Case Report

Aortic Root Abscess with Aorta to Right Atrium Fistula due to Vancomycin-Intermediate Staphylococcus aureus (VISA)

Stephen J. Hankinson, Elliot A. Sultanik, and Gautam V. Ramani

Department of Medicine, Division of Cardiovascular Medicine, University of Maryland School of Medicine, Baltimore, Maryland 21201, USA

Correspondence should be addressed to Stephen J. Hankinson; shankinson@som.umaryland.edu

Received 2 March 2019; Revised 1 May 2019; Accepted 7 May 2019; Published 29 May 2019

Academic Editor: Antonio de Padua Mansur

Copyright © 2019 Stephen J. Hankinson et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

We present a case of root abscess with aorta to right atrium fistula due to vancomycin-intermediate Staphylococcus aureus (VISA) after limb amputation and cardiac surgery. Patient underwent redo aortic valve replacement, patch repair of aorta to right atrial fistula, and tricuspid valve repair with a ring. Fistula formation is a rare complication of prosthetic valve endocarditis (PVE). This is the first case to discuss aortocavitary fistula (ACF) formation due to VISA. Transesophageal echocardiogram (TEE) is the preferred imaging modality to diagnose ACF.

1. Introduction

The emergence of multidrug-resistant (MDR) organisms makes the medical management of endocarditis increasingly difficult. TEE is the preferred imaging modality to diagnose ACF. Surgical repair continues to be the definitive treatment option for ACF.

2. Case Presentation

Our patient is a 74-year-old man with a history of rheumatoid arthritis (on prednisone), left below the knee amputation (BKA), coronary artery bypass graft (CABG) with a saphenous vein graft to the right coronary artery (SVG to RCA), aortic valve replacement (AVR) with a bioprosthetic valve, and mitral valve replacement (MVR) with a bioprosthetic valve who presented with fever, chills, and generalized weakness after a prolonged course of vancomycin for methicillin-resistant Staphylococcus aureus (MRSA) bacteremia.

The patient was previously admitted for left foot MRSA osteomyelitis. During that hospitalization, the patient had a myocardial infarction. Source control obtained with BKA of the left leg and five days later subsequently underwent CABG (SVG to RCA), AVR for severe aortic stenosis (AS), and MVR for severe mitral regurgitation (MR). The patient was discharged with a six-week course of vancomycin; however, vancomycin course was extended due to BKA wound that required skin graft surgery. Eighty-eight days after cardiac surgery, the patient was readmitted for MRSA bacteremia attributed to cellulitis of the BKA stump vs. endocarditis. Transthoracic echocardiogram (TTE) at that time was negative for PVE. Patient was treated with a six-week course of vancomycin, and BKA stump cellulitis subsequently resolved. Five days after completing antibiotics, the patient presented with MRSA bacteremia, which progressed to VISA bacteremia with a vancomycin minimum inhibitory concentration (MIC) of 4 μg/mL (Table 1). The patient was started on daptomycin, ceftaroline, and rifampin for VISA bacteremia. TEE showed aortic root thickening suggestive of abscess with associated structural defect, a mobile 2.4 cm × 1.9 cm echodensity projecting into the right atrium (RA) (Figure 1(a)), and left to right shunting (Figure 1(b)).

The patient subsequently underwent cardiac surgery for redo AVR with a bovine pericardial tissue valve, patch repair of aorta to right atrial fistula with a bovine pericardial patching material from both the left ventricular side and right atrial side, and tricuspid valve repair with a ring. Postsurgery TTE demonstrated a normal left ventricle size and systolic...
function, a normal right ventricle size and function, a bio-
prosthetic valve in aortic position (mean gradient 20 mmHg
and peak gradient 45 mmHg) and no aortic regurgitation,
and an annuloplasty ring indicative of tricuspid valve repair.

3. Discussion

This case discusses ACF formation as a complication of
cardiac surgery shortly after limb amputation. PVE is a devastat-
ing complication of valve replacement with the prevalence
being 4.1% at 4 years after primary valve replacement with
the greatest risk occurring 1 to 2 months after surgery [1].

ACF is a rare condition caused by congenital abnor-
malities, aortic dissection, valve replacement, and infective
endocarditis (IE) [2]. The pathogenesis of ACF related to
infection is caused by extension and infiltration of abscesses
related to endocarditis. Annular infection affects contiguous
tissue leading to pyogenesis and tissue necrosis, which causes
formation of an abscess cavity. As a result, the weakened
necrotic myocardium may expand and rupture which may
create intracardiac fistulous communications or even peri-
cardial shunts [3]. Echocardiography can be used to identify
the location of the lesion while angiography is often used to
demonstrate the course of the lesion and define the surgical
approach. Anguera et al. demonstrated that the detection of
ACF for TTE and TEE is 53% and 97%, respectively [4].
TEE is the superior imaging technique because the flow
across the fistula is highly turbulent and Doppler mapping
can easily detect pressure differences between the aorta
and cardiac chambers even when the fistulous orifice is
small; therefore, TEE allows for the detection of almost all
fistulas and allows the optimal characterization of each fis-
tula tract. Additionally, TEE is superior to TTE in assessing
valve function and morphology as well as delineating intra-
cardiac pathology such as complications of endocarditis,
namely, root abscess and fistulas. Furthermore, TEE has a
better signal to noise ratio and proximity of the trans-
ducer to the heart leading to higher quality images with
lesser attenuation [5].

Our case is unique because it is the first case of ACF due
to VISA. Our patient had extensive comorbidities prior to
BKA including cardiac issues, sepsis, and steroid use, all of
which have been shown to be predictors of increased mortal-
ity and postoperative complications within 30 days after BKA
[6]. Given these comorbidities, perhaps a longer time course
should have elapsed between the BKA in order to further
optimize the patient prior to cardiac surgery. Overall, these
comorbidities lead to a prolonged course of vancomycin,
which resulted in the development of a MDR organism.

VISA and vancomycin-resistant S. aureus (VRSA) are
relatively rare infections that occur in the setting of heavy
prior use of glycopeptide antibiotics [7]. The Clinical Labo-
ratory Standards Institute (CLSI) defines VISA as a vanco-
mycin MIC of 4-8 μg/mL and VRSA as a vancomycin MIC
of ≥16 μg/mL [8]. Vancomycin MIC ≥4 μg/mL is associ-
ated with vancomycin treatment failures in MRSA IE,
which is a novel concept for this cohort [9]. MRSA resis-
tance to vancomycin occurs through a variety of mecha-
nisms including cell wall thickening, decreased autolysis,
reduced production of cell surface protein A, increased cap-
sule expressions, increased D-alanylation of teichoic acids,
and reduced agr activity [8]. Given the prolonged course
of vancomycin prior to the discovery of the ACF, it is dif-
ficult to identify whether the valve annulus was seeded dur-
ing implantation of the valve or BKA stump cellulitis lead
to hematogenous seeding of the valve.

4. Conclusion

Presented above was a case of a patient with an ACF due to
VISA. This case demonstrated that protracted use of van-
comycin resulted in VISA IE. Clinicians should exercise
cautions in patients with high bacterial load infections after
prolonged antibiotic use. Infectious disease specialist

| Type of culture | Date       | Organism | Vancomycin MIC (μg/mL) |
|-----------------|------------|----------|------------------------|
| Left foot wound | 11/10/2017 | MRSA     | ≤0.5                   |
| Blood           | 2/27/2018  | MRSA     | 1                      |
| Blood           | 4/16/2018  | MRSA     | 2                      |
| Blood           | 4/26/2018  | MRSA     | 4                      |

Table 1: Culture data during protracted use of vancomycin.

Figure 1: TEE demonstrates mobile echodensity (red arrow)
measuring 2.4 cm × 1.9 cm in the RA associated with the wall of the
atrium at the site of the suspected defect (a). TEE demonstrates
atrioventricular defect and a systolic left to right shunt suggestive
of aortic root abscess and erosion into the RA (b).
consultation, change in antibiotic regimen, and aggressive surgical management are appropriate for the management of VISA IE.

**Conflicts of Interest**

The authors declare that they have no conflicts of interest.

**Supplementary Materials**

“Color doppler video” (supplementary material 1) 2.4 cm × 1.9 cm mobile echodensity in the RA with a systolic left to right shunt. (**Supplementary Materials**)

**References**

[1] J. F. Sabik, B. W. Lytle, E. H. Blackstone, A. G. M. Marullo, G. B. Pettersson, and D. M. Cosgrove, “Aortic root replacement with cryopreserved allograft for prosthetic valve endocarditis,” *The Annals of Thoracic Surgery*, vol. 74, no. 3, pp. 650–659, 2002, discussion 659.

[2] E. A. Fierro, R. R. Sikachi, A. Agrawal, I. Verma, M. Ojrzanowski, and S. Sahni, “Aorto-atrial fistulas: a contemporary review,” *Cardiology in Review*, vol. 26, no. 3, pp. 137–144, 2018.

[3] N. Kang, S. Wan, C. S. Ng, and M. J. Underwood, “Periannular extension of infective endocarditis,” *Annals of thoracic and cardiovascular surgery: official journal of the Association of Thoracic and Cardiovascular Surgeons of Asia*, vol. 15, no. 2, pp. 74–81, 2009.

[4] I. Anguera, J. M. Miro, I. Vilacosta et al., “Aorto-cavitary fistulous tract formation in infective endocarditis: clinical and echocardiographic features of 76 cases and risk factors for mortality,” *European Heart Journal*, vol. 26, no. 3, pp. 288–297, 2005.

[5] K. Ananthasubramaniam, “Clinical and echocardiographic features of aorto-atrial fistulas,” *Cardiovascular Ultrasound*, vol. 3, no. 1, 2005.

[6] P. J. Belmont Jr., S. Davey, J. D. Orr, L. M. Ochoa, J. O. Bader, and A. J. Schoenfeld, “Risk factors for 30-day postoperative complications and mortality after below-knee amputation: a study of 2,911 patients from the national surgical quality improvement program,” *Journal of the American College of Surgeons*, vol. 213, no. 3, pp. 370–378, 2011.

[7] G. Chesi, A. Colli, C. A. Mestres, G. Gambarati, F. Boni, and T. Gherli, “Multiresistant-MRSA tricuspid valve infective endocarditis with ancient osteomyelitis locus,” *BMC Infectious Diseases*, vol. 6, no. 1, 2006.

[8] B. P. Howden, J. K. Davies, P. D. Johnson, T. P. Stinear, and M. L. Grayson, “Reduced vancomycin susceptibility in Staphylococcus aureus, including vancomycin-intermediate and heterogeneous vancomycin-intermediate strains: resistance mechanisms, laboratory detection, and clinical implications,” *Clinical Microbiology Reviews*, vol. 23, no. 1, pp. 99–139, 2010.

[9] A. M. Casapao, S. L. Davis, J. P. McRoberts et al., “Evaluation of vancomycin population susceptibility analysis profile as a predictor of outcomes for patients with infective endocarditis due to methicillin-resistant Staphylococcus aureus,” *Antimicrobial Agents and Chemotherapy*, vol. 58, no. 8, pp. 4636–4641, 2014.