

## Mechanical Flow Obstruction After Heart Transplantation Diagnosed by TEE

Jean-Luc Canivet, Jean-Olivier Defraigne, Jean-Claude Demoulin and Raymond Limet

*Departments of Anesthesiology, Cardiovascular Surgery, and Cardiology, CHU du Sart-Tilman, Liège, Belgium*

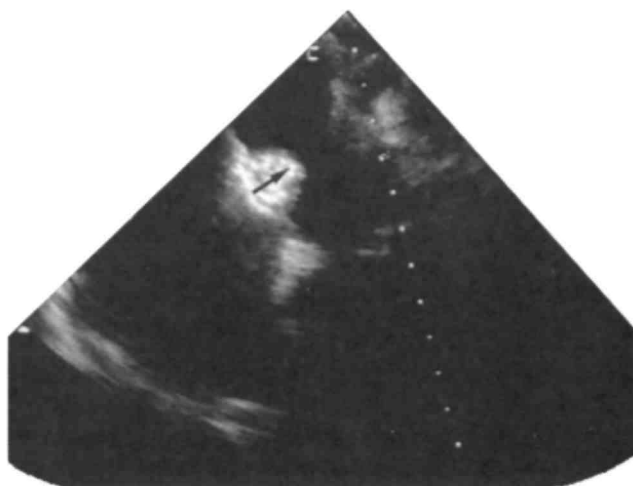
### ABSTRACT

We report a case of mechanical flow obstruction after heart transplantation caused by a prominent left atrium suture with a "pursestring" effect. The diagnosis was achieved by transesophageal echocardiography. The mean transstenotic gradient was measured at 13 mm Hg. Because of the profound hemodynamic and multisystemic failure, no surgical correction was attempted. The postmortem examination confirmed the stenosis at the level of the left atrium.

After orthotopic heart transplantation, several causes of hemodynamic failure have been identified, such as poor myocardial preservation, prolonged ischemic time, discrepancies between donor's and recipient's body surfaces, and recipient pulmonary hypertension with right ventricular failure [1, 2]. In these circumstances, the measurement of intracardiac pressures with Swan-Ganz or left atrial catheters is helpful for the management of the patient and adjustment of the inotropic drugs. In this perspective, echocardiographic findings are valuable for the differential diagnosis of cardiac tamponade with right ventricular failure. It also provides information on the segmental contractility and on the occurrence of valvular regurgitation or other abnormalities resulting from right heart failure and elevated central venous pressure such as reopening of a foramen ovale.

One case of severe obstruction at the site of left atrial anastomosis has been described after cardiac transplantation for congestive heart failure late in the course of a corrected transposition of the great vessels [3]. We report here a second case of this uncommon cause of heart transplant failure diagnosed by means of transesophageal echocardiography.

*Fig 1. The "hourglass" configuration of the left atrium due to the "pursestring" effect of the suture line (arrows). (Transesophageal echocardiography: transverse image.)*



**Fig 2.** Aliasing at the zone of flow convergence as velocity of blood flow increases in the restricted orifice. (Transesophageal echocardiography: longitudinal image.)



A 59-year-old man was considered for cardiac transplantation because of terminal hypertensive and diabetic cardiopathy requiring intravenous analeptic treatment. Body weight was 90 kg and his height was 185 cm. Diabetes was well controlled by insulin therapy and the renal function was normal. Precapillary pulmonary resistance reached  $292 \text{ dynes} \cdot \text{s} \cdot \text{cm}^{-5}$  (3.6 Wood units). A 44-year-old male donor was obtained. The cause of cerebral death was a gunshot wound of the head. His body weight was 90 kg and his height was 185 cm. A brief period of cardiac arrest occurred at admission and required 5 minutes of external massage. Because of hypotension episodes (systolic blood pressure less than 90 mm Hg), the donor was treated with dopamine ( $20 \mu\text{g} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ) and dobutamine ( $20 \mu\text{g} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ). Predonation echocardiography was normal. Despite the inotropic support of the donor, transplantation was planned considering the hemodynamic instability of the recipient. Cardiac arrest was obtained with St. Thomas' cardioplegia. An orthotopic cardiac transplantation was performed in the classic way. The total ischemic time was 2 hours 34 minutes. Weaning from cardiopulmonary bypass required administration of inotropic support (dobutamine and adrenaline, respectively,  $20 \mu\text{g} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$  and  $1 \mu\text{g} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ).

Postoperative hemodynamic state deteriorated rapidly because of severe right heart failure requiring high doses of pulmonary vasodilators and inotropes. The systemic arterial blood pressure was 90/40 mm Hg and the central venous pressure was 20 mm Hg. A Swan-Ganz catheter was placed. The pulmonary artery pressure was 50/30 mm Hg with a pulmonary capillary wedge pressure of 20 mm Hg. The cardiac output measured by thermodilution was 6.0 L/min and the heart rate was 100 beats/min. Biplane transesophageal echocardiography performed 3 days after transplantation showed an "hourglass" configuration of the left atrium, in both transverse and longitudinal planes, with a stenotic orifice at the level of the suture line between the recipient and the donor left atria (Fig 1). Color Doppler echocardiography showed a high velocity across the stenosis (Fig 2), and the mean transstenotic gradient calculated with the simplified Bernoulli equation reached 13 mm Hg (pulsed and continuous-wave Doppler). The left ventricular telediastolic volume was small (about 90 mL) with a normal left ventricular ejection fraction (0.65), whereas the right ventricle appeared severely hypokinetic and enlarged. The right ejection fraction measured with a Swan-Ganz thermodilution ejection fraction catheter was 0.25.

Unfortunately, despite extensive analeptic and mechanical support by an intraaortic balloon, the hemodynamic condition rapidly continued to deteriorate, leading to multiple organ failure and intractable right heart failure. Reoperation was considered impracticable and the patient died 2 days later. Postmortem examination confirmed the echocardiographic findings. A pursestring effect was found clearly on the suture line of the left atrium leading to mechanical flow obstruction.

### Comment

After heart transplantation, two-dimensional echocardiography has been used for detection of eventual atrial thrombi in recipients with postoperative acute cerebrovascular events. Sometimes a left atrial "mass" is observed on echocardiography after orthotopic heart transplantation and represents the echocardiographic appearance of the donor-recipient atrial anastomosis [3, 4]. The approximation of the two atrial borders by the continuous suture increases the thickness of the atrial wall at the level of the suture and causes abnormal echocardiographic

findings. This phenomenon is a consequence of surgical technique with creation of a prominent atrial anastomosis, which was called the "snowman" configuration by Stevenson and associates [5]. A prominent suture line also was observed by Fagan and associates [6] near the mitral annulus in the left atrium after orthotopic heart transplantation, with diastolic fluttering of both mitral leaflets suggesting high-velocity diastolic flow. It was attributed by them to the inversion and protrusion of the redundant native and donor atrial tissue into the common left atrium. The echocardiographic appearance of this phenomenon may be quite similar to the echocardiographic pattern found in the cor triatriatum, which is characterized by the presence of a transverse fenestrated septum between the pulmonary veins and the mitral valve.

After heart transplantation, cardiac failure most commonly is related to inadequate preservation or to elevated pulmonary resistances inducing right heart failure [1, 2]. This case illustrates a rare mechanical cause of posttransplantation heart failure recognized only by TEE. The snowman configuration of the left atrium, related to a prominent bulging suture line, usually is not associated with a hemodynamic impairment because of the large size of the atrial anastomosis. For the diagnosis of this condition, the advantage of transesophageal echocardiography lies in the close proximity of the esophageal probe to the left atrium, allowing very precise analysis of the region and accurate measurement of the transstenotic gradients. In the case reported here, the pursestring effect of the suture line with an hourglass configuration of the left atrium provoked a hemodynamically significant obstruction of the flow at the level of the anastomosis. It is clear that this obstruction precipitated the failure of the heart, which had required analeptic drugs for weaning from the extracorporeal circulation. In fact, at that moment, some degree of right heart failure was observed. Thrombus formation on a prominent suture line also may result in inflow obstruction. In our case, however, no thrombus was detected at autopsy.

## **References**

1. Page RD, Harringer W, Hodakowski GT, et al. Determinants of maximal right ventricular function. *J Heart Lung Transplant* 1992;11:90-8.
2. Reichart B. Size matching in heart transplantation. *J Heart Lung Transplant* 1992;11:S199-202.
3. Ulstad V, Braunlin E, Bass J, Shumway S, Molina E, Homans D. Hemodynamically significant suture line obstruction immediately after heart transplantation. *J Heart Lung Transplant* 1992;11:834-6.
4. Starling RC, Baker PB, Hirsch SC, Myerowitz PD, Galbraith TA, Binkley PF. An echocardiographic and anatomic description of the donor-recipient atrial anastomosis after orthotopic cardiac transplantation. *Am J Cardiol* 1989;64:109-11.
5. Stevenson LW, Dadourian BJ, Kobashigawa J, Child JS, Clark SH, Laks H. Mitral regurgitation after cardiac transplantation. *Am J Cardiol* 1987;60:119-22.
6. Fagan LF, Penick DR, Williams GA, Labovitz AJ, Pearson AC. Two dimensional spectral Doppler and color flow imaging in adults with acquired and congenital cor triatriatum. *J Am Soc Echo* 1991;4:177-84.