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Case Report

Interventional Bridging Therapy for Radical Cardiac Surgery in a Patient Seemed to be Inoperable Due to Very Poor Left Ventricular Function: A Case Report

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Abstract

Cases that are inoperable owing to poor preoperative conditions are sometimes encountered. However, there are some cases that are led to radical treatment by performing bridge therapy. Here, we presented a case of a patient with complex cardiac disease in an inoperable state who underwent bridging therapy that led to successful surgical treatment. A 73-year-old male who received hemodialysis treatment and had severe aortic valve stenosis and coronary artery disease planned surgical treatment. However, he was deemed inoperable owing to his low cardiac function and hemodynamic instability. Therefore, to escape from a fatal condition, we first performed balloon aortic valvuloplasty and percutaneous coronary intervention as palliative procedures. Subsequently, his cardiac function and hemodynamic stability remarkably improved; therefore, after 1 month, we performed a successful radical surgical treatment. Even in inoperable patients, bridging therapy leading to radical treatment is possible.

Keywords

bridge therapy; balloon aortic valvuloplasty; low cardiac function

Introduction

Preoperative condition is related to surgical outcomes. Therefore, a surgical procedure is not performed in cases with very poor preoperative conditions in general. In those cases, palliative procedures can occasionally serve as a bridging therapy and can lead to radical surgery. Here, we present a case of a patient with an inoperable complex cardiac disease with chronic hemodialysis and low cardiac function who underwent bridging therapy leading to radical surgery.

Case Report

A 73-year-old male was introduced to our department owing to performed surgical procedure for the right atrial tumor, aortic valve stenosis (AS), ischemic heart disease (IHD), and paroxysmal atrial fibrillation. He had a 7-year history of peritoneal dialysis followed by 1 year of hemodialysis. Other comorbidities included dyslipidemia and diabetes mellitus, and the introduction of dialysis was due to diabetic nephropathy. He has had no previous surgery. Two years ago, he was diagnosed with AS and IHD and was recommended for surgical treatment. However, he declined surgical treatment. Following the detection of a right atrial tumor, he was recommended surgical treatment again, wherein he voluntarily agreed.

In preparation for the planned surgery, a thorough examination was performed. Transthoracic echocardiography (TTE) revealed extremely depressed cardiac function with the following results: an ejection fraction (EF) of 12% and a low-flow low-gradient AS requiring surgery. The right atrial tumor detected in the lateral wall measured 19 $\times$ 21 mm and was suspected as myxoma (Fig. 1). Coronary angiography revealed three-vessel disease: the proximal segment of the right coronary artery had chronic total occlusion, the left anterior descending artery (LAD) and the proximal and middle segments of the left circumflex artery had severe stenosis. His blood pressure remained low, and he was unable to undergo hemodialysis properly. His preoperative very poor condition combined with a high in-hospital mortality risk of 22% according to EuroscoreII, led to the decision that the patient was inoperable. As early death was imminent without immediate treatment, balloon aortic valvuloplasty (BAV) and percutaneous coronary intervention (PCI) for LAD were performed. It was a very high-risk procedure, therefore the procedure performed under extracorporeal membrane oxygenation (ECMO). Both BAV and PCI were performed with left femoral artery approach. BAV is a treatment that uses a balloon catheter to dilate a stenosis aortic valve. In this case, we performed

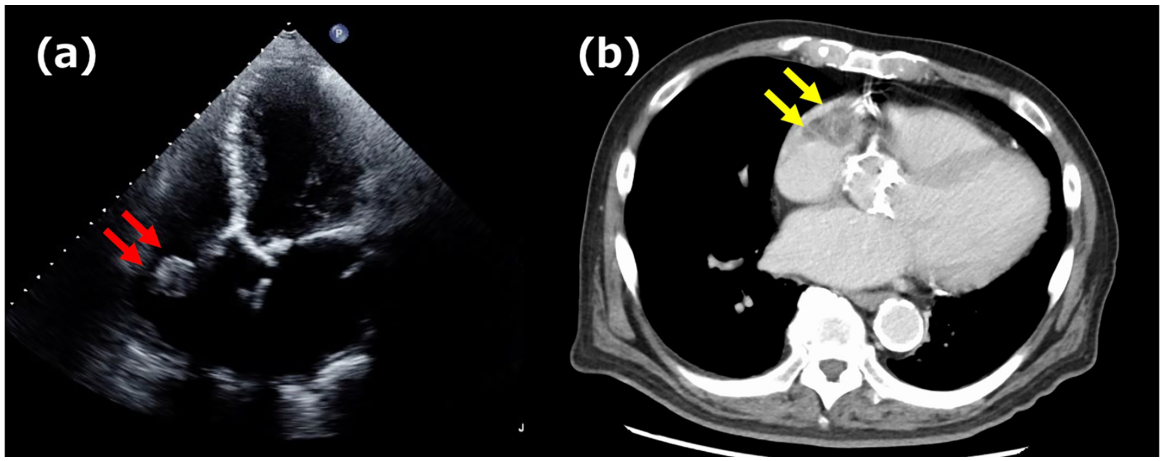

Fig. 1. Image findings of the tumor. (a) Transthoracic echocardiographic image, red arrows indicate the tumor in the right atrium. (b) CT image, Yellow arrows indicate the tumor in the right atrium. CT, computed tomography.

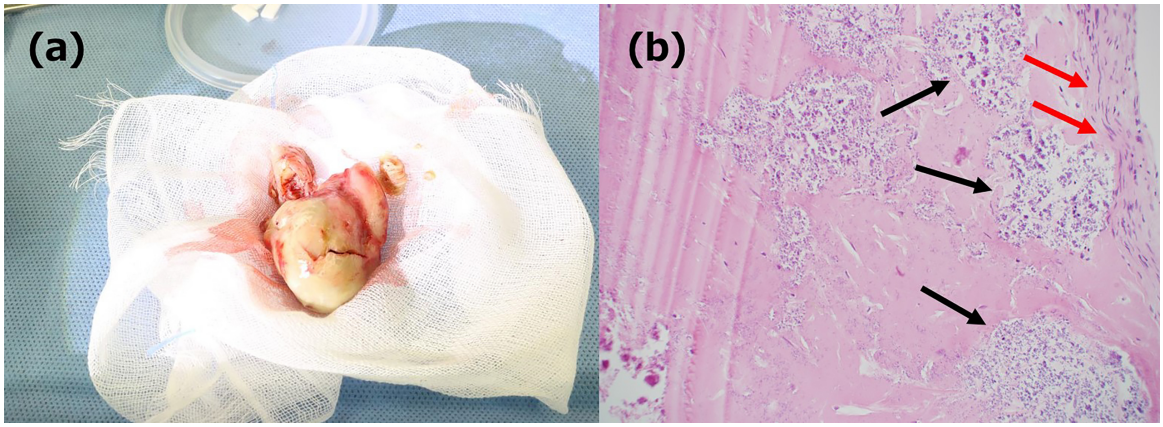

Fig. 2. The resected tumor and pathology findings. (a) The resected tumor. There was little adhesion. (b) Pathological image of the tumor. Red arrows indicate organized thrombus with fibroblast proliferation and black arrows indicate calcification scattered in islands in fibrin thrombus-like areas.

using a 20-mm valvuloplasty balloon (CAMEL™; Goodman, Nagoya, Japan). At the time of the procedure, the temporary pacing lead were inserted through the right internal jugular vein and balloon dilation was performed under rapid pacing of 200 bpm at the BAV. Three dilation attempts were unsuccessful due to slippage, but the fourth attempt was successful and a fifth dilation was also successful. According to TTE measurements, the aortic valve area before and after BAV changed from 0.82 cm^2 to 1.26 cm^2. PCI is a procedure that uses a catheter to improve blood flow in stenotic or occluded lesion in a coronary artery. In this case, the LAD lesion was evaluated with Optimal Coherence Tomography and pre dilation was performed using 2.0 $\times$ 15 mm non-compliant balloon (NC Kamui, Asahi Intecc, Aichi, Japan) and 3.0 $\times$ 15 mm non-compliant balloon (Hiryu plus, TERUMO, Tokyo, Japan) followed by placement 4.0 $\times$ 16 mm drug eluting stent (SYNERGY™ XD, Boston Scientific, Marlborough, MA, USA) and 3.0 $\times$ 12 mm drug eluting stent (XIENCE Skypoint™, Abbott, Chicago, IL, USA). No attempt has been made to open the chronic total occlusion lesion in the right coronary artery. ECMO was withdrawn without problems and no complications occurred during the procedure. One day postoperatively, his cardiac function remarkably improved, and the EF increased to 40%. His hemodynamics became stable, and hemodialysis could be performed without any problem. We determined that he was sufficiently healthy to tolerate the surgery and subsequently performed radical surgery 1 month following BAV and PCI.

We performed aortic valve replacement (AVR), coronary artery bypass grafting (CABG), right atrial tumor resection, and left atrial appendage closure. AVR was performed using a bioprosthetic valve (25 mm Inspiris; Edwards Lifesciences, Irvine, CA, USA). CABG is a procedure to create a bypass distal to a stenosed or occluded coronary artery using a graft such as internal thoracic artery or saphenous vein. The following was the graft design for CABG: left internal thoracic artery to LAD, aorta to diagonal branch to obtuse marginal branch to post descending artery. The great saphenous vein was used for aortocoro-

nary bypass, and sequential anastomosis was performed. The right atrial tumor had no surrounding adhesions and was easily detached. An organizing thrombus was suspected; however, pathological examination revealed that it was a calcified amorphous tumor (CAT) (Fig. 2). Left atrial appendage closure was performed using AtriClip (AtriCure, Inc., Mason, OH, USA).

The postoperative course was uneventful, and he was transferred to another hospital for continued rehabilitation. It has been one year since the surgery and the patient is alive with no change in cardiac function. Rehabilitation is on going to improve quality of life.

Discussion

Here, we performed BAV as a palliative procedure for severe AS. Although BAV is a minimally invasive procedure, transcatheter aortic valve replacement (TAVR) is also minimally invasive and can be used with curative intent. However, in Japan, only a few facilities perform TAVR for patients undergoing chronic hemodialysis; unfortunately, TAVR is not performed in our facility.

Some reports consider BAV as a bridging therapy [1–3]. Yanagisawa *et al*. [2] reported that BAV as a bridge therapy to transcatheter aortic valve implantation (TAVI) can be safely and effectively performed even during the TAVI training period. The review by Nwaejike *et al*. [3] examined whether BAV can be used as a bridge therapy to replacement treatments, including TAVI or SAVR. They recommended that BAV can be used as a bridge therapy; however, they considered it as an option for some patients who are at very high risk for either TAVI or AVR. Furthermore, they stated that the transition from BAV to definitive therapy is between a median of 2 and 7 months and that delaying definitive therapy should be avoided as the high mortality rate in the group that did not receive definitive therapy [3].

In the past, BAV did not show good results [4,5]; however, recently, with the development of devices and proficiency in the technique, the performance is stabilized. In addition, with the advent of the TAVI era, BAV has begun to be reevaluated, and several studies of its outcome have been conducted. Kapadia *et al*. [6], showed that BAV improves short term (3 months) life expectancy in patients in whom TAVI or surgical procedure was no feasible, but it was shown no to be a curative treatment.

Similarly, in the study by Ben-Dor *et al*. [7] the long-term prognosis with BAV alone is poor. However, BAV as a bridging therapy to TAVI or surgery is a viable technique and is associated with good outcomes [7]. Sandhu *et al*. [8] conducted a single-center retrospective analysis to examine the efficacy of BAV and concluded that it is effective both as a bridging therapy and for patients with no other treatment options. Rigatelli *et al*. [9] reported acceptable outcomes of the modified BAV technique for fragile and symptomatic patients, as in our case. Their modified BAV technique used no pacing and a minimally invasive approach [9]. Ford *et al*. [10] showed outcomes of BAV in patients with high comorbidities and high surgical risk (mean age, 88 $\pm$ 5.7 years; mean logistic EuroSCORE, 25.22% $\pm$ 14.5%) at a single institution. Of 55 cases, no intraoperative deaths and a low 30-day mortality were observed (n = 2, 3.9%); furthermore, six patients underwent bridge therapy to definitive valve replacement. They reported that BAV can be safely and effectively performed even in high risk and older adult cohorts of patients [10]. Kleczynski *et al*. [11] reported the results of BAV as bridging therapy as well as the results of BAV as a palliative therapy. As in previous reports, BAV as palliative therapy had a poor outcome (one-year mortality rate: 66.9%) [11]. However, a small number of patients who underwent BAV as palliative treatment improved their condition postoperatively and qualified for radical treatment such as TAVI. Similarly, in our case, BAV was initially performed as a palliative treatment, but the left ventricular function improved markedly, leading to curative treatment. It may be premature not to use BAV as a palliative treatment because of poor outcome.

CAT, which was first named by Reynolds *et al*. [12], is a relatively rare non-neoplastic cardiac mass. There have been several case reports but few large series on CAT. According to a systematic review by de Hemptinne *et al*. [13], the right atrium was the second most common site of CAT (21%), with the mitral valve or annulus being the most common (36%). The most frequent symptom was dyspnea (45%), followed by syncope (21%). Pulmonary and systemic emboli were reported in 31% cases. In this review, surgical resection was performed in most cases, and the prognosis was good [13]. In our case, no CAT-derived symptoms were noted. Preoperative diagnosis by CAT imaging is challenging, and the only way to diagnose the disease at present is by tissue diagnosis following resection.

Conclusion

Even in inoperable patients, bridging therapy leading to curative treatment is possible. Establishment of a treatment protocol incorporating bridging therapy will save more patients in the future, and we will continue to accumulate cases and consider appropriate timing and methods of bridging therapy. The CARE checklist was used when writing this case report (**Supplementary Table 1**).

Author Contributions

JL perfomed gather information on the case and manuscript writing. MT performed gather information on the case, data analysis, manuscript writing and coordination of the study. HK conceived of the study and reviewed the

manuscript. NM, YS, FS, MN, AH, SK, TS and NI helped gather information on the case. SY performed pathological analysis. HK reviewed the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work to take public responsibility for appropriate portions of the content and agreed to be accountable for all aspects of the work in ensuring that questions related to its accuracy or integrity.

Ethics Approval and Consent to Participate

This case report was approved by the Institutional Review Board of Asahikawa Medical University. Approval Number: 19207. Informed consent was obtained from the patient for scientific activity, including publication of this case report.

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Conflict of Interest

The authors declare no conflict of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://doi.org/10.59958/hsf.5779.

References

[1] Fukunaga H, Higashitani M, Tobaru T, Mahara K, Takanashi S, Takayama M. Emergent balloon aortic valvuloplasty as a bridge to transcatheter aortic valve implantation with marked risk reduction of perioperative and postoperative mortality. Cardiovascular Intervention and Therapeutics. 2016; 31: 151–155.

[2] Yanagisawa H, Saito N, Imai M, Minakata K, Fujita T, Watanabe S, *et al*. Successful balloon aortic valvuloplasty as a bridge therapy to transcatheter aortic valve implantation during the proctoring period. Journal of Cardiology Cases. 2015; 12: 113–116.

[3] Nwaejike N, Mills K, Stables R, Field M. Balloon aortic valvuloplasty as a bridge to aortic valve surgery for severe aortic stenosis. Interactive Cardiovascular and Thoracic Surgery. 2015; 20: 429–435.

[4] Otto CM, Mickel MC, Kennedy JW, Alderman EL, Bashore TM, Block PC, *et al*. Three-year outcome after balloon aortic valvuloplasty. Insights into prognosis of valvular aortic stenosis. Circulation. 1994; 89: 642–650.

[5] Percutaneous balloon aortic valvuloplasty. Acute and 30-day follow-up results in 674 patients from the NHLBI Balloon Valvuloplasty Registry. Circulation. 1991; 84: 2383–2397.

[6] Kapadia S, Stewart WJ, Anderson WN, Babaliaros V, Feldman T, Cohen DJ, *et al*. Outcomes of inoperable symptomatic aortic stenosis patients not undergoing aortic valve replacement: insight into the impact of balloon aortic valvuloplasty from the PARTNER trial (Placement of AoRtic TraNscathetER Valve trial). JACC. Cardiovascular Interventions. 2015; 8: 324–333.

[7] Ben-Dor I, Pichard AD, Satler LF, Goldstein SA, Syed AI, Gaglia MA Jr, *et al*. Complications and outcome of balloon aortic valvuloplasty in high-risk or inoperable patients. JACC. Cardiovascular Interventions. 2010; 3: 1150–1156.

[8] Sandhu K, Krishnamoorthy S, Afif A, Nolan J, Gunning MG. Balloon aortic valvuloplasty in contemporary practice. Journal of Interventional Cardiology. 2017; 30: 212–216.

[9] Rigatelli G, Dell'Avvocata F, Conte L, Lanza D, Giatti S, Del Santo P, *et al*. Modified balloon aortic valvuloplasty in fragile symptomatic patients unsuitable for both surgical and percutaneous valve replacement. Cardiovascular Revascularization Medicine. 2018; 19: 444–447.

[10] Ford TJ, Nguyen K, Brassil J, Kushwaha V, Friedman D, Allan R, *et al*. Balloon Aortic Valvuloplasty in the Transcatheter Valve Era: Single Centre Indications and Early Safety Data in a High Risk Population. Heart, Lung & Circulation. 2018; 27: 595–600.

[11] Kleczynski P, Kulbat A, Brzychczy P, Dziewierz A, Trebacz J, Stapor M, *et al*. Balloon Aortic Valvuloplasty for Severe Aortic Stenosis as Rescue or Bridge Therapy. Journal of Clinical Medicine. 2021; 10: 4657.

[12] Reynolds C, Tazelaar HD, Edwards WD. Calcified amorphous tumor of the heart (cardiac CAT). Human Pathology. 1997; 28: 601–606.

[13] de Hemptinne Q, de Cannière D, Vandenbossche JL, Unger P. Cardiac calcified amorphous tumor: A systematic review of the literature. International Journal of Cardiology. Heart & Vasculature. 2015; 7: 1–5.