Aortic valve replacement for quadricuspid valve: a lesson learnt from a negative experience

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Abstract

Quadricuspid aortic valve is a rare congenital abnormality often associated with valve incompetence and requires surgical correction in adulthood. However, using a standard suture technique of aortic valve replacement, postoperative complete atrioventricular block is not uncommon because of the downward displacement of the suprernumerary leaflet towards the membranous septum. We describe a suture technique where the sutures on the suprernumerary leaflet were passed through the aortic sinus wall above the valvar hinge. This technique can preclude injury to the conduction system, thereby avoiding atrioventricular block.

Keywords: Aortic valve • Replacement • Congenital heart disease • Heart valve disease • Pacemaker

INTRODUCTION

Quadricuspid aortic valve is a rare entity that carries an incidence between 0.003 and 0.08% of all congenital heart diseases [1–5]. In the majority of cases, it causes valve insufficiency and requires valve replacement in adulthood [1–5]. Although it was reported that a standard suture technique for valve replacement is prone to complete atrioventricular block [4], there has been no specific technique described to overcome this issue. Herein, we propose a new suture technique that avoids disrupting the conduction system.

CASE REPORT

A 64-year old female was referred to our service for symptomatic aortic insufficiency. Echocardiography revealed quadricuspid aortic valve with three normally located leaflets and one smaller leaflet (the suprernumerary leaflet) (Fig. 1A). After informed consent was obtained, she underwent aortic valve replacement. After sternotomy, standard cardiopulmonary bypass with right atrial cannulation was used. Cardiac arrest was achieved by retrograde cardioplegia. The outside of the aortic root was dissected from the right ventricle to allow suture placement. The aortic valve was exposed and inspected by standard transverse aortotomy (Fig. 1B). The valve was quadricuspid and three normally located leaflets and one suprernumerary leaflet located between the non-coronary and right coronary leaflets were present. The valve was excised and 2–0 braided, non-everting sutures with pledgets were placed on the left coronary, right coronary and non-coronary annuls in the usual fashion. On the valvar hinge that corresponded to the suprernumerary leaflet, three pledgeted sutures were passed from the outside to the inside of the sinus of Valsalva. Care was taken not to go underneath the level of the valvar hinge (Figs. 2A–C). The sutures were passed through the cuff of the bioprosthetic valve and placed on the supra-annular position. The aorta was closed and the aortic clamp was removed. Sinus rhythm was restored spontaneously, and cardiopulmonary bypass was discontinued in the usual fashion. Transoesophageal echocardiography showed the normally functioning bioprosthetic valve without an evidence of perivalvular leak. Postoperative course was uneventful with no documented arrhythmia.

COMMENT

Quadricuspid aortic valves are rare; however, are occasionally encountered in adulthood with severe aortic insufficiency. Hurwitz and Roberts [1] classified the valves based on the relative size of the suprernumerary leaflet. Nakamura et al. [5] reported another classification that focused on the location of the suprernumerary leaflet. According to these classifications, the most common variation is the non-dominant suprernumerary leaflet located between the right coronary and non-coronary leaflet. Pirundini et al. reported that the risk of atrioventricular conduction block is higher in patients with quadricuspid aortic valve, especially when the suprernumerary leaflet is located above the membranous septum [4]. This is possibly because of the downward displacement of the leaflet attachment (i.e. valvar hinge) towards the muscular septum. The conduction system traverses the membranous septum where the suprernumerary leaflet is located. Therefore, one may potentially cause injury to the conduction tissue if sutures are placed on the valvar hinge.
This condition is similar to our recent cases including the presented case. In the first case, we have experienced complete heart block, despite extra caution that sutures were placed in the supra-annular position.

Although Pirundini et al. have previously stated that sutures should be placed on a supra-annular position at the location that corresponds to the supranumerary leaflet [4], it was not clear where sutures could be securely passed. To our knowledge, this is the first report that specifically describes a suture technique to avoid complete atrioventricular block in the quadricuspid aortic valve. Using the presented technique, valve sutures and the implanted prosthetic valve will always stay above the ventricular tissue, which should preclude any direct injury or compression on the membranous septum. It is also emphasized that complete heart block could occur and be prevented by our suggested technique only when the supranumerary leaflet is located between the right coronary and the non-coronary leaflets. Another advantage of this technique is that the sutures, placed through the whole thickness of the sinusal wall, could enforce the suture line and minimize the risk of perivalvular leak. Moreover, this technique could be used in other congenital abnormalities such as bicuspid valve, which is also predisposed to injury to the atrioventricular node and postoperative pacemaker implantation.

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REFERENCES