

Enlargement of Mitral Valve Ring in a Young Woman with Severe Prosthesis-Patient Mismatch

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ABSTRACT

Mechanical prosthesis is the first choice for valve replacement at the mitral position in children. Replacement of the original prosthesis because of prosthesis-patient mismatch (PPM) is almost inevitable when prostheses are implanted in small children. The impact of PPM on long-term mortality becomes significant when the effective orifice area (EOA) is severely reduced. In these cases prosthesis replacement can be technically difficult, and it often requires extended enlargement of the mitral valve annulus ring. We report a case of a woman who underwent a mitral valve replacement with a 19-mm St. Jude mechanical prosthetic valve at the age of 3 years. At the age of 33 years, the patient underwent a successful minimally invasive mitral annulus ring enlargement and implantation of a 23-mm St. Jude mechanical prosthetic valve via a right minithoracotomy.

INTRODUCTION

Mechanical prosthesis is the choice for valve replacement at the mitral position in children. Replacement of the prosthesis because of prosthesis-patient mismatch (PPM) is almost inevitable when prostheses are implanted in small children [Masuda 2004]. Indications for prosthesis replacement are based on the results of Doppler echocardiography and cardiac catheterization and the absence of signs of heart failure [Masuda 2000; Van Doorn 2000].

The impact of PPM on long-term mortality becomes significant when the effective orifice area (EOA) is severely reduced [Tanné 2008, Aziz 2010]. In these cases prosthesis replacement could be technically difficult and it often requires extended enlargement of the mitral valve annulus ring.

We report the case of a woman who underwent a mitral valve replacement with a 19-mm St. Jude mechanical

prosthetic valve and closure of a ventricular septal defect with a patch at the age of 3 years. At the age of 33 years, the patient underwent a successful minimally invasive mitral annulus ring enlargement and implantation of a 23-mm St. Jude mechanical prosthetic valve via a right minithoracotomy.

CASE REPORT

The case patient was a 33-year-old woman who, at the age of 7 months, had undergone banding of the pulmonary artery for a perimembranous ventricular septal defect associated with mitral valve stenosis. At the age of 3 years she underwent a mitral valve replacement with a 19-mm St. Jude mechanical prosthesis and closure of the defect with a Dacron patch. Until the age of 33 years the patient remained asymptomatic and in good condition. Echocardiography showed normal left ventricular function without signs of ventricular remodeling. In the mitral position the transprosthesis gradient was 29 mmHg with mild intraprosthesis regurgitation without signs of prosthesis malfunction. There was also mild tricuspid regurgitation, with an estimated systolic pulmonary artery pressure of 65 mmHg. The EOA indexed for body size was severely reduced (0.9 cm^2). The right cardiac catheterization showed moderate pulmonary hypertension, with a mean pulmonary pressure of 36 mmHg and a wedge pressure of 30 mmHg with a normal transpulmonary gradient of 6 mmHg. The pulmonary vascular resistance was 1.1 Wood units. The prosthesis valve area calculated at the catheterization was 1.1 cm^2 with a mean transprosthesis gradient of 18 mmHg. In consideration of echocardiographic and catheterization data, the intervention of replacement of the mitral prosthesis was planned. The patient underwent surgery with the minimally invasive “heart port” technique via a right minithoracotomy. The previous mitral prosthesis was removed, and enlargement of the mitral valve annulus was performed in order to position the largest replacement prosthesis. The posterior leaflet of the native valve and the 2 papillary muscles with their subvalvular apparatus were removed in order to create a hole as wide as possible without any subannular obstruction (Figure 1).

The anterior fibrous trigone was resected near the left anterior commissure to increase the anteroposterior diameter and to avoid any damage to the conduction tissue (Figure 2). The posterior annulus was not resected, in order to avoid

Received October 6, 2013; accepted January 22, 2014.

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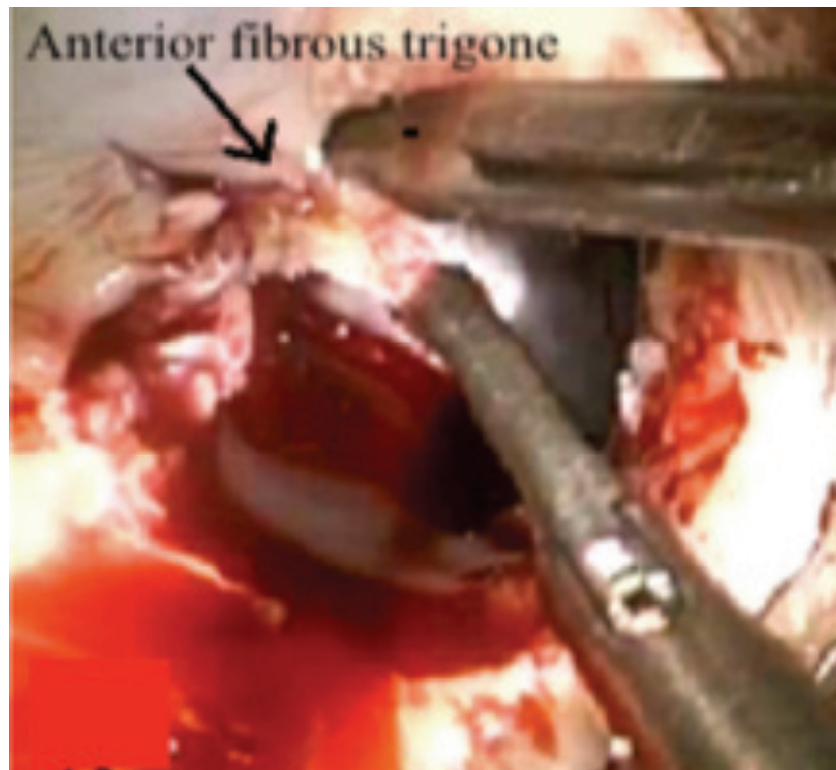


Figure 1. Posterior leaflet of the native valve. The 2 papillary muscles with their subvalvular apparatus and the anterior fibrous trigone near the left anterior commissure trigone were removed.

any risk of direct injury or distortion of the circumflex coronary artery, which depends mainly on the anatomic proximity of that vessel to the posterior segment of the mitral annulus. At the end of resection, increases in the anteroposterior diameter of about 5 mm and the transverse diameter of about 4 mm were obtained. A new mechanical prosthesis by the same manufacturer (St. Jude) with a diameter of 23 mm was calibrated. The prosthesis was placed using interrupted sutures in Ti-cron 2/0 with subannular pledgets. There were no periprocedural complications. On the fourth postoperative day a definitive bicameral pacemaker was implanted for a third-degree permanent atrioventricular block. At the follow-up examination 6 months after the intervention, the patient was in good clinical condition. Transesophageal echocardiography showed normal prosthesis function with a mean gradient of 9 mmHg and an estimated mean valvular area of 2.5 cm². The systolic pulmonary pressure was decreased to 45 mmHg.

DISCUSSION

Small mechanical replacement mitral valves perform remarkably well in young children, with durable hemodynamics despite the growth of the patients well beyond more than double their initial body weight. Valves can be expected to last over 8 years before requiring re-replacement [Vohra 2006]. The impact of PPM on mortality becomes significant when the EOA is <0.9 cm²/m². This level of EOA is referred

to as severe mitral PPM [Tanné 2008; Aziz 2010]. Stratification of patient subgroups on the basis of age and prosthesis type provides evidence of an important association between PPM and late mortality after mitral valve replacement with a mechanical prosthesis in younger patients [Aziz 2010]. PPM in the mitral position can be equated to residual mitral stenosis, with similar consequences, the persistence of abnormally high mitral pressure gradients and increased left atrial and pulmonary arterial pressures. In turn, the development of chronic irreversible precapillary pulmonary arterial hypertension (related to reactive hypertrophy of the medial layer of the vessel wall, hyperplasia of the intimal layer, proliferation of the adventitial layer, and plexiform lesions) may cause right-sided heart failure, and the persistence of high left-atrial pressure may predispose patients to atrial fibrillation [Tanné 2008]. The patient discussed here presented with significant PPM with severe postcapillary pulmonary hypertension, as evidenced by right-heart catheterization results despite an asymptomatic condition. We believe that in these cases surgery is mandatory in order to prevent the progression to irreversible precapillary pulmonary hypertension, which could compromise the feasibility and the long-term results of a surgical prosthesis replacement. Mitral valve replacement in a small annulus ring is a very challenging procedure for surgeons. Mitral prosthesis replacement should be based on a radical excision of the subvalvular apparatus and part of the ring in order to place a prosthesis that is as large as possible.

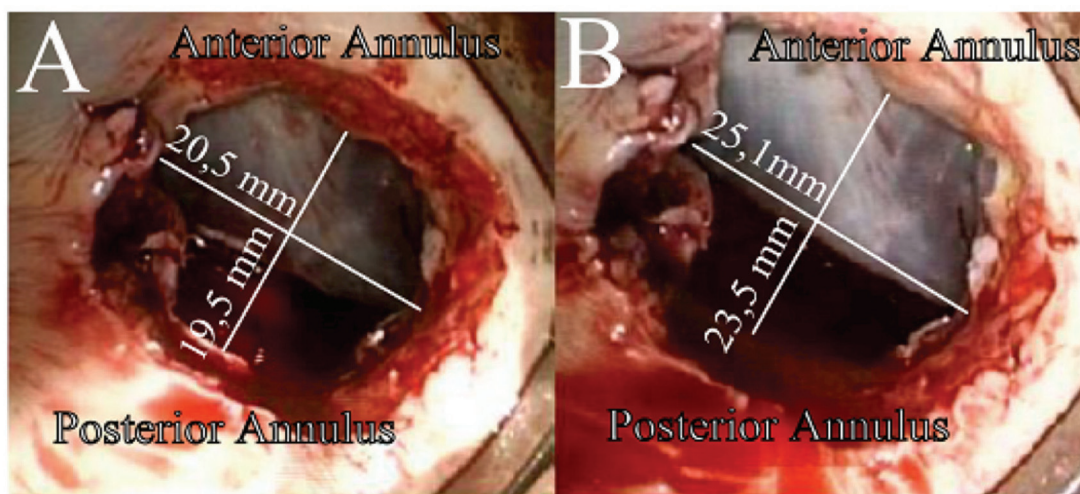


Figure 2. A. Mitral annulus diameter after removal of the 19-mm St. Jude prosthesis. B. Mitral annulus diameter after radical excision of subvalvular apparatus and part of the ring.

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