A case of left ventricular perforation due to balloon slip during percutaneous aortic valvuloplasty

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1. Case report

A 70-year-old woman was hospitalized for shortness of breath on exertion. She had a history of diabetes and cirrhosis due to hepatitis C. Cirrhosis was decompensated and Child–Pugh score was B. Transthoracic echocardiography (TTE) revealed severe AS. She felt that her symptoms were worsening, but surgical AVR was a high-risk procedure because of Child–Pugh Class B cirrhosis and pancytopenia. As TAVI was not available in Japan at that time, we decided to perform PTAV in order to improve the symptoms in heart team conference. PTAV was performed via the retrograde femoral artery approach under local anesthesia and TTE guidance. Coronary angiography showed that the coronary artery was intact. Furthermore, the left ventricle-aortic gradient was 99.9 mm Hg, and AVA was 0.72 cm² as measured by the Gorlin formula. We deployed a pacing catheter in the right ventricle and confirmed 1:1 capture and a systolic pressure of <50 mm Hg at 160 ppm (pace per minute). Next, we crossed the native aortic valve with a 5-Fr Judkins right diagnostic catheter and Radifocus® half-stiff straight wire (Terumo, Tokyo, JAPAN) and then exchanged the wire for a 0.035-inch Amplatz super-stiff™ guidewire Straight 3.5 cm Tip (Boston Scientific, Natick, MA, USA). Aortic annulus diameter was measured as 18 mm by TTE, and therefore, we chose an 18-mm balloon (Z-MEDI; NuMED, Hopkinton, NY, USA). The balloon was inflated under rapid pacing at 160 ppm; however, the balloon slipped into the LV, and we immediately pulled the balloon out of the LV (Fig. 1). Next, we inflated the balloon under rapid pacing at 170 ppm, and as a result, the balloon did not slip, and effective valvuloplasty was provided. However 50 s later, TTE revealed pericardial effusion, and the patient’s blood pressure suddenly dropped. Therefore, pericardiocentesis was immediately performed, and arterial blood was aspirated. Moreover, 5000 units of heparin injected at the start of the procedure was counteracted with 50 mg of protamine sulfate. We stabilized the patient’s hemodynamics by managing the respirator, intra-aortic balloon pumping, and percutaneous cardiopulmonary support. However, arterial blood was continuously aspirated through the pericardial drainage, therefore emergency surgical repair was performed. Intraoperative findings included a hematoma and a rip defect of 3 mm in the lateral LV wall suggesting that the balloon slipping into the LV at the second balloon inflation was causal. The defect was repaired with a bovine pericardial patch. However, the patient died due to disseminated intravascular coagulation 2 days postoperatively.

2. Discussion

Transcatheter aortic valve implantation (TAVI) is recommended in patients having a high risk for complications related to surgical AVR [1–3]. Percutaneous aortic valvuloplasty (PTAV) has been considered to be only temporarily effective, but it is still an important initial treatment as a bridge to surgical AVR or TAVI in patients who are hemodynamically unstable or have symptomatic severe AS and require urgent major non-cardiac surgery [1]. PTAV has the advantage of being less invasive, but balloon slip is fatal. When the balloon slips, apart from the loss of curative effect, fatal complications such as LV perforation may also occur. Rapid pacing has been reported as a safe and effective method to provide the transient reduction of cardiac output during balloon inflation, and the balloon must be inflated only when there is 1:1 capture; systolic pressure is <50 mm Hg, and pulse pressure is <10 mm Hg [4].

In addition, we want to recommend that the stiff wire should be delivered onto the cardiac apex. The stiff wire is easy to be delivered on the lateral wall because the stiff wire goes down retrogradely from left to right through the aortic arch, and tends to go directly toward the LV lateral wall through the aortic valve. In addition, it is difficult to deliver the wire onto the apex in small LV cavity due to concentric hypertrophy in severe AS and the stiff wire is difficult to maneuver. When the wire is located in the lateral wall, there is a risk that the balloon sticks into the LV wall if the balloon slips, because the distance between the aortic valve and the LV lateral wall is short. To deliver the stiff wire onto the apex, we use the following technique: we cross the aortic valve with a 5-Fr Judkins right diagnostic catheter and turn the catheter clockwise in the left anterior oblique (LAO) and cranial projection after crossing the valve with a 0.035-inch guidewire. The Judkins right diagnostic catheter is easy to turn toward the apex, and the stiff wire can be delivered onto the apex. The correct positioning of the stiff wire onto the apex should be confirmed by several methods. Not only frontal view but also RAO projection and LAO and cranial projection are useful to confirm the position of the stiff wire (Fig. 2A, B). The correct position of the stiff wire on the LV is critical, and maximum efforts should be put forth in its placement onto the apex. And also, TTE is very useful in assessing the position of the wire (Fig. 2C). Moreover, TTE has the advantage of immediately detecting complications such as cardiac tamponade, aortic regurgitation, and mitral regurgitation.

In conclusion, PTAV is one of the therapeutic methods for patients with severe AS having high risk for surgical AVR and also the technical basics of TAVI. One of the most critical complications of PTAV is balloon slip because it is often fatal. Therefore, the placement of the stiff wire onto the apex is very important to avoid the LV injury due to balloon slip.
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References


Yukiko Mizutani*
Norio Tada
Kaname Takizawa
Tatsushi Ootomo
Naoto Inoue
Taiichiro Meguro
Sendai Kousei Hospital, Japan

*Corresponding author at: Department of Cardiology, Sendai Kousei Hospital, 4-14 Hirose-machi Aoba-ku Sendai, Miyagi 980-0873, Japan.
Tel.: +81 22 222 6181; fax: +81 22 222 6189.

E-mail address: eau.yuki@hotmail.co.jp.

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