# Complex surgical repair of rheumatic mitral stenosis

**Taweesak Chotivatanapong[1], Piyawat Lerdsomboon[1], Vibhan Sungkahapong[2]**

[1]Departments of Cardiothoracic Surgery, [2]Departments of Anesthesiology, Central Chest Institute of Thailand, Nonthaburi, Thailand

*Correspondence to:* Taweesak Chotivatanapong, MD. Department of Cardiothoracic Surgery, Central Chest Institute of Thailand, Bang Kraso, Mueang Nonthaburi District, Nonthaburi, Thailand. Email: twchoti@gmail.com.

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## Clinical vignette

A 36-year-old Thai woman presents with a 6-month history of worsening dyspnea, chest pain and occasional hemoptysis. Her past medical history is significant for multiple upper respiratory tract infections as a child. On auscultation, a mid-diastolic rumbling murmur is heard at the apex, graded 3/6. Echocardiography demonstrates left atrial dilatation with a mitral valve area of 1.0 $cm^2$, a mean transmitral gradient of 10 mmHg and severe subvalvular fusion. The patient is referred for surgical correction of rheumatic mitral stenosis.

## Surgical techniques

### Preparation

The patient is positioned supine and maintained under general anesthesia. A radial arterial pressure line is placed and a pulmonary artery catheter is inserted via the internal jugular vein. Antibiotics are administered prior to surgical incision and the patient is prepped and draped in standard fashion.

### Exposition

Mitral valve repair is usually accomplished through the conventional transsternal approach. Bicaval venous cannulation is employed for cardiopulmonary bypass. The mitral valve is then exposed via the right atrium with a superior transseptal incision.

### Operation

Repair techniques for rheumatic mitral stenosis differ based on the specific etiologic valve lesions. In the setting of severe subvalvular fusion and leaflet restriction, a full commissurotomy is first performed to better assess leaflet mobility. All restrictive or obstructive chordae—primary, secondary or basal—are then resected. The necessary chordal resection will often render the valve regurgitant from excess leaflet mobility and prolapse. This is an anticipated problem that we preferentially correct with artificial neochordoplasty (1,2). A figure-of-eight 5-0 polytetrafluoroethylene (PTFE) suture resuspends the leaflet margin to the papillary muscle. Neochordal length is estimated with the reference point method, whereby the neochord is tied at a length that approximates that of a marginal chorda of a non-diseased segment. If leaflet mobility remains inadequate, a papillotomy is performed and may be safely extended to the middle of the papillary muscle. In rheumatic heart disease, leaflet pliability is often compromised and the tissue must be thinned to restore physiologic leaflet billowing (3). The appropriate plane is bluntly entered at the leaflet-annulus junction and extended to the rough zone of the leaflet (approximately two-thirds of the anterior leaflet and one-half of the posterior leaflet). Sharply excising the dissected layer of thickening from the leaflet surface augments the coaptation surface and reduces chordal stress during systole. All repairs are routinely reinforced with a remodeling ring annuloplasty using a complete rigid ring.

Severe calcification complicates repair but does not preclude it. Sharp dissection is used to open the hard, calcific commissures, while chordal resection, fenestration and papillotomy alleviate leaflet restriction. Leaflet calcification, including the often present obstructive calcium bar along the posterior leaflet, can be sharply

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debrided if it is not transmural. In addition, rheumatic valve destruction and leaflet retraction frequently mandate leaflet augmentation, for which we preferentially enlarge the anterior leaflet. The leaflet is incised 2 mm from the anterior annulus and extended across both commissures. Glutaraldehyde-fixed autologous pericardium is interposed with interrupted 5-0 polypropylene sutures, thereby restoring normal anterior leaflet function. Again, a rigid, complete ring remodeling annuloplasty buttresses the durability of the repair.

### Completion

Valve competence is tested with a pressurized ventricle. The atrial septotomy and right atriotomy are closed with a running prolene suture and the heart is de-aired with echocardiographic guidance. The patient is separated from cardiopulmonary bypass and the repair is interrogated with transesophageal echocardiography. The median sternotomy, pectoral fascia and superficial tissue are closed in standard fashion and the patient is transferred to the intensive care unit for recovery.

## Comments

### Clinical results

Rheumatic mitral valve repair has been performed in 221 patients (mean age 44 years, 64% female) between March 2003 and June 2011 at our institution (1). Despite complex reconstruction and 57% of patients undergoing concomitant procedures, the mean cardiopulmonary bypass time was 120 minutes. Operative mortality was excellent (2.7%) and only four patients (1.8%) required re-operation at a mean follow-up of 3 years. This was due to: (I) technical failure amenable to re-repair or (II) disease progression mandating valve replacement. Only one patient (0.5%) had a transient ischemic attack and there were no incident strokes. Importantly, functional status improved substantially and post-operative echocardiography confirmed effective and durable correction of mitral stenosis (mean mitral valve area 1.99±0.87 $cm^2$).

### Advantages

Although excellent results have been demonstrated in patients undergoing repair for rheumatic mitral regurgitation (3-5), less is known regarding the safety and efficacy of valve repair for rheumatic mitral stenosis. In our experience, repair of rheumatic mitral stenosis is feasible, reproducible and can be performed at low risk to the patient. As these patients are usually young, major benefits include: (I) avoidance of the life-long anticoagulation required of mechanical prostheses; (II) freedom from the short-term durability of bioprostheses in the mitral position in young patients; and (III) a lower risk of endocarditis due to less implanted prosthetic material.

### Caveats

The burgeoning success of mitral valve repair for rheumatic heart disease stems primarily from results of correction of rheumatic mitral regurgitation (3-5). Patients with rheumatic mitral stenosis present later in the disease process. Consequently, the valve sustains more damage prior to surgical intervention. Durable and successful repair of mitral stenosis mandates an understanding of the rheumatic inflammatory process and the myriad valvular lesions generated. Employing a stepwise and lesion-targeted approach to restore leaflet mobility, pliability and coaptation is critical to repair such complex valves. However, if severe valve destruction precludes effective repair, surgeons should not hesitate to replace the valve—a valve replacement should not be viewed as a failure. Until we learn more about long-term durability, repair of rheumatic mitral stenosis is generally reserved for females of reproductive age, poorly compliant patients deemed unsafe for warfarin or patients who live in areas too remote to receive routine medical care.

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## Footnote

*Conflicts of Interest:* The authors have no conflict of interest to declare.

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