

REFERENCES

1. Lindroos M, Kupari M, Heikkila J, Tilvis R. Prevalence of aortic valve abnormalities in the elderly: an echocardiographic study of a random population sample. J Am Coll Cardiol. 1993; 21: 1220-1225.
2. Cribier A, Eltchaninoff H, Bash A, Borenstein N, Tron C, Bauer F, et al. Percutaneous transcatheter implantation of an aortic valve prosthesis for calcific aortic stenosis. First human case description. Circulation. 2002; 106: 3006-3008.
3. Kleiman NS, Reardon MJ. Advances in Transcatheter Aortic Valve Replacement. Methodist Debakey Cardiovasc J. 2016; 12: 33-36.
4. Daubert MA, Weissman NJ, Hahn RT, Pibarot P, Parvataneni R, Mack MJ, et al. Long-Term Valve Performance of TAVR and SAVR: A Report From the PARTNER I Trial. JACC Cardiovasc Imaging. 2017; 10: 15-25.
5. Smith CR, Leon MB, Mack MJ, Miller DC, Moses JW, Svensson LG, et al. Transcatheter versus Surgical Aortic-Valve Replacement in High-Risk Patients. N Engl J Med. 2011; 364: 2187-2198.
6. Leon MB, Smith CR, Mack MJ, Makkar RR, Svensson LG, Kodali SK, et al. Transcatheter or Surgical Aortic-Valve Replacement in Intermediate-Risk Patients. N Engl J Med. 2016; 374: 1609-1620.
7. Nishida T, Tominaga R. A look at recent improvements in the durability of tissue valves. Gen Thorac Cardiovasc Surg. 2013; 61: 182-190.
8. Mack MJ, Leon MB, Smith CR, Miller DC, Moses JW, Tuzcu EM, et al. 5-year outcomes of transcatheter aortic valve replacement or surgical aortic valve replacement for high surgical risk patients with aortic stenosis (PARTNER 1): a randomized controlled trial. Lancet. 2015; 385: 2477-2784.
9. Abdel-Wahab M, Mehilli J, Frerker C, Neumann FJ, Kurz T, Tölg R, et al. Comparison of Balloon-Expandable vs Self-Expandable Valves in Patients Undergoing Transcatheter Aortic Valve Replacement the CHOICE Randomized Clinical Trial. JAMA. 2014; 311: 1503-1514.
10. Gurvitch R, Wood DA, Tay EL, Leipsic J, Ye J, Lichtenstein SV, et al. Transcatheter Aortic Valve Implantation – Durabilty of Clinical and Hemodynamic Outcomes beyond 3 Years in a Large Patient Cohort. Circulation. 2010; 122: 1319-1327.
11. Hing Ong S, Mueller R, Iversen S. Early calcific degeneration of a Core Valve transcatheter aortic bioprosthesis. Eur Heart J. 2011; 283: 586.
12. Hammerstingl C, Nickenig G, Grube E. Treatment of a degenerative stenosed Core Valve aortic bioprosthesis by transcatheter valve-in-valve insertion. Catheter Cardiovasc Interv. 2012; 79: 748-755.
13. Bonow RO, Carabello B, de Leon AC, Edmunds LH Jr, Fedderly BJ, Freed MD, et al. ACC/AHA guidelines for the management of patients with valvular heart disease. Executive summary. A report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Committee on Management of Patients with Valvular Heart Disease). J Heart Valve Dis. 1998; 7: 672-707.
14. Bianchi G, Solinas M, Bevilacqua S, Glauber M. Are bioprostheses associated with better outcome than mechanical valves in patients with chronic kidney disease requiring dialysis who undergo valve surgery? Interact CardioVasc Thorac Surg. 2012; 15: 473-483.
15. Hoffmann G, Lutter G, Cremer J. Durability of Bioprosthetic Cardiac Valves. Dtsch Arztebl Int. 2008; 105: 143-8.
16. Maher ER, Young G, Smyth-Walsh B, Pugh S, Curtis JR. Aortic and mitral valve calcification in patients with end stage renal disease. Lancet. 1987; 2: 875-877.
17. Hegazy Y, Rayan A, Sodian R, Hassanein W, Ennker J. Medtronic Freestyle aortic bioprosthesis: a potential option for haemodialysis patients. Interact CardioVasc Thorac Surg. 2016; 10: 1-6.
18. London GM, Pannier B, Marchais SJ, Guerin AP. Calcification of the Aortic Valve in the Dialyzed Patient. J Am Soc Nephrol. 2000; 11: 778-783.
19. Braunwald E. Valvular heart disease. Heart Disease. 1997; 5: 1035-1048.
20. Fernandez-Reyes MJ, Auxiliadora BM, Robles P, Selgas R, Oliver J, Del Peso G, et al. Mitral annular calcification in CAPD patients with a low

degree of hyperparathyroidism: An analysis of other possible factors. Nephrol Dial Transplant. 1995; 10: 2090-2095.

21. Ribeiro S, Ramos A, Brandao A, Rebelo JR, Guerra A, Resina C et al. Cardiac valve calcification in haemodialysis patients: role of calcium-phosphate metabolism. Nephrol Dial Transplant. 1998; 13: 2037-40.

22. Perkovic V, Hunt D, Griffin SV, du Plessis M, Becker GJ. Accelerated progression of calcific aortic stenosis in dialysis patients. Nephron Clin Pract. 2003; 94: 40-45.

Cite this article

Bothner C, Seeger J, Rottbauer W, Wöhrle J (2017) Fast Valve Degeneration after Transcatheter Aortic Valve Replacement in a Hemodialysis Patient. J Cardiol Clin Res 5(3): 1102.