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## Severe cardiogenic shock due to acute onset of an aorto-to-right atrial shunt in a patient with aortic valve endocarditis

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## ABSTRACT

**INTRODUCTION:** Heart failure is the most common cause of death due to infective endocarditis. We report a case of a patient presenting with severe shock due to an infection-associated left-to-right cardiac shunt. **PRESENTATION OF CASE:** A 62-year-old man, who underwent aortic valve replacement five years previously, was admitted to ICU due to acute hemodynamic deterioration. A few days earlier, he had a septic episode with blood cultures positive for *Staphylococcus aureus* and clinical features of infective endocarditis. In ICU, transthoracic echocardiography revealed shunting from the aortic root to the right atrium resulting in severe cardiogenic shock.

**DISCUSSION:** This case report describes a near fatal complication of infective endocarditis, detected by routine use of transthoracic echocardiography.

**CONCLUSION:** Our case outlines the relevance of early cardiac surgery strategies in patients with infective endocarditis and we briefly discuss the current literature.

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## 1. Introduction

Heart failure is the most common cause of death due to infective endocarditis. This is mainly because of valvular insufficiency as a result of progressive infective destruction.<sup>1</sup> Nearly one third of the patients develop perivalvular abscesses leading to an increased rate of systemic embolization and death.<sup>1</sup> Usually cardiac surgery is necessary for restoration of valve function and abscess exclusion. We report a rare case of infective endocarditis in a patient with a biological aortic valve prosthesis with paravalvular abscess that acutely penetrated into the right atrium. Acute left-to-right shunting caused severe hemodynamic depression and multiple organ failure.

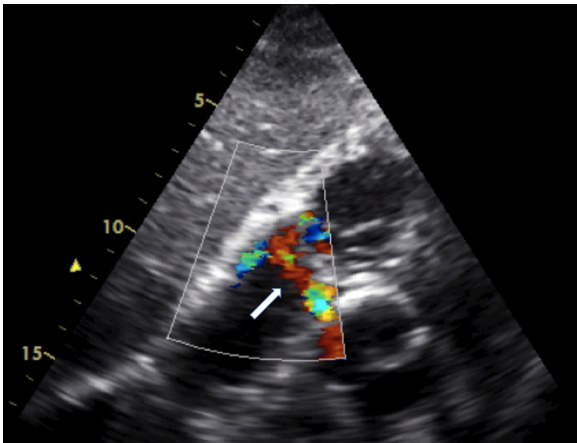
## 2. Presentation of case

A 62-year-old, HIV positive, male patient, who underwent bioprosthetic aortic valve replacement five years previously, was admitted to an external hospital with sepsis. Blood cultures were positive for *Staphylococcus aureus*. Septic shock was accompanied with respiratory insufficiency and renal failure. No specific focus

was found by an initial CT-scan of the chest and abdomen. A transesophageal echocardiography (TEE), performed upon admission, showed no endocarditis. Treatment with broad-spectrum antibiotics was initiated immediately. His clinical condition improved and the patient was discharged from ICU. Exactly one week after admission the patient developed symptoms of a stroke and CT detected a thromboembolism in the region of the posterior cerebral artery. Subsequent TEE, revealed a vegetation on the right coronary cusp of the aortic valve bioprosthesis and an aortic root abscess. The patient was hemodynamically stable, so semi-elective surgical treatment was planned. His neurological symptoms declined during the following days. On day 12 after admission, however, acute deterioration of the patient's hemodynamic conditions required urgent transfer to our hospital. On admission to the intensive care unit the patient required high dose vasopressor therapy. Transthoracic echocardiography (TTE) showed hyperdynamic biventricular function and shunting from the aortic root to the right atrium (Fig. 1). Position, dimension and exact anatomic conditions of the fistula were obtained by contrast enhanced computed tomography (Fig. 2). Cardiac surgery was performed immediately. After removal of the bioprosthesis, a large periannular abscess opening into the right atrium was uncovered (Fig. 3). A pericardial patch plasty was performed to exclude the abscess and another to seal the right atrium interiorly. In addition, a new bioprosthesis was implanted. Postoperatively, his clinical status improved quickly and the patient left the ICU nineteen days after surgical treatment in stable physical condition and without any neurological deficit. Eight weeks after surgery he was discharged.

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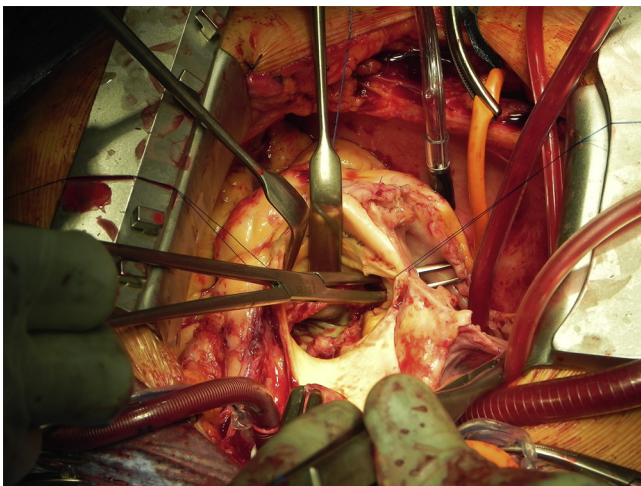
**Fig. 1.** Transthoracic echocardiography. Color Doppler revealed the newly detected aorto-right atrial shunt (arrow).



**Fig. 2.** CT-scan of the heart showing fistula between LVOT and right atrium (arrow).

### 3. Discussion

A high in-hospital mortality rate of up to 40% has been documented in prosthetic valve endocarditis.<sup>1</sup> In this case, several risk factors such as immunodeficiency, presence of an intracardiac



**Fig. 3.** Intraoperative view into the aortic root after explantation of the infected bioprosthesis. Cardiomy of the right atrium allowed for exact detection of the perforated root abscess.

abscess, transient cerebral ischemia and in particular staphylococcal sepsis were present. All these findings are associated with poor overall prognosis.<sup>1,2</sup> The European Society of Cardiology Guidelines for the treatment of infective endocarditis recommends cardiac surgery in these cases within a few days.<sup>1</sup> There is still a lack of evidence defining the optimal timing. Current publications are indicative of early cardiac surgery. Duk-Hyun et al. recently showed that cardiac surgery performed within 48 h after diagnosis of infective endocarditis with severe valve disease and large vegetations results in a significantly improved outcome.<sup>3</sup> To our best knowledge this work is the first randomized trial confirming the superiority of early surgical intervention. In a linear regression model with the data from 24 non-randomized studies Thuny et al. also presented a significant enhanced correlation between early cardiac surgery and survival.<sup>4</sup> Neurological complications are not a contraindication for cardiac surgery. They occur in about one third of all patients with infective endocarditis. In the absence of cerebral hemorrhage, cardiac surgery could be performed with a moderate rate of 3–6% for neurological deterioration.<sup>1</sup> Less invasive interventions, such as atrial or ventricular septal defect occluder, the Amplatzer duct occluder or coils, described feasible in patients with paravalvular leaks.<sup>1,5</sup> However, they seem not to be beneficial under time-critical conditions and implantation of non-biologic material in an infected field cannot be recommended. Finally, detection of a fistula in a cardiac chamber or the pericardium resulting in shock remains an inescapable indication for emergent cardiac surgery. In our case the patient was not yet intubated, so we did not perform TEE to prevent further aggravation of the hemodynamic conditions due to sedation. Two-dimensional TTE reliably detects left-to-right shunting but only the CT-scan allowed exact description of the lesion and planning of cardiac surgery. To reduce further risk of deterioration in-hospital transfer of the critically ill patient should be minimized. Three-dimensional (3D) TEE was not available. It is described as effective point of care imaging method with high sensitivity and specificity to verify diagnosis in several case reports.<sup>6,7</sup> Therefore, in the intensive care setting this new technique should be taken into account in future.

### 4. Conclusion

Infective endocarditis is a life-threatening disease and management could be challenging. Our case report supports the early surgery strategies and shows that maximum therapeutic efforts can achieve good outcomes even in complex medical situations associated with poor prognosis.

### Conflicts of interest

None.

### Funding

None.

### Ethical approval

The patient was asked for written consent! A copy is available on request.

### Authors' contributions

C. Siebers and T. Weig treated the patient on the ICU. They wrote the main part of the paper. R. Schramm added the surgical parts of the text and took the picture of the intraoperative view of the heart. A. Friedmann was involved in postoperative care of the

patient. He asked the patient for written consent and optimized the ultrasound-pictures. He wrote the legends for the figures and corrected the paper prior submission.

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