CASE REPORT / ПРИКАЗ БОЛЕСНИКА

Transapical transcatheter aortic valve implantation in a patient with small body weight complicated by severe hypotension – an enigma successfully solved by echocardiography

Aleksandar Lazarević1,2, Toru Naganuma1, Satoru Mitomo1, Hiroyoshi Kawamoto1, Tatsuya Nakao1, Hisaaki Ishiguro1, Sunao Nakamura1
1New Tokyo Hospital, Department of Cardiovascular Medicine, Matsudo, Japan; 2University of Banja Luka, Faculty of Medicine, Banja Luka, Republic of Srpska, Bosnia and Herzegovina

SUMMARY
Introduction Transcatheter aortic valve implantation is currently considered an alternative treatment for older patients with severe aortic valve stenosis and increased surgical risk, but can be associated with multiple life-threatening complications.

Case outline An 83-year-old woman with severe symptomatic aortic stenosis, body weight of 29 kg and body surface area of 1.1 m² underwent transcatheter aortic valve implantation via transapical access. Severe hypotension occurred before the valve implantation, due to temporary distortion of the mitral valve apparatus by stiff wire, leading to acute mitral regurgitation. This complication was immediately recognized by continuous transesophageal echocardiography and managed by simple wire retrieval instead of applying mechanical circulatory support. After rewiring and predilatation of the stenotic aortic valve, a 23 mm balloon-expandable transcatheter stent-prosthetic valve was successfully implanted.

Conclusion This case demonstrates that continuous imaging during transcatheter aortic valve implantation is key to rapid diagnosis of life-threatening complications, associated with the procedure, especially during the early learning curve in transapical approach.

Keywords: transcatheter aortic valve implantation; transapical approach; acute mitral regurgitation

INTRODUCTION

Transcatheter aortic valve implantation (TAVI) has now become the standard of care for the high- and intermediate-risk elderly patients with symptomatic severe aortic stenosis [1, 2]. Two routes of delivery for TAVI are commonly employed for the balloon expandable valve – the transfemoral and the transapical route (Figure 1 a and b). In patients in whom a transfemoral approach is not feasible, a subclavian, direct aortic (all three approaches represent retrograde delivery), or transapical approach (anterograde delivery) can be utilized.

A mortality benefit has been shown for TAVI compared with conservative treatment in patients deemed inoperable, and the procedure was proven to be at least non-inferior to surgical aortic valve replacement in high- and intermediate-risk patients [1, 2].

Acute hypotension during TAVI is a complication mainly due to aortic/annular rupture, landing zone trauma, ventricular perforation, cardiac tamponade, severe aortic or mitral regurgitation, or ventricular dysfunction due to coronary occlusion [3, 4, 5]. Whatever the cause, hypotension might initiate a downward spiral of ischemia and myocardial dysfunction, leading to shock [3]. Accurate positioning and deployment of the transcatheter heart valve (THV) may be complicated by marked septal hypertrophy because of prominent angulation of the left ventricular outflow tract diameter and difficulty on maintaining coaxial alignment of the guidewire, sheath, and valve delivery catheter [6]. This may be particularly apparent during the transapical approach when the aortic valve position is fixed.

In this paper, we present a case of acute hemodynamic deterioration during transapical TAVI, due to temporary distortion of the mitral valve apparatus by stiff wire leading to acute mitral regurgitation and hypotension, which was immediately recognized by transesophageal echocardiography (TEE) and managed by simple wire retrieval instead of applying mechanical circulatory support. Continuous imaging is key to rapid diagnosis of life-threatening complications, associated with the procedure.

CASE REPORT

We report a case of a frail 83-year-old woman with severe symptomatic aortic stenosis. Based on the frailty, the patient was considered unsuitable for conventional surgery. The patient’s body weight was 29 kg, and body surface area 1.1 m². Due to very tortuous aorta and small

Примљено • Received: August 2, 2016
Ревизија • Revised: January 13, 2017
Прихваћено • Accepted: February 9, 2017
Online first: March 10, 2017

Correspondence to: Sunao NAKAMURA
Interventional Cardiology Unit, New Tokyo Hospital, 1271 Wanagaya, Matsudo, Chiba, Japan
boss0606@pluto.plala.or.jp
iliofemoral arteries, TAVI was performed by the transapical approach. The left coronary artery and the right coronary artery ostium heights were 13 mm and 16.5 mm, respectively. The left ventricular outflow tract diameter, sinus of Valsalva diameter, and sinotubular junction diameter were 15.9 × 23.3 mm, 29.2 × 29.6 × 31.9 mm, and 22.8 × 23.7 mm, respectively. The mean aortic gradient was 38.7 mmHg. The left ventricular ejection fraction was calculated to be 75% using a modified Simpson method. Indexed aortic valve area was 0.51 cm²/m²; mild mitral regurgitation (Figure 2a) and trace aortic regurgitation were recorded.

The TAVI procedure was performed under general anesthesia and continuous TEE guidance in the hybrid operating room. The left ventricular outflow tract diameter, sinus of Valsalva diameter, and sinotubular junction diameter were 15.9 × 23.3 mm, 29.2 × 29.6 × 31.9 mm, and 22.8 × 23.7 mm, respectively. The mean aortic gradient was 38.7 mmHg. The left ventricular ejection fraction was calculated to be 75% using a modified Simpson method. Indexed aortic valve area was 0.51 cm²/m²; mild mitral regurgitation (Figure 2a) and trace aortic regurgitation were recorded.

The TAVI procedure was performed under general anesthesia and continuous TEE guidance in the hybrid operating room. An anterior left mini-thoracotomy was performed to obtain access to the apex of the left ventricle. After the puncture of the apex, a guide wire was malpositioned into the left atrium due to narrow left ventricular outflow tract diameter and severe left ventricle concentric hypertrophy, which was documented in fluoro, as well as in echo images. The wire was removed from the left atrium and was difficult to replace through the narrow aortic valve. Second puncture was attempted in order to redirect the wire across the aortic valve. After the second puncture, a 23 mm Sapien XT valve (Edwards Lifesciences Inc., Irvine, CA, USA) was successfully implanted following predilatation with a 20 mm balloon (Figure 3 c, d, and e).

**DISCUSSION**

We report a case with mitral apparatus distortion and hemodynamic deterioration due to severe mitral regurgitation detected by TEE during transapical TAVI. Continuous imaging is key to rapid diagnosis of life-threatening complications associated with the procedure. A wire can be passed underneath a mitral chordae utilizing the antegrade apical approach [6, 7]. Sliding forward a wire or a catheter over the wire might result in temporary distortion of the mitral valve apparatus, leading to acute mitral regurgitation [3]. If resistance to catheter advancement is noticed or transient mitral regurgitation is assessed by TEE, this
should alert the operator to the possibility. To avoid the subchordal passage, rewiring or the use of a balloon flotation catheter might be considered.

It is critically important to have communication between the echocardiographer and other TAVI team members about the qualitative features of the left ventricular outflow tract and septal geometry [7]. Accurate positioning and deployment of the THV may be complicated by marked septal hypertrophy because of prominent angulation of the left ventricular outflow tract and difficulty on maintaining coaxial alignment of the guidewire, sheath, and valve delivery catheter. This may be particularly apparent during the transapical approach when the apical cannula position is fixed. In addition, a hyperdynamic hypertrophied septum may cause the THV to be superiorly displaced during balloon inflation or unsheathing of the valve [3].

During the immediate implantation period, echocardiographic imaging is essential even though precise valve placement can be performed with fluoroscopic imaging alone [8, 9]. Echocardiographic imaging provides rapid and accurate assessment of the valve position, valve shape, leaflet motion, and gradients following the THV deployment. Color Doppler imaging provides prompt and precise feedback to the operator about the presence, location, and severity of aortic regurgitation, as well as coronary patency and mitral valve function [7, 9, 10]. Left ventricular dysfunction or aortic root catastrophe can be assessed within seconds as potential etiologies in this setting of hemodynamic compromise [11, 12].

The presented case report showed the importance of continuous TEE monitoring during the TAVI procedure. TEE seems be useful to clarify the etiology of sudden hemodynamic deterioration. Furthermore, it provides invaluable information with regard to treatment of severe hypotension during transapical TAVI by simple wire retrieval instead of applying mechanical circulatory support. TEE with general anesthesia remains to be an important option, especially during the early experience with transapical or transfemoral TAVI.

REFERENCES

Транскатетерска имплантација аортне валвуле трансапикалним приступом код болеснице са малом телесном масом и тешком хипотензијом – загонетка решена ехокардиографским прегледом

Александар Лазаревић1,2, Тору Наганума1, Сатору Митомо1, Хиројоши Кавамото1, Татсуја Накао1, Хисаки Ишигуро1, Сунао Накамура1
1Болница Новог Токија, Одељење за кардиоваскуларну медицину, Матсуо, Јапан;
2Универзитет у Бањој Луци, Медицински факултет, Бања Лука, Република Српска, Босна и Херцеговина

САЖЕТАК
Увод Транскатетерска уградња аортне валвуле представља алтернативно лечење старијих болесника са тешком стеноzem аортне валвуле и високим хируршким ризиком, а може бити праћена бројним компликацијама.
Приказ болесника Болесница стара 83 године, тешка 29 kg и површине тела 1,1 m², са тешком симптомом аортном стенозом, подвргнута је транскатетерској уградњи вештачке аортне валвуле трансапикалним путем. Пре уградње валвуле јавила се акутна митрална регургитација и тешка хипотензија узрокована дисторзијом митралне вавлуле чврстом жицом. Ова компликација је одмах препозната ехокардиографским прегледом и решена једноставним повлачењем жице натраг и репозицијом жице, уместо применом механичке циркулаторне подршке. После поновног пласирања жице и предилатације стенотичне аортне валвуле успешно је транскатетерским путем након надувавања балона угађена вештачка стент валвула пречника 23 mm.
Закључак Континуирано праћење болесника помоћу трансезофагусне ехокардиографије за време транскатетерске уградње аортне валвуле представља кључ за брzu дијагнозу компликација које могу да се јаве у току ове процедуре, посебно у раној фази учења трансапикалног приступа.
Кључне речи: транскатетерска уградња аортне валвуле; трансапикални приступ; акутна митрална регургитација

DOI: https://doi.org/10.2298/SARH160802064L