

# Infective Endocarditis as a Complication of Ventriculoatrial Shunting for Hydrocephalus Treatment

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## ABSTRACT

Our aim is to present a rare cause of tricuspid valve infective endocarditis (IE) in grown-up age due to cerebrospinal fluid shunt-associated infection. A 32-year-old woman, with a history of hydrocephalus that was treated with ventriculoperitoneal (VP) shunt at the age of 4, was admitted to a hospital due to fever. The VP shunt was replaced several times due to dysfunction and replaced with ventriculoatrial (VA) shunt 3 months before admission. Transesophageal echocardiogram revealed two separate VA catheters in the right atrium, with two floating echo formations, one attached to the tip of one catheter and the other to the anterior leaflet of tricuspid valve. Blood cultures grew methicillin-susceptible *Staphylococcus aureus*. Computed tomography scan showed bilateral pneumonia. The patient was treated with antibiotics followed by partial extraction of the VA shunt. After 8 weeks, the patient was discharged, without signs of infection. Two months later, she was readmitted due to fever, echocardiographic signs of catheter infection, and septic pulmonary embolization. Complete extraction of VA catheter was done and treatment was continued with antibiotics with complete recovery. Early diagnosis and optimal management that combines both conventional and surgical approaches is crucial for reducing the high embolic risk, risk of complications, and mortality risk.

**Key words:** Endocarditis, tricuspid valve, ventriculoatrial shunt

## INTRODUCTION

Despite advances in modern diagnostic and treatment strategies, infective endocarditis (IE) still carries a substantial risk of complications and mortality.<sup>[1]</sup> The prevalence of isolated tricuspid valve IE is estimated at 2.5–3.1%<sup>[2]</sup> of all IE cases.

The risk factors for bacterial colonization as a source of bacteremia for tricuspid valve endocarditis are intravenous drug abusers, patients with implantable cardiac devices, indwelling catheters, or congenital heart disease.<sup>[3]</sup> A rare cause of tricuspid valve IE, especially in grown-up age,

is cerebrospinal fluid (CSF) shunt-associated infections. Nowadays, these cases are rarely described in literature. Ventricular CSF shunts are commonly used in pediatric neurosurgery for the treatment of hydrocephalus of various etiologies. Most commonly performed are the shunting procedures including ventriculoperitoneal (VP), ventriculopleural, or ventriculoatrial (VA) shunt; endoscopic third ventriculostomy implies surgical creation of an opening in the floor of the third ventricle to enable drainage of CSF into the cistern.<sup>[4]</sup>

In this case report, we describe a rare case of distal VA catheter infection and catheter-related tricuspid valve IE.

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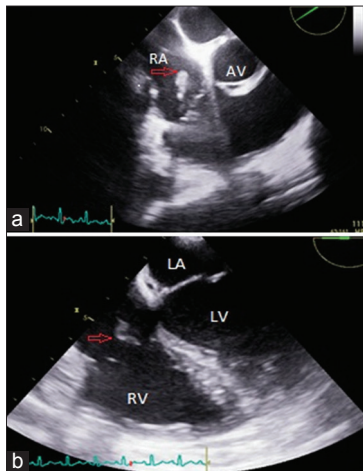
## CASE REPORT

A 32-year-old woman, with a history of innate hydrocephalus, was admitted to a regional hospital due to fever, tachypnea, and tachycardia. She complained of malaise, poor appetite, cough, and pain in the lower back; the symptoms appeared a week before admission.

Hydrocephalus developed as a result of aqueductal stenosis and was treated with the right-sided VP shunt at the age of 4. Due to malfunction, the VP shunt was subsequently replaced for several times. VA shunt was inserted 3 months before hospital admission and appeared to be functioning well.

Physical examination on admission revealed a body temperature of 39.2°C, heart rate of 105 beats/min, respiratory rate 22/min, and blood pressure of 110/60 mmHg. There were no signs of meningeal irritation.

Chest X-ray showed bilateral pneumonia. Computed tomography (CT) scan identified right-sided sacroiliitis and confirmed bilateral pneumonia. Transthoracic echocardiography (TTE) showed VA catheter tip in the right atrium, with no pathological changes on the valves or the catheter. Repeat blood cultures grew methicillin-susceptible *Staphylococcus aureus* (MSSA) sensitive to vancomycin. The patient was referred to tertiary hospital and further diagnostic and treatment. Transesophageal echocardiography (TOE) showed two separate VA catheters in the right atrium, with two floating echo formations, one attached to the tip of one catheter [Figure 1a] and the other to the anterior leaflet of the tricuspid valve, associated with mild tricuspid regurgitation [Figure 1b].



**Figure 1:** Transesophageal echocardiography: (a) mid-esophageal aortic valve short axis view 37°. Arrow points to the floating echo formation connected to the tip of catheter. AV: Aortic valve, RA: Right atrium. (b) Mid-esophageal four-chamber view 0°. Arrow points to the floating echo formation attached to the anterior leaflet of tricuspid valve. LV: Left ventricle, RV: Right ventricle, LA: Left atrium

Thoracic CT scan confirmed the existence of two twisted VA catheters, right and left sided, in the right atrium.

The patient was treated with antibiotics, according to antibiogram for MSSA. Repeated blood cultures remained sterile. After neurosurgical consultation, she continued the treatment at the clinic for neurosurgery, where a partial extraction of the VA shunt and placement of new VP shunt were performed. Due to malfunction, in the same hospitalization, VP shunt was removed and replaced with ventriculopleural shunt. The removed VA shunt was microbiologically negative. The further treatment was complicated with the development of the shunt-related nephritis. After 8 weeks of treatment, the patient was discharged in good general condition, with no signs of infection. Two months later, she was readmitted to hospital due to fever. Laboratory investigations revealed anemia with hemoglobin of 74 g/l, leukocytosis with white blood cells of 16, 5 × 10<sup>9</sup>/l, and raised C-reactive protein of 231 mg/l. Repeat blood culture grew methicillin-susceptible *S. aureus* (MSSA) sensitive to vancomycin. TTE as well as TOE showed a VA catheter within the right atrium with echogenic structure (1.3 cm × 0.7 cm) at the tip of the catheter. There was no vegetation on the tricuspid valve.

Thoracic CT scan confirmed the existence of VA catheter in the right atrium and identified the presence of inflammatory changes in both lungs that were complement to the septic emboli, suspected right-sided lung abscesses and bilateral pleural effusions. Endocarditis team reached a decision that complete extraction of VA catheter was warranted. Extraction was performed through the internal jugular vein access by a vascular surgeon. The intervention was performed without complications. TTE was repeated following the procedure, and there were no remaining catheter and no signs of IE. Treatment with vancomycin was continued for 2 weeks after this shunt removal, and repeated blood cultures remained sterile. The patient was discharged in good general condition with no signs of infection.

## DISCUSSION

We present herein a rare case of tricuspid valve endocarditis caused by VA shunt infection in adulthood. In the follow-up, the patient was readmitted due to relapse of infection with same microorganism complicated with shunt nephritis. Early diagnostics and multidisciplinary treatment that combined surgery and conventional antibiotic treatment led to complete recovery.

VA shunt was one of the oldest solutions for hydrocephalus that becomes standard treatment since 1952.<sup>[5]</sup> Over the subsequent years, this promising intervention led to remarkable concerns with the recognition of various range of severe complications related to<sup>[6]</sup> catheter dysfunction such as shunt infections, valve obstructions, catheter migrations,

shunt disconnections, malposition, or any combination of these reasons. However, infections are one of the most common complications of ventricular CSF shunts. Reports on infections incidence are variable and varied from 0.3% to 26%<sup>[7]</sup> with a mortality rate ranging from 1.5% to 22%. Shunt removal with internal antibiotic treatment (usually with external ventricular drainage) carries the highest shunt infection cure rate and lowest mortality rate.<sup>[8]</sup>

Today, VP shunts are the most preferred method of the treatment of hydrocephalus, but there is a notable patient population where VA shunt is needed.<sup>[6]</sup> Follow-up of patients with VA shunts is currently poorly defined. Consciousness of complications of CSF shunts such as infection and IE and long-term clinical and echocardiographic follow-up in patients with VA shunts is necessary to prevent severe complications in these patients.

## CONCLUSION

This is a rare case of VA shunt infection complicated by tricuspid valve IE uncommonly seen in adulthood in nowadays. Early diagnosis and optimal management that combines both conventional and surgical approaches is crucial for reducing the high embolic risk, risk of complications, and mortality risk.

## DECLARATIONS

Patient's approval for publishing data and this case report.

We wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

Maja Stefanović contribution to manuscript was study design, analysis, interpretation of data, and writing the manuscript.

Ilija Srdanović critical revision of paper. Lazar Velicki acquisition and collection of data. Snežana Tadić analysis and interpretation of data. Aleksandra Ilić critical revision of paper. Aleksandra Milovančev writing the manuscript. Tatjana Miljković analysis and interpretation of data. Snežana Bjelić interpretation of data.

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