Mitral Valve Replacement in a Patient With a Collapsed Lung

A 67-year-old man, with a history of pulmonary tuberculosis since 18 years old, presented shortness of breath because of severe mitral regurgitation. Magnetic resonance imaging showed that the heart was displaced into the left thoracic cavity and rotated clockwise around its long axis. The forced expiratory volume per second was 1.06 l (46.7% of the predicted value) and the vital capacity was 2.48 l (72.1% of predicted value). Surgery was performed through a median sternotomy. An internal mammary artery harvest retractor was used to obtain operative exposure. Extensive pericardial suspension was used to push the over-inflated right lung across the midline. Extracorporeal circulation was established. The mitral valve was replaced with a mechanical prosthesis. The patient was weaned easily from extracorporeal circulation and was extubated on the day of surgery. If preoperative respiratory function is adequate, cardiac surgery can be performed safely in a patient with only one functional lung. (JJTCVS 2001; 49: 122–124)

Key words: mitral valve replacement, tuberculosis, single lung

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Open heart surgery is rarely performed in patients with only one functional lung. There have been several reports, however, of cardiac surgery in patients after having undergone pneumonectomy.1–5 We have successfully performed mitral valve replacement in a patient with total left lung collapsed due to tuberculosis.

Case

A 67-year-old man was admitted to our hospital with a diagnosis of severe mitral regurgitation. His past medical history included pulmonary tuberculosis since 18 years old, and a consequent deformity developing in the left chest wall. But he did not complain much during daily life before developing severe mitral regurgitation. Marked precordial pulsation and a pansystolic murmur were detected at the fifth intercostal space on the anteroaxillary line. Chest radiography revealed total collapse of the left lung and displacement of the heart shadow to the left (Fig. 1).

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Fig. 1. Chest radiograph showing total collapse of the left lung and a shift of the heart to the left.
Magnetic resonance imaging (MRI) showed that the heart was displaced into the left thoracic cavity and rotated clockwise around its long axis (Fig. 2). The dilated left atrium is located behind the right atrium. The right lung was over-inflated across the midline. The forced expiratory volume per second (FEV1.0) was 1.06 l (46.7% of the predicted value). The vital capacity (VC) was 2.48 l (72.1% of the predicted value).

The room-air arterial carbon dioxide tension (PaCO2) was 45 mmHg and the oxygen tension (PaO2) was 92 mmHg. Transesophageal echocardiography confirmed severe mitral regurgitation due to torn chordae of the middle scallop of the posterior leaflet, and moderate tricuspid regurgitation. Electrocardiography showed atrial fibrillation.

Surgery was performed through a median sternotomy. A slide type retractor for the internal mammary artery (IMA) harvesting (Jostra AB, Lund, Sweden) was used on the sternal edge. The pleura was carefully separated from the pericardium. The right side of the pericardium was elevated extensively to prevent obstruction of the operative view by the over-inflated right lung. This provided wide exposure of the right atrium, and superior and inferior vena cavae (Fig. 3). Extracorporeal circulation (ECC) was established via an arterial cannula in the ascending aorta and bicaval venous cannulation. Cannulation was performed in the usual fashion. The aorta was cross-clamped and the heart was arrested with the infusion of cold blood cardioplegic solution. After separation of the interatrial groove, the left atrium was opened longitudinally. The mitral valve was exposed adequately and was replaced with a bileaflet mechanical prosthesis (31 STD; ATS Medical., Minneapolis, Minnesota, USA). Tricuspid valve annuloplasty was performed using the De Vega technique. The patient was weaned from ECC.

The patient was extubated on the day of the operation without difficulty. The postoperative recovery was uneventful, and he was discharged from our hospital on the 16 postoperative day.

Discussion

There are two main considerations when performing cardiac surgery in a patient with one functional lung. The first is adequate surgical exposure, and the second is respiratory tolerance. Few authors have described exposure of the heart in patients with only one functional lung. A standard sternal retractor could not be used in our case because the deformity in the left chest wall had caused increased stiffness. Therefore, we used a retractor for IMA harvesting, as previously described. This retractor lifted the left sternal edge, providing good exposure of the heart. Extensive pericardial suspension was used to push the over-inflated right lung across the midline. This provided a good view of the mitral valve. Mitral valve replacement was performed without difficulty.