

Repair of Mitral Periprosthetic Leak Secondary to Severe Annular Calcification

Yoshimasa Sakamoto, Kazuhiro Hashimoto, Hiroshi Okuyama, Shinichi Ishii, Shingo Taguchi, Hiroshi Kagawa, Kiyozo Morita

Department of Cardiovascular Surgery, Jikei University School of Medicine, Tokyo, Japan

Hemolytic anemia due to a periprosthetic leak is a rare complication of valve replacement that has a poor prognosis. Herein are reported the details of two women (aged 62 and 74 years) who had undergone mitral valve surgery four times each; in both cases, a fifth operation was performed because of hemolytic anemia due to periprosthetic leak. An anterior repair of the leaks was performed instead of

re-replacing the valve or standard repair, because the extensively calcified annulus led to sufficient space, and viable tissue was available to place direct sutures. Both patients made a rapid and uneventful recovery, with satisfactory short-term results; however, the long-term outcomes remain uncertain.

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Standard surgical procedures for heart valve replacement have been well established for some years. At the present authors' institution, the need for reoperation due to mitral valve restenosis after open or closed mitral commissurotomy and dysfunction of bioprosthetic valve has increased during recent decades. There are some inevitable complications of valve replacement, including thromboembolism, structural deterioration of the valve, prosthetic valve endocarditis, pannus formation, and periprosthetic leakage. The reported incidence of periprosthetic leak ranges from 0.3% to 5% (1-3), and reoperation for these leaks is associated with high mortality and high recurrence; consequently, this represents a major challenge for surgeons. Herein are reported the details of two elderly female patients, each of whom required a fifth mitral valve operation due to periprosthetic leakage.

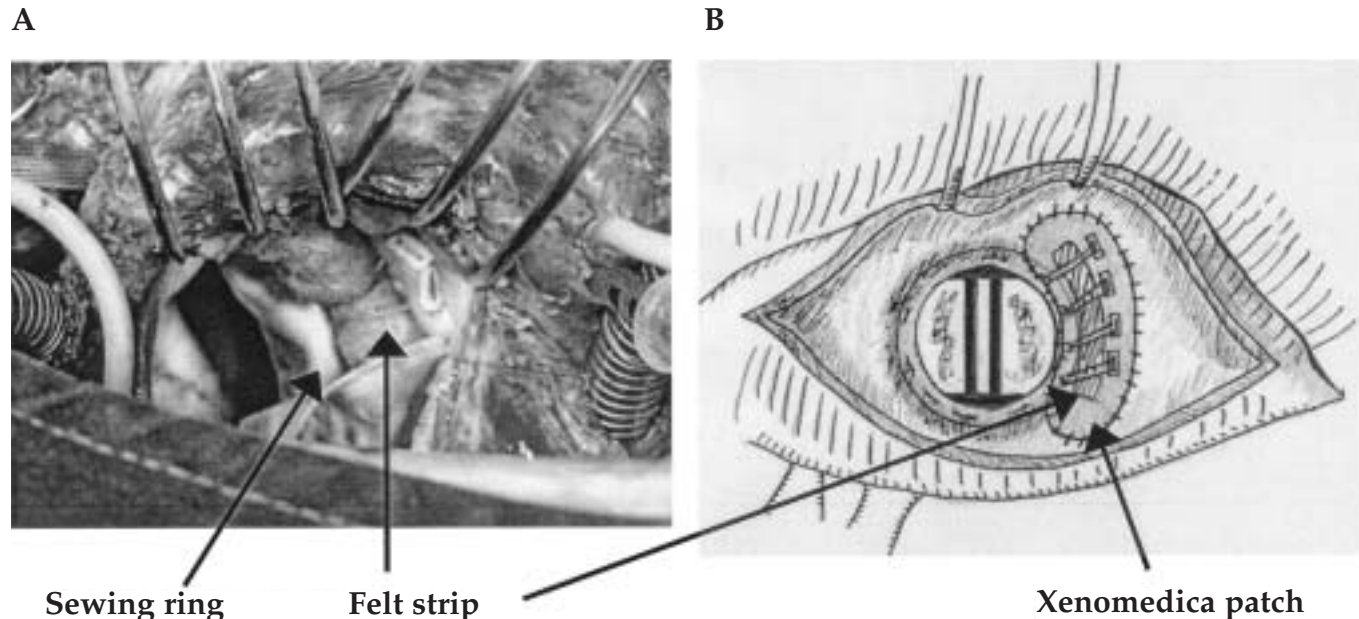
Case reports

Case 1

This 74-year-old woman first underwent open mitral commissurotomy for rheumatic mitral stenosis at the age of 32 years, at which time severe calcification existed around the entire mitral annulus. At the age of 53

years, she underwent mitral valve replacement with a 29-mm Ionescu-Shiley valve in order to treat restenosis. Gradual deterioration of this prosthesis occurred, and a third operation for valve replacement was performed at the age of 62 years, using a 27-mm CarboMedics valve. The patient was subsequently followed up on a regular basis at the outpatient department. Some 12 years after the third operation, hemolytic anemia developed, whereupon echocardiography showed the presence of small periprosthetic leaks around the posteromedial commissure and the mid-portion of the anterior annulus. At the fourth operation, the mitral valve was exposed via an incision in the right side of the left atrium. After removing the old CarboMedics valve, a new CarboMedics valve was implanted in standard manner, using a horizontal mattress suture buttressed with Teflon felt pledgets. Although the patient remained in a good condition for three years, without further periprosthetic leaks, hemolytic anemia re-developed due to recurrent periprosthetic leakage at the same location. When screened, the patient's serum lactate dehydrogenase (LDH) level had risen to 2,931U/l. Ultimately, a fifth operation was performed to close the leaks, with pledgeted sutures first being placed through the left atrial wall away from the calcified area, and then inserted into the sewing cuff. A double-folded Teflon felt strip was sandwiched into the space between the sutures, and a Xenomedica patch stitched to the non-calcified left atrial wall and to the prosthetic sewing cuff with a running 4-0 polypropylene suture (Fig. 1). Before com-

Address for correspondence:
Kazuhiro Hashimoto MD, Department of Cardiovascular Surgery,
Jikei University School of Medicine, 3-25-8 Nishishinbashi, Minato-
ku, Tokyo 105-8461, Japan
e-mail: kaz-hash@jikei.ac.jp



Sewing ring

Felt strip

Xenomeda patch

Figure 1: Closure of a posteromedial mitral periprosthetic leak. A) Intraoperative procedure (for details, see text). B) Schematic diagram of the procedure.

pleting patch closure, gelatin-resorcinol-formaldehyde glue was used to fill the space. No leakage was observed at a follow up examination conducted at 12 months after the final operation.

Case 2

This 62-year-old woman first underwent mitral valve plasty with a total circumferential purse-string suture and chordoplasty (4) at the age of 33 years. Mitral regurgitation progressed gradually, and a second operation was performed at the age of 41 years to implant a 29-mm Duromedics valve. Five years later, severe hemolytic anemia developed, and transesophageal echocardiography showed severe periprosthetic leakage around the mid-portion of the anterior annulus. At the third operation, this leak was closed successfully using the conventional technique of placing a horizontal mattress suture buttressed with Teflon felt pledgets around the site leak. At three months after the third operation, a fourth procedure was performed due to recurrent leakage at the same site. The 29-mm Duromedics valve was removed and replaced with a 29-mm CarboMedics valve; this was implanted by placing buttressed Teflon felt pledgets in the left ventricular myocardium. At six years after the fourth operation, the patient presented with symptoms of NYHA class III and hemolytic anemia due to recurrent leakage at the same site, combined with congestive heart failure due to aortic valve stenosis/regurgitation and tricuspid regurgitation. At this time, her serum LDH level had risen to 3,076 IU/l. At a fifth

operation, the leak was repaired and the aortic valve replaced with a 19-mm St. Jude Medical Regent valve, and tricuspid ring annuloplasty performed using an Edwards MC³ ring. As it was difficult to cut through the hard calcified atrial septum via a right atrial incision, the left atrium was opened from the right side in order to expose the mitral valve. The sewing ring was not endothelialized at the site of leakage (from 11 to 3 o'clock from the surgeon's view), which corresponded to the periprosthetic leak visualized on preoperative echocardiography. The leak was first closed by using the conventional technique of placing horizontal mattress sutures buttressed with Teflon felt pledgets around the periprosthetic leak. However, the tissue was so fragile that it was necessary to employ an additional technique, as described by Konstantinov et al. (5), in order to achieve complete repair by using healthy, full-thickness atrial septal wall. The 3-0 polypropylene sutures were then reinforced with Teflon felt, placed through the base of the inter-atrial septum from the right atrium to the left atrium, and then tied to the sewing ring of the prosthesis after being passed through the cuff (Fig. 2). These stitches covered the site of leakage, from the 11 to 3 o'clock positions. Following removal of the diseased aortic valve, two pledgeted stitches were placed at the 2 o'clock position (surgeon's view) through the left atrial incision via the aortotomy. Currently, the patient is well at three months after the final surgery, without any periprosthetic leakage.

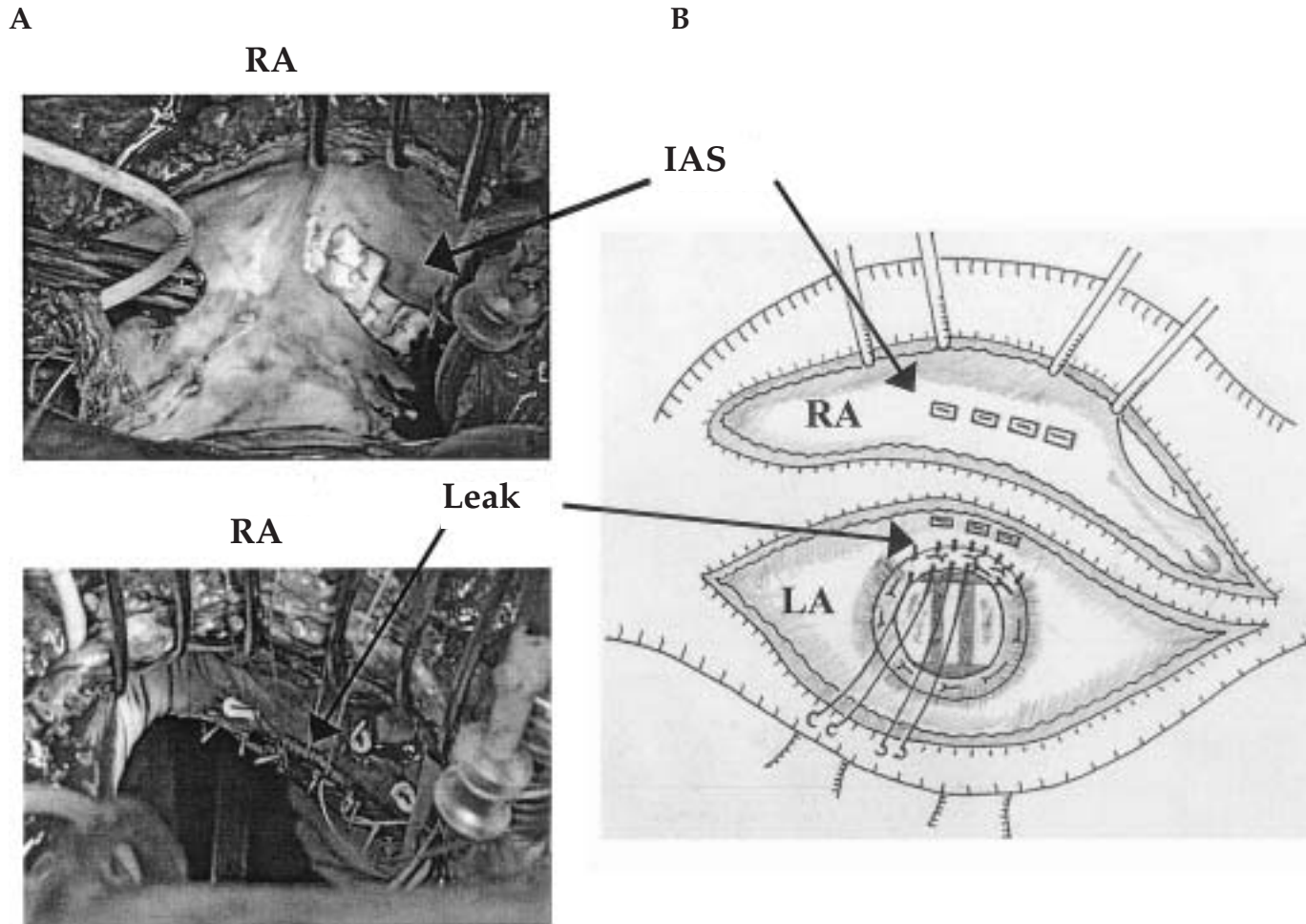


Figure 2: Closure of an anterior mitral periprosthetic leak. A) Intraoperative photograph (for details, see text). B) Schematic diagram of the procedure. IAS; Inter-atrial septum; RA: Right atrium; LA: Left atrium.

Discussion

Among a reported series of 3,334 autopsies, the prevalence of mitral annular calcification (MAC) was reported as 8.5% (6). Reoperation for periprosthetic leak due to MAC is associated with high mortality and high recurrence, which makes such procedures a major challenge for surgeons. Lytle et al. (7) reported the operative mortality rate to be 17% in patients with mitral periprosthetic leaks, while Mangi and Torchiana (8) found that direct suture of the leak and re-replacement of the valve had failure rates of 13% and 35%, respectively. El Asmar et al. (9) suggested that mitral valve repair might be performed safely even in the presence of extensive calcification of the posterior annulus, avoiding the risks of left ventricular rupture, thromboembolic events, and hemorrhagic complications associated with mitral valve replacement. Björk and Hultquist (10) described the standard technique of repair with buttressed horizontal mattress sutures for

aortic periprosthetic leaks in 1966.

For the present patients, an alternative method was chosen to repair the leaks rather than to replace the valve or perform a standard repair, because there was extensive calcification of the annulus such that insufficient space was available, despite viable tissue being available for the placement of direct sutures. It is important to localize the leak accurately preoperatively, or intraoperatively with transesophageal echocardiography, as it is difficult to judge the area of critical leakage during the surgical procedure.

Konstantinov et al. (5) suggested that a lack of suture support might result from erosion of the annulus and surrounding tissues by active infection, by weakness resulting from connective tissue disorders such as Marfan or Ehlers-Danlos syndromes, or by calcification that is impossible to remove. In the first patient, direct sutures could not be placed due to severe annular calcification, and consequently a conventional

method could not be used. However, the leak was closed successfully by double patching with Teflon felt strips and a Xenomedica patch. The application of a rather large mass of felt strip embedded between the valve sewing ring and calcified tissue might, potentially, cause problems with wound healing, although a longer follow up is necessary to verify this point. The technique of using atrial septal tissue adjacent to the denuded sewing ring to plug an anteromedial mitral periprosthetic leak was originally reported in 1997, by Konstantinov et al. (5), and four case reports have subsequently been identified in the literature. Konstantinov et al. (5) used the technique in two patients with Marfan syndrome and a frail mitral annulus, while Mangi and Torchiana (8) performed the operation on two patients with severe calcification of the mitral annulus. All four patients have shown good mid-term results, without recurrent leakage. If anterior periprosthetic leaks near the inter-atrial septum (as in the second patient) are difficult to repair using the standard technique, then this method may represent a simple and effective alternative approach.

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