

A Surgical Case for a Carbomedics Stuck Valve Due to Thrombotic Pannus Formation in the Mitral Position

Naoki Konagai, MD, Hiromi Yano, MD, Susumu Makimura, MD, Kazumasa Nishida, MD, Yasunori Iida, MD, Masahiro Sato, MD, and Tatsuhiko Kudo, MD

The patient was a 61-year-old female. She underwent mitral valve replacement (MVR) with a 27 mm Carbomedics valve and tricuspid valve annuloplasty using the DeVega method in September 1997. She has received anticoagulant therapy by aspirin and warfarin in a nearby hospital. Because of aggravating dyspnea and chest pain after an acute upper respiratory inflammation, she was transferred to our hospital on an emergency basis on April 14, 2003. Upon admission she went into cardiogenic shock and multiple-organ failure.

Biolite carbon coating prevents adhesion of thrombus or pannus on the sewing cuff of Carbomedics valve, and there were few reports of Carbomedics valve dysfunction by pannus formation. But in this case cineradiography demonstrated the prosthetic valve was fixed in the closed position. We diagnosed acute heart failure due to a stuck valve in the mitral position, and redo MVR was performed in emergency. Thrombotic pannus extended from the sewing cuff and into the orifice on the inflow and outflow sides of the valve, and fixed both leaflets in a closed position. The postoperative course was uneventful, and she was discharged on the 20th postoperative day, and now anticoagulant therapy is managed in the outpatient clinic of our hospital. A combination of cineradiography and echocardiography provides a detailed diagnosis of asymptomatic valve dysfunction. Periodical examination by a prosthetic valve specialist is necessary in order to perform adequate anticoagulant therapy, echocardiography and cineradiography after prosthetic valve replacement. (*Ann Thorac Cardiovasc Surg* 2005; 11: 186–9)

Key words: thrombotic pannus formation, stuck valve, carbomedics valve, mitral valve replacement

Introduction

By improvement of durability, anti-thrombosis and hemodynamics of the prosthetic valve, operative results and long-term results of prosthetic valve replacement became generally satisfactory. However, it is difficult to completely prevent prosthetic valve dysfunction by thrombus and pannus. Thrombus and pannus formation of the Carbomedics valve is prevented by an anti-thrombotic biolite carbon coating on the sewing cuff. But we experi-

enced a stuck valve with a Carbomedics heart valve due to thrombotic pannus in the mitral position that occurred in the 6th postoperative year. We report this case together with consideration from literatures.

Case Report

The patient was a 61-year-old female who underwent mitral valve replacement (MVR) with a 27 mm Carbomedics valve and tricuspid valve annuloplasty using the DeVega method in September 1997. Anticoagulant therapy by aspirin and warfarin was received in a nearby hospital. Because she complained of aggravating dyspnea and chest pain after an acute upper respiratory inflammation, she was transferred to our hospital on an emergency basis on April 14, 2003.

Upon admission, the blood pressure was 83/71 mmHg

From Department of Cardiovascular Surgery, Hachioji Medical Center of Tokyo Medical University, Tokyo, Japan

Received September 28, 2004; accepted for publication November 21, 2004.

Address reprint requests to Naoki Konagai, MD: Department of Cardiovascular Surgery, Hachioji Medical Center of Tokyo Medical University, 1163 Tate-machi, Hachioji, Tokyo 193-0998, Japan.

and pulse rate was 88/min. The prosthetic valve opening and closing sound by auscultation was indistinct. Laboratory findings showed multiple-organ failure: white blood cell count $9,160/\text{mm}^3$, red blood cell count $394 \times 10^4/\text{mm}^3$, hemoglobin 12.5 g/dL, hematocrit 37%, platelet count $19.5 \times 10^4/\text{mm}^3$, creatinine 2.4 mg/dL, aspartate aminotransferase 9,600 IU/L, alanine aminotransferase 2,973 IU/L, lactate dehydrogenase 22,200 IU/L, total bilirubin 2.4 mg/dL, C-reactive protein 11.4 mg/dL, International Normalized Ratio (INR) 5.52. She went into cardiogenic shock and multiple-organ failure, and a high dosage of catecholamine (dopamine 20 $\mu\text{g}/\text{kg}/\text{min}$, dobutamine 20 $\mu\text{g}/\text{kg}/\text{min}$) was required to maintain circulatory hemodynamics.

Chest X-ray demonstrated a cardiothoracic ratio of 55%. Pulmonary congestion and pleural effusion were recognized. An electrocardiogram showed sinus rhythm, a heart rate of 98/min with incomplete right bundle branch block and left atrial overload. The movement of the prosthetic valve in the mitral position was indistinct only by transthoracic echocardiography, but emergency cineradiography demonstrated the prosthetic valve fixed in a closed position (Fig. 1).

Based on these findings we diagnosed acute heart failure due to a stuck valve in the mitral position caused by thrombus or pannus, and emergency redo MVR was performed. Ascending aorta and both vena cava were cannulated and cardiopulmonary bypass was established. The sewing cuff of the removed Carbomedics valve was covered with pannus on both sides of the valve, and red thrombosis was observed covering the inflow and outflow sides of one leaflet (Fig. 2). A 25 mm Carbomedics valve was implanted in an anti-anatomical orientation, and the patient was weaned from cardiopulmonary bypass under intra-aortic balloon pumping support. The postoperative course was uneventful and she was discharged on the 20th postoperative day. Anticoagulant therapy is now managed in the outpatient clinic of our hospital.

The removed prosthetic valve was returned to Carbomedics Inc. for analysis, and was sent out for pathological analysis at Case Western Reserve University School of Medicine. Fibrotic pannus with a little cell component was observed that extended from the sewing cuff into the orifice on the inflow and outflow sides. The acute thrombosis was red in color and present on the leaflet surface. The chronic thrombus was white in color and present on the edge of leaflet and the hinge areas. The sewing cuff was removed and the pyrolite valve assembly was cleaned after pathological analysis, and then hy-

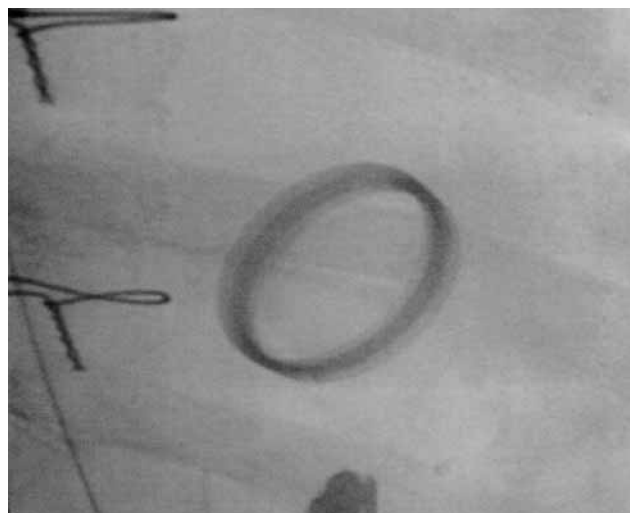


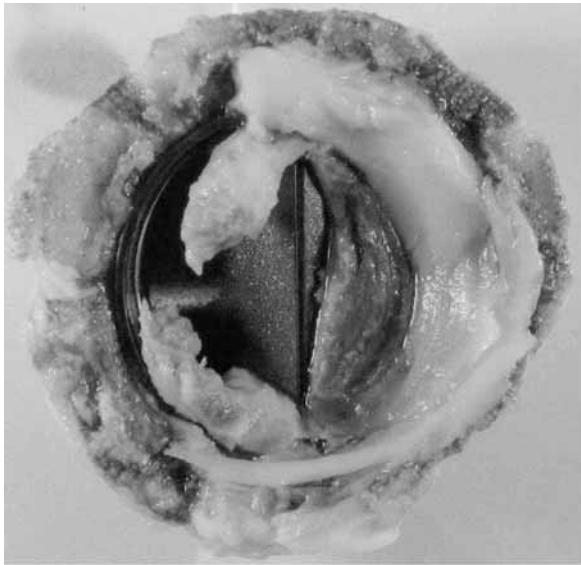
Fig. 1. Cineradiogram.

Cineradiography demonstrated that the artificial valve was fixed in closed position.

drodynamic testing was performed in a vitro heart valve function tester. Results of the testing found the valve met all test requirement specifications in effect at the time of manufacture.

Discussion

Various prosthetic valves have been developed since Harken et al.¹⁾ reported successful aortic valve replacement (AVR) using the ball valve. Now, the second-generation bileaflet disk valves have been used clinically, for example, the St. Jude Medical valve since 1977, Carbomedics valve since 1986 and ATS valve since 1992. Operation results and long-term results were generally satisfactory by improving of durability, anti-thrombosis and hemodynamics of the prosthetic valve.²⁻⁴⁾ But there are some reports of thrombotic valve dysfunction in the mitral position caused by inadequate anticoagulant therapy and thrombotic condition.^{5,6)} In addition, there are some reports of prosthetic valve dysfunction due to pannus formation in the cases of AVR using the St. Jude Medical valve. In the aortic position, it has been pointed out that in the St. Jude Medical valve, one of the pivot guards placed in the ventricular septum or left ventricular wall and pannus formation may restrict the opening of the leaflet.^{7,8)} The sewing cuff of the Carbomedics valve is an coated in Biolite carbon that is an antithrombotic material and prevents thrombus and pannus formation. Therefore there were few reports of Carbomedics valve dys-



Inflow side

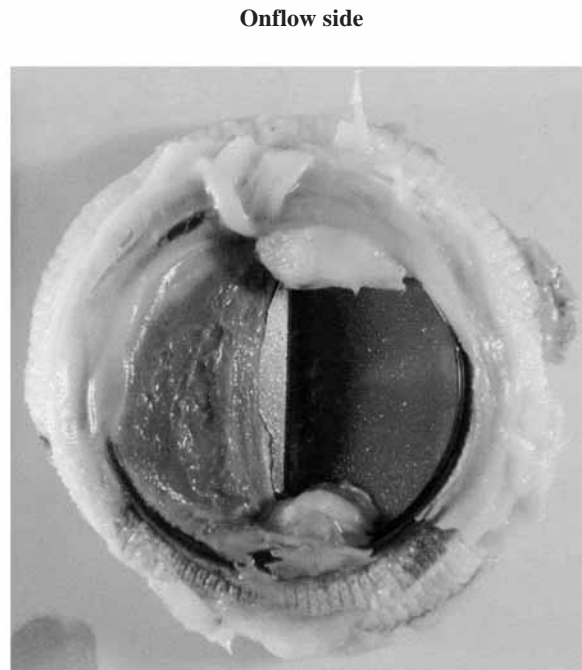


Fig. 2. Excised Carbomedics valve.

On both sides of the valve, the sewing cuff was covered with pannus and red thrombosis was observed covering one leaflet and white thrombosis was observed on the edge of the leaflet and in the hinge area.

function by pannus in comparison with the St. Jude Medical valve, and there was only one report of thrombotic pannus in the mitral position.⁹⁾ Three hundred sixty-five cases of prosthetic valve replacement have been performed in our hospital and the Carbomedics valve was used for 215 cases. This case was our first experience of redo valve replacement due to a stuck valve caused by pannus formation.

Even if pannus invades the orifice of the prosthetic valve and restricts the movement of one piece of the leaflets of the bileaflet valve, symptoms of heart failure will not develop. In this case, it was thought that the complete fixation of bileaflet occurred by secondary thrombus after pannus formation due to inadequate anticoagulation and dehydration after an acute upper respiratory inflammation. If prosthetic valve dysfunction is discovered in the early stages, redo valve replacement should be performed before the patient experiences multiple-organ failure.

Echocardiography is a simple and easy technique to evaluate hemodynamic information about the pressure gradient however valve areas of the prosthetic valves. But accurate evaluation of the prosthetic valve function by a single echocardiography is often difficult, however, cineradiography exhibits information about leaflet movement of the prosthetic valve.⁷⁾ A combination of cineradiography and echocardiography provides detailed information of asymptomatic prosthetic valve dysfunction. Aoyagi et al.⁸⁾ performed cineradiography in 183 patients who underwent AVR with a St. Jude Medical valve, and 34 (18.6%) of the 183 patients had restricted leaflet movement with opening angles equal or greater than 20° (normal opening angle: 11.0±1.4).

Even if the sewing cuff is coated with Biolite carbon, microthrombus attached to valvular suture may develop pannus formation. In addition, adequate anticoagulant therapy is necessary in order to prevent secondary thrombus following pannus formation. In our hospital, INR has

been set in the range of 2.0 to 2.5 and all patients have received antiplatelet therapy with low-dose aspirin or ticlopidine. It seems to be important that the patients are managed periodically by a cardiac surgeon and scheduled cineradiography is performed together with echocardiography for early diagnosis of asymptomatic valve dysfunction.

Conclusion

The patient was a 61-year-old female who underwent MVR with a 27 mm Carbomedics valve. She fell into acute heart failure due to a stuck valve caused by thrombotic pannus, and was successfully treated by emergency redo valve replacement.

It is desirable to perform cineradiography and echocardiography regularly in order to discover detailed information of asymptomatic valve dysfunction due to pannus and thrombus formation. Periodical medical examination by a specialist of the prosthetic valve is necessary in order to perform adequate anticoagulant therapy together with echocardiography and cineradiography for the patients after the prosthetic valve replacement.

References

1. Harken DE, Soroff HS, Taylor WJ, Lefemine AA, Gupta SK, Lunzer S. Partial and complete prosthesis

- in aortic insufficiency. *J Thorac Cardiovasc Surg* 1960; **40**: 744–62.
2. Fernandez J, Laub GW, Adkins MS, et al. Early and late phase events after valve replacement with the St. Jude Medical prosthesis in 1200 patients. *J Thorac Cardiovasc Surg* 1994; **107**: 394–407.
3. Aagaard J, Tingleff J, Andersen PV, Hansen CN. Fourteen years' experience with the Carbomedics valve in young adults with aortic valve disease. *J Heart Valve Dis* 2003; **12**: 81–6.
4. Alsaddique AA. Carbomedics bileaflet prosthesis, experience with 165 uneventful implants. *Cardiovasc Surg* 2002; **10**: 512–6.
5. de Luca L, Vitale N, Giannolo B, Cafarella G, Piazza L, Cotrufo M. Mid-term follow-up after valve replacement with CarboMedics bileaflet prostheses. *J Thorac Cardiovasc Surg* 1993; **106**: 1158–65.
6. Copeland JG 3rd. An international experience with the CarboMedics prosthetic heart valve. *J Heart Valve Dis* 1995; **4**: 56–62.
7. Kuniyoshi Y, Koja K, Miyagi K, et al. Pannus formation in aortic valve prostheses in the late postoperative period. *J Artif Organs* 2003; **6**: 179–82.
8. Aoyagi S, Nishimi M, Kawano H, et al. Obstruction of St Jude Medical valves in the aortic position: significance of a combination of cineradiography and echocardiography. *J Thorac Cardiovasc Surg* 2000; **120**: 142–7.
9. Chung DA, Sherry EN, Chambers JB, Blauth CI. Thrombotic pannus causing mixed prosthetic mitral valve dysfunction. *Eur J Cardiothorac Surg* 2002; **22**: 312.