Unusual 30-year durability of Hancock II porcine bioprosthesis in tricuspid position

Bachar El Oumeiri *, Frédéric Vanden Eynden, Guido Van Nooten

Department of Cardiac Surgery, ULB Erasme, Brussels, Belgium

ARTICLE INFO
Article history:
Received 8 December 2014
Received in revised form 30 January 2015
Accepted 31 January 2015
Available online 7 February 2015

Keywords:
Tricuspid valve
Stenosis
Bioprosthesis

ABSTRACT
INTRODUCTION: We describe an unusual durability of a Hancock II porcine bioprosthesis in tricuspid position. Sustainability of bioprostheses is known to be limited especially in young patients.
PRESENTATION OF THE CASE: A 52-year old Caucasian woman with a history of multiple valve interventions. Her clinical presentation of dyspnoea and lower limb oedema led to the diagnosis of severe tricuspid valve stenosis and right heart failure, and was managed by the replacement of the tricuspid bioprosthesis by another bioprosthesis 30-years after the initial implantation.
DISCUSSION: Calcification is the leading cause of bioprosthesis structural deterioration. This immune–induced phenomenon is more pronounced in young patients. Although several patient-related and valve-related factors influence the durability of a xenograft, unknown factors may be of some importance.
CONCLUSION: To our knowledge, this is the first report of a 30-year durability of tricuspid bioprosthesis in a young recipient. In the absence of extensive calcifications, pannus formation covering the whole prosthesis, peculiar hemodynamics and other unknown factors might have contributed to an extended durability in this young patient.

1. Introduction

The Hancock II valve bioprosthesis (Hancock II; Medtronic, Inc Minneapolis, Mn) was commercialized in 1982. It is a porcine bioprosthesis fixed at low pressure in glutaraldehyde (0.625%) to preserve the natural collagen crimping, treated with a calcium-retarding agent (T6 sodium dodecyl sulphate), and mounted on a low-profile Delrin stent (Dupont, Wilmington, Del) [1]. Excellent long-term durability has been showed especially in the aortic position [2].

2. Presentation of case

A 52-year Caucasian woman, operated for the first time in 1965 for complete atrio-ventricular canal, underwent in 1983 mitral and tricuspid valve replacement with Hancock II porcine bioprostheses for advanced rheumatic valve disease. In 1988, the mitral bioprosthesis was replaced by a St Jude mechanical valve because of structural valve deterioration due to excessive calcification. The patient did well for over 25 years, until the beginning of 2013 when she experienced shortness of breath and presented an important lower limb oedema. Patient’s dyspnoea progressed to a NYHA functional class IV with development of right heart failure, pleural effusions and ascitis. Trans-thoracic (TTC) and transoesophageal (TEE) echocardiography revealed severe deterioration of the tricuspid bioprosthesis with a IV/IV regurgitation surprisingly without any calcification of the free-moving leaflets. By contrast, the papillary muscles were completely immobilized and severely calcified (Fig. 1), thus creating a kind of tunnel downstream the valve with an important intra-ventricular pressure gradient. The pre-operative coronary angiography was normal. At the fourth reoperation in September 2013, the explanted prosthesis showed holes and tears in all leaflets with no signs of calcification other than at the level of the commissures. By contrast extensive pannus proliferation surrounded the whole external clot surface even covering the edges of the calcified papillary muscles fused to the leaflets at all three commissures with a severe creep stenosis of the struts (Fig. 2). The calcified papillary muscles were excised and the tricuspid xenograft was replaced by another 31 mm bioprosthesis. Patient recovered uneventfully and remained asymptomatic at 1-year follow-up.

3. Discussion

Structural valve deterioration is the most common cause of reoperation after bioprosthetic replacement and only few valves remain functional beyond 20 years. Intrinsic calcification is the...
leading cause of failure and reoperation as common in younger patients and is more significantly affected by this type of structural valve deterioration [3]. Valfré and co-workers report an impressive long-term durability of the Hancock bioprosthesis with a freedom from re-operation in the aortic position of 79.3% and 52.8% in the mitral at twenty years [4]. However few reports exists of a more extended durability even in the tricuspid position [5]. Although several patient-related and valve related factors may influence the durability of a xenograft, the reasons for our unexpected longevity are not easily explained. For that matter Butany and colleagues suggested, that while pannus overgrowth usually is considered as a cause of prosthetic dysfunction, it could be an important protective factor [6]. In our patient the pannus overgrowth was abundant covering the whole stent but also the leaflets at the commissures, possibly contributing to its protection from both increasing mechanical stress and excessive calcification. Another observation was the complete fusion of the papillary muscles with the struts as often seen in rheumatic valve disease. In this particular case the fixation of the sub-valvular apparatus to the struts created a perfect tubular structure downstream the prosthesis inside the right ventricle. It might have temporarily improved the hemodynamics avoiding any turbulent flow across the valve henceforth lowering the stress on the leaflets. Those two observations might contribute to this exceptional durability in addition to others unknown factors. However once the valve became truly stenotic due to the creep stenosis our patient’s symptoms rapidly increased.

4. Conclusion

To our knowledge this is the first report of a 30-year durability of a tricuspid bioprosthesis in a young recipient. Excessive calcification, normally the leading cause of structural prosthetic deterioration, was not observed in this case. Pannus formation covering the whole stent of the prosthesis, peculiar hemodynamics and others unknown factors might have contributed to the extended durability in this young patient.

Conflicts of interest

There is no conflict of interest.

Sources of funding

There is no sponsor.

Consent

The patient is consent and volunteer.

Author’s contribution

Guido van Nooten: operator.
Frederic Vandeneynden: data collection.
Bachar El Oumeiri: writing, operator.

References

[1] A. Carpentier, C. Dubost, E. Lane, A. Nashef, S. Carpentier, J. Relland, et al., Continuing improvements in valvular bioprostheses, J. Thorac. Cardiovasc. Surg. 83 (1982) 27–42.
[2] G. Rizzoli, T. Bottio, G. Thiene, G. Toscano, D. Casarotto, Long-term durability of the Hancock II porcine bioprosthesis, J. Thorac. Cardiovasc. Surg. 126 (2003) 66–74.
[3] T.E. David, J. Ivanov, S. Armstrong, C.M. Feindel, G. Cohen, Late results of heart valve replacement with the Hancock II bioprosthesis, J. Thorac. Cardiovasc. Surg. 121 (2001) 268–277.
[4] C. Valfré, P. Ius, G. Minniti, L. Salvador, T. Bottio, The fate of the Hancock II porcine valve recipients 25 years after implantation, Eur. J. Cardiothorac. Surg. 38 (2010) 141–146.

[5] K. Kuwaki, K. Komatsu, K. Morishita, M. Tsukamoto, T. Abe, Long-term results of porcine bioprostheses in the tricuspid position, Surg. Today 28 (1998) 599–603.

[6] J.W. Butany, R. Kesarwani, T.M. Yau, G. Singh, M. Thangaroopan, V. Nair, et al., The role of pannus in the longevity of an Ionescu-Shiley pericardial bioprosthesis, J. Card. Surg. 21 (2006) 505–507.