Growth of mitral annulus in the pediatric patient after suture annuloplasty of the entire posterior mitral annulus

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Abstract

When mitral annuloplasty is performed in small children, room for annular growth should be allowed. However, it has not been reported how the valve develops after mitral annuloplasty of the entire posterior annulus. We report a case showing traces of annular growth at redo surgery. A female patient suffering from mitral valve insufficiency due to annular dilatation underwent modified Paneth plasty with Kay–Wooler commissural plication annuloplasty at the age of two years one month. In redo surgery 8.4 years after initial repair, enlargement of the commissural portion of the posterior annulus in addition to enlargement of the anterior leaflet and anterior annulus was observed. Modified Paneth plasty reinforced with a pericardial strip and Kay–Wooler annuloplasty of the posteromedial commissure were performed. Mitral orifice size measured with the Hegar dilator was 18 mm after the re-repair, increasing from 16 mm after the initial repair. Taking into account the normal mitral annulus diameter related to body surface area (BSA) of 16 mm at initial operation and 20 mm at redo surgery, the increase in mitral orifice size from 16 mm to 18 mm in this patient may be regarded as the annular growth in 8.4 years.

Keywords: Mitral valve insufficiency; Heart valve disease; Cardiovascular surgical procedures; Re-operation

1. Introduction

After the performance of suture annuloplasty of the entire posterior annulus in small pediatric patients, how the mitral valve develops is a matter of concern. We report on a case of redo mitral valve repair, in which intraoperative photographs demonstrate evidence of annular growth.

2. Case report

A female patient aged two years one month with body surface area (BSA) of 0.48 m² and suffering from severe mitral regurgitation (MR) of unknown etiology was referred to our hospital for surgery. Echocardiography revealed grade 4 MR, left ventricular ejection fraction (LVEF) of 78%, left ventricular internal dimension at end-diastole (LVIDd) of 40 mm, and mitral annular diameter of 27 mm. On surgical inspection the mitral annulus was markedly dilated. No structural defects of the mitral leaflets or chordae tendineae were found. The patient underwent suture annuloplasty of the mitral valve, i.e. modified Paneth plasty with 4-0 Prolene (polypropylene monofilament) sutures and in addition Kay–Wooler commissural plication annuloplasty of the posteromedial commissure in order to achieve better coaptation of the mitral leaflets. Mitral orifice size measured with the Hegar dilator after mitral repair was 16 mm. The normal mitral annular diameter related to the patient’s BSA of 0.48 m² calculated by the nomogram of Rowlatt et al. [1] is 16 mm. Echocardiography showed no MR at the patient’s discharge from hospital.

The patient was referred to our hospital 8.4 years later for redo surgery because of increasing MR. Since one year before re-admission, the patient’s functional capacity had become progressively impaired. Echocardiography two years before re-admission showed grade 2 MR but nine months before re-admission grade 3 MR was present. Echocardiography on re-admission demonstrated grade 3 MR, LVEF of 64%, and LVIDd of 43 mm. On surgical inspection of the mitral valve, the mitral annulus was markedly dilated. Enlargement of the commissural portion of the posterior annulus in addition to enlargement of the anterior leaflet and anterior annulus was observed. The plication sutures of the initial operation were covered with fibrous tissue and remained in the central portion of the posterior annulus. There was no sign of break-down of the plication sutures (Fig. 1A). The anterior leaflet was slightly thickened, pliable and freely mobile. Growth of the posterior leaflet had been slightly disturbed (Fig. 1B). Modified Paneth plasty with 3-0 Prolene sutures reinforced with a pericardial strip and Kay–Wooler annuloplasty of the posteromedial commissure were performed. Good mitral valve competence was confirmed by injection of cold saline solution into the left ventricle (Fig. 1C). Mitral orifice size measured with the Hegar dilator after mitral repair was 18 mm. The normal mitral annular diameter according to

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Case Report

Fig. 1. Operative pictures during redo mitral valve repair. (a) A pair of suture tails of the Kay–Wooler plasty placed on the posteromedial commissure, (b and c) two knots with a pair of suture tails of running sutures of the modified Paneth plasty placed on each half of the posterior mitral annulus. (A) On inspection of the mitral valve before redo mitral valve repair, the sutures were covered with fibrous tissue and only the suture tails were seen. There was no sign of break-down of the suture annuloplasties. (B) Growth of the posterior leaflet was slightly disturbed compared with that of the anterior leaflet. (C) Completion of redo mitral repair, i.e. modified Paneth plasty with pericardial strip reinforcement and additional Kay–Wooler annuloplasty of the posteromedial commissure.

3. Discussion

For mitral valve repair in children suffering from MR accompanying mitral annular dilatation, in order to allow for growth of the annulus, annuloplasty without use of a complete annuloplasty ring has often been preferred [2–6], although complete annuloplasty ring has been used in children to avoid secondary annular dilatation [7]. In particular for patients under the age of one year [3] and those with BSA < 0.5 m² [5], suture annuloplasty by the Kay, Wooler, and Reed methods is most suitable, whereby the center of the posterior annulus is kept free from plication sutures and thus spared for growth. Multiple portions for growth are afforded by the modified de Vega plasty [2] or a row of compression mattress sutures [6]. Older children underwent suture annuloplasty of the entire posterior annulus such as Paneth plasty and de Vega plasty [5], which allow subsequent growth of the anterior annulus. In such cases it has not been demonstrated how the unfixed part of the annulus grows. The anterior mitral annulus is composed of a rigid fibrous component [8]. However, even in adult patients the anterior annulus dilates when the posterior annulus is fixed with a non-circumferential prosthetic ring [9]. The photographs presented in this paper show where and how the mitral annulus grows or dilates in pediatric patient after annuloplasty of the entire posterior annulus. In the present case, the commissural portion of posterior annulus was enlarged after 8.4 years; so were the anterior leaflet and the anterior annulus. When we divide mitral annular enlargement into growth and dilatation, the increase in mitral orifice size measured with the Hegar dilator from 16 mm after initial mitral repair to 18 mm after redo surgery may be regarded as mitral valve growth. These values are within the normal range according to nomogram of Rowlatt et al. [1]. On the basis of these findings, we are convinced that even after annuloplasty of the entire posterior annulus, annular growth occurs. This encourages us to apply modified Paneth plasty with reinforcement with a pericardial strip in infants and young children [10], who need more growth of the annulus.

In our case, use of a standard mitral annuloplasty ring would have been considered for the 10-year-old patient at redo surgery. Mitral repair with a biodegradable ring or a biodegradable suture annuloplasty may be helpful in preserving the native annulus growth potential in small children. However, according to our institutional policy, we routinely use suture annuloplasty reinforced with a pericardial strip in pediatric as well as adult patients.

In conclusion, annular enlargement at the commissural portion of the posterior annulus was observed as a trace of growth in redo surgery after annuloplasty of the entire posterior annulus in a pediatric patient.

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References