



Aortic homograft for aortic valve replacement in patient with Alpha-Gal allergy

Simon Dang Van¹ · Olivier Fouquet^{1,4} · Audrey Jeanneteau² · Jean-Marie Leclere³ · Christophe Baufreton^{1,4}

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Abstract

Allergy to Galactose-Alpha-1,3-Galactose is an allergy to mammalian proteins, that are present on the surface of standard bioprosthetic valves, and could result in a catastrophic allergic reaction or may cause early deterioration of the bioprostheses. Aortic homograft is an acceptable alternative to standard prosthetic valves (biological and mechanical) to avoid a potential allergic manifestation and the need for definitive oral anticoagulation. We report the implantation of an aortic homograft in a patient with an aortic stenosis who presents a documented AlphaGal allergy.

Keywords Aortic homograft · Aortic stenosis · Alpha-Gal allergy · Bentall procedure

Introduction

Allergy to mammalian proteins, resulting in heterogeneous anaphylactic manifestations and an increased specific IgE alpha-gal titer, has been poorly described in cardiac surgery. Only a few articles report hypersensitivity reaction [1] and bioprosthetic valve degeneration associated with allergy to Galactose-Alpha-1,3-Galactose [2]. We report the implantation of an aortic homograft (AH) in a patient with an aortic stenosis who presents a documented AlphaGal allergy.

Case report

A 70-year-old male with a medical history of hypercholesterolemia, diabetes mellitus and hypertension was referred to our center with dyspnea and chest pain. Allergy to

mammalian meat was identified in 2012 after anaphylactic shock with a specific IgE AlphaGal titer > 100 kUA/L (reference range < 0.35 kUA/L), specific IgE bovine and porcine meat antibodies respectively of 32.6 kUA/L and 27.7 kUA/L (reference range < 0.10 kUA/L). Since the diagnosis, no allergic reaction occurred with a diet excluding mammalian meat. The echocardiography revealed a severe aortic stenosis with a mean gradient of 44 mmHg, maximal blood flow greater than 4 m/s and normal left ventricular ejection fraction (LVEF). Preoperative chest computed tomography showed a normal size of the ascending aorta (left ventricular outflow tract (LVOT): 23 mm, Valsalva sinuses: 32 mm, sino-tubular junction: 26 mm, ascending aorta: 34 mm). Preoperative immunologic investigations revealed a positive IgE to Gelofusine® (B. Braun, Melsungen, Germany) and latex. No specific allergy concerning the non-fractionated heparin used in our institution was observed after testing. After discussion with the patient and according to guidelines [3], an aortic homograft was chosen as a substitute of the aortic valve (patient's will: no oral anticoagulation, no mechanical prosthesis). Surgery was performed through full median sternotomy. Conventional normothermic cardiopulmonary bypass (CPB) was set between an aortic canula and a venous canula inserted in the right atrium. CPB was performed with a Physio® phosphorylcholine-coated closed circuit (Liva Nova, London, UK). Non-fractionated heparin was administered during cardiopulmonary bypass with an objective of activated clotting time (ACT) more than 350 s (according to local institution's protocol of CPB). Intermittent cold

✉ Simon Dang Van
Simon.DangVan@chu-angers.fr; simon.dangvan@gmail.com

¹ Department of Thoracic and Cardiovascular Surgery, University Hospital of Angers, 4, Rue Larrey, 49933 Angers, France

² Department of Thoracic and Cardiovascular Anesthesia, University Hospital of Angers, Angers, France

³ Department of Allergology, University Hospital of Angers, Angers, France

⁴ MITOVASC Institute UMR CNRS 6015, INSERM U1083, University Hospital of Angers, Angers, France

cardioplegia with 4/1 mix of blood and Plegisol® (Pfizer, New York, USA) was injected with selective cannulation of the coronary arteries with myocardial temperature monitoring. After ultimate LVOT sizing (23 mm), a root replacement procedure was performed with a running suture of the proximal and the distal suture of the AH. Coronary arteries were implanted in the AH in anatomic position with a standard running suture. No surgical glue was used. No perioperative complication occurred, especially concerning anaphylactic event or postoperative bleeding. Postoperative cares were uneventful, except a paroxysmal atrial fibrillation (<48 h) reduced with a loading dose of beta blockers. At patient's discharge from the hospital (day 8), mean aortic gradient of the aortic homograft implanted was 11 mmHg, without curative oral anticoagulation.

Institutional Review Board approval was waived because it was not required by Ethics Committee according to French regulation, concerning this case report.

Comment

AlphaGal allergy that is a rare and poorly described disease in cardiothoracic surgery, especially because of the difficulty of predicting the occurrence of allergic symptoms during cardiac surgery, in a significantly underdiagnosed population. Indeed, Burk et al. found in a group of patients who underwent upper endoscopic study that almost 25% of them were sensitized to AlphaGal [4]. To date, there is no strong data concerning the relationship between the early deterioration of bioprosthetic valves and alpha-Gal allergy. Nevertheless, some studies have shown the presence of AlphaGal epitope on the leaflets of the bioprosthetic valves [5]. On the other hand, Mangold et al. [6] showed that alpha-Gal specific IgG was significantly increased 3 months after implantation of bioprostheses compared to preoperative values and was significantly higher than AlphaGal specific IgG level in patients who received mechanical valves. Based on these observations, the immunologic reaction associated with the presence of AlphaGal epitope on the bioprostheses would be responsible for their early deterioration [2]. Without other obvious causes of early bioprostheses deterioration, AlphaGal allergy should be investigated because of its underestimated prevalence and should lead to reoperate patients (if needed) with a prosthesis that avoids any immunological reaction. To avoid early structural degradation of the porcine or bovine pericardial valve, implantation of a mechanical prosthesis is a suitable alternative, with however the need for a curative oral anticoagulation and some potential heparin substitute during further surgeries. Total decellularization of the bioprostheses using different protocols instead of the standard glutaraldehyde treatment would provide also less immunologic deterioration of the prostheses

[7]. In this particular case, the patient categorically refused to take prolonged anticoagulation. As a result, an AH was implanted in place of the native aortic root, with a modified Bentall procedure during a well-prepared elective surgical intervention, avoiding every potential adverse event related to the presence of AlphaGal allergen in the operating room (except intravenous heparin, needed for CPB). More than describing the surgical procedure and the valvular substitute which are both well known, the description of the materials used during the surgery seemed to be important, while numbers of drugs and materials were identified as bovine compounds containers in the preoperative investigations, and had to be removed from the surgical field in the operating room and during hospitalization. For example, one type of coated cardiopulmonary bypass circuit was chosen because surface treatment contained no bovine compound, while the other surface treatment usually used for tubing coating is derived from bovine. AH used as a valvular substitute are in loss of interest for several reasons: difficulty for implantation, reoperation and similar long-term results, compared to standard aortic prosthetic valves, and insufficient supply. However, AH allows such patients to avoid mechanical valve implantation and their adverse events related to oral anticoagulation. In addition, no switch of heparin and oral anticoagulation is required (for other surgeries), knowing that most of the injectable heparins are derived from porcine intestinal tissues, and that way decrease the risk of anaphylactic shock in case of other surgeries to be performed after cardiac surgery or hospitalizations.

Conclusion

AH implantation is an acceptable alternative to biological and mechanical prosthetic valves in case of documented AlphaGal allergy. Further investigation should be performed to evaluate its long-term performance. AlphaGal allergy should be considered in case of early bioprosthetic valve deterioration when no patient-related mismatch is documented.

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Declarations

Conflict of interest None.

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