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Case Report

Microbiology Section

Achromobacter xylosoxidans Subspecies *denitrificans* Endocarditis in a Patient with Prosthetic Aortic Valve: A Case Report and Review of Literature

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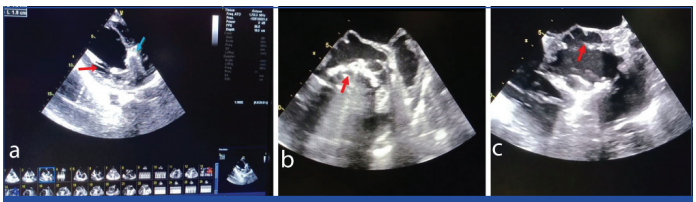
ABSTRACT

Achromobacter xylosoxidans subspecies *denitrificans* flourishes in presence of oxygen, commonly isolated from aquatic milieu. It is rarely implicated as the causative agent of endocarditis. It is not known to cause virulent infections in patients but causes severe infections in immunosuppressed patients with underlying co-morbidities. Present report is first case of *Achromobacter xylosoxidans* prosthetic valve endocarditis from India. This case report is of a 47-year-old male, suffering from Rheumatic Heart Disease (RHD), who presented to the cardiology emergency with a chief complaints of remitting type high-grade fever for two years followed by persistent fever for 10 days. On echocardiography and positively flagged BACTEC blood culture reports, it was diagnosed as a case of *Achromobacter xylosoxidans* subspecies *denitrificans* bacteraemia and prosthetic aortic valve endocarditis. Antibiotics were started according to the susceptibility testing but the patient could not complete the course of treatment as he developed dyspnoea and cardiac arrest following which he could not be resuscitated.

Keywords: Aortic regurgitation, Endocarditis, Immunocompromised patients, Matrix-assisted laser desorption/ionisation-time of flight-mass spectrometry, Mitral regurgitation, Rheumatic heart disease

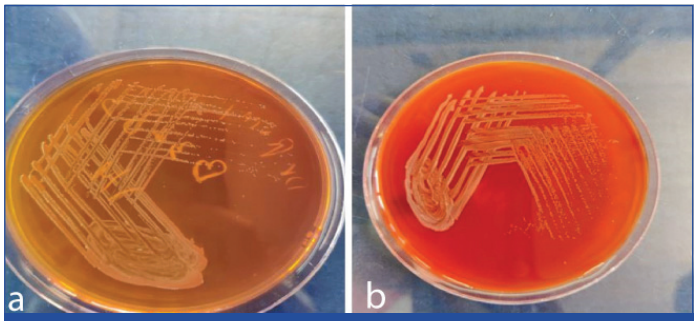
CASE REPORT

A 47-year-old male who underwent prosthetic valve replacement surgery 18 years ago due to aortic regurgitation, presented to the cardiology emergency with chief complaints of remitting type high-grade fever for two years followed by persistent fever for 10 days. This patient was a follow-up case of RHD and infective endocarditis of prosthetic valve with chronic kidney disease, metabolic acidosis, and septic shock. His blood pressure was 107/60 mmHg, pulse rate was 96 beats/minute, and normal jugular venous pressure with metallic click sound of S1. Due to strong suspicion of valvular defect, he was advised for a two-dimensional Echocardiography (2D-ECHO). His 2D-ECHO signs showed severe aortic and tricuspid valve regurgitation with moderate to severe mitral valve regurgitation and vegetations on the prosthetic aortic valve [Table/Fig-1a-c].



[Table/Fig-1]: a) 2D-ECHO image showing vegetations on the prosthetic aortic valve (blue arrow) along with tricuspid regurgitation (red arrow); b) 2D-ECHO image showing newly developed tricuspid regurgitation; c) 2D-ECHO image showing small vegetations near the prosthetic aortic valve.

Three pairs of BACTEC bacterial cultures were sent to the Bacteriology Section of the Department of Microbiology within 24 hours to diagnose the causative pathogen (microbiological criteria) of Infective Endocarditis (IE). Two of the blood culture bottles flagged positive on the same day whereas the third bottle flagged positive the next morning. The microorganism isolated from all the blood culture bottles revealed growth of small pale colored colonies on Mackonkey agar and non haemolytic colonies on blood agar [Table/Fig-2a,b]. Organism was recognised as *Achromobacter xylosoxidans* subspecies *denitrificans* by Matrix-Assisted Laser Desorption/Ionisation-Time of Flight-Mass Spectrometry (MALDI-TOF-MS) assay.



[Table/Fig-2]: a) *Achromobacter xylosoxidans* subspecies *denitrificans* showing small and pale coloured colonies on Mackonkey agar; b) *Achromobacter xylosoxidans* subspecies *denitrificans* showing non haemolytic colonies on blood agar.

Kirby-Bauer disc diffusion method was used for performing antibiotic sensitivity testing which renders it susceptible to imipenem, meropenem, piperacillin-tazobactam, and cotrimoxazole. The patient was given the first two doses of intravenous piperacillin-tazobactam eight hourly for a day according to the antibiotic susceptibility but could not complete the course of treatment as he developed dyspnoea and underwent cardiac arrest on the same day before starting haemodialysis for chronic kidney disease. He was intubated for mechanical ventilation following cardiac arrest but despite all possible measures his blood pressure continued to fall and the patient went into cardiorespiratory arrest. Cardiopulmonary resuscitation procedures were performed as per protocol but the patient could not be resuscitated.

DISCUSSION

Achromobacter xylosoxidans subspecies *denitrificans* flourishes in presence of oxygen and is commonly isolated from aquatic milieu [1]. It was acknowledged for the first time by Yabuuchi E

and Oyama A in 1971, in pus samples obtained from ear infections in seven cases [2]. This microorganism has been isolated as causative agent of central catheter infections, pneumonia, sepsis, meningitis, mediastinitis, and other hospital-acquired infections which may include outbreaks, but is rarely known to cause endocarditis [3-5].

Achromobacter xylosoxidans subspecies *denitrificans* stains negatively on grams staining and is rarely implicated as the causative agent of endocarditis. Although it is known to cause several serious infections like sepsis, meningitis, and pneumonia, it rarely causes endocarditis [3,4]. It is not a highly virulent pathogen but immunocompromised patients are highly susceptible to the infections caused by them due to underlying co-morbidities and prosthetic valves [6-8].

The Duke criteria by Durack DT et al., [9], diagnosed IE by amalgamating the findings of echocardiography with microbiological and clinical data. The three major echocardiographic criteria for diagnosing IE include: 1) the presence of echogenic, opaque, mobile masses denoted as vegetations on the native or prosthetic valve or myocardium, 2) valvular or myocardial abscess, 3) any breakdown of sutures leading to detachment of the prosthetic valve [10]. The definitive diagnosis of IE can be made by the presence of either two major criteria with one minor criterion or the presence of one major criterion with three minor criteria.

The index patient met three of Duke's major criteria which include the echocardiographic evidence of valvular vegetations, repeated positive blood cultures and new valvular regurgitations, and one minor criterion of high-grade fever above 38ºC [11]. Out of 23 known cases of *Achromobacter xylosoxidans* endocarditis, only eight cases of prosthetic valve endocarditis are known in literature as described in [Table/Fig-3]. The presence of an abnormal heart valve was observed in 65% of cases, which acts as a predisposing condition for IE [12-19].

The age of the patient in present study was 47 years while the mean age of the patients who developed *Achromobacter xylosoxidans* prosthetic valve endocarditis was around 57.12 years, with equal prevalence among both the genders [12-19]. The vegetations of *Achromobacter xylosidans* endocarditis were commonly isolated from the prosthetic aortic valve in the studies by Tokuyasu H et al., [12], Ahmed MS et al., [14], Sawant AC et al., [16], Van Hal S et al., [17], Lofgren RP et al., [13], and Olson DA and Hoeprich PD [18]. Thus, prosthetic aortic valve endocarditis was observed in 66.67% (6/9) cases, which includes present case of prosthetic aortic valve endocarditis [12-19].

In most of the cases discussed in the literature, IE caused by *Achromobacter* species was susceptible to beta-lactam antibiotics and beta-lactamase inhibitors, carbapenems, and Trimethoprim/Sulphamethoxazole (TMP/SMX) [20], which was in agreement with present study and the patient was started on piperacillin-tazobactam, to which the isolate was sensitive by antibiotic susceptibility testing.

The mortality was more among the patients of *Achromobacter* species endocarditis who were treated with antibiotics only, in comparison to those managed with valve replacement surgery and antibiotics [12]. The mortality among cases with prosthetic valve endocarditis who underwent antibiotic treatment only without valve replacement surgery was about 55.55% (5/9), including index patient in this case [12-19]. Thus valve replacement surgery although deemed important, index patient in this case was unable to survive due to underlying co-morbidities like new regurgitation on all valves and chronic kidney disease needing haemodialysis.

S. No.	Author reporting the case	Place of study and year of publication	Age (years)/ Gender	Risk factors	Underlying co-morbidities	Valve affected	Antibiotics taken	Surgery for prosthetic valve replacement	Outcome of the treatment
1	Lofgren RP et al., [13]	Minneapolis, United States of America, 1981	77/Female	Prosthetic valve, rheumatic heart disease	Prosthetic valve	Mitral and aortic valve	Tobramycin, carbapenicillin, TMP-SMX, moxalactam	No	Dead
2	Olson DA and Hoeprich PD [18]	California, United States of America, 1982	35/Male	Aortic valve surgery	None	Aortic valve	Carbenicillin, TMP-SMX, rifampicin, moxalactam, azlocillin	No	Dead
3	Van Hal S et al., [17]	Sydney, Australia, 2008	37/Male	Prosthetic valve and Ischaemic heart disease	None	Aortic valve	Carbapenem	Yes	Alive
4	Ahmed MS et al., [14]	Liverpool, United Kingdom, 2009	69/Male	Prosthetic valve	Diabetes mellitus, hypertension and coronary artery bypass rafting	Mitral and aortic valve	Ertapenem, Tigecycline, TMP/SMX	No	Dead
5	Derber C et al., [15]	Virginia, United States of America, 2011	54/Female	Prosthetic valve and Fallot's tetralogy	Fallot's tetralogy	Pulmonary valve	Piperacillin-tazobactam, imipenem-cilastatin, levofloxacin	Yes	Alive
6	Tokuyasu H et al., [12]	Tottori, Japan, 2012	86/Female	Prosthetic valve	None	Aortic valve	Carbapenem	No	Dead
7	Sawant AC et al., [16]	Arizona, United States of America, 2013	62/Female	Prosthetic valve and pacemaker	Atrial fibrillation, heart failure, chronic obstructive pulmonary disease, coronary artery bypass rafting	Mitral and aortic valve	Piperacillin-tazobactam, TMP-SMX, Amikacin, meropenem, rifampicin	Yes	Alive
8	Bhattarai M et al., [19]	Illinois, United States of America, 2016	37/Female	Prosthetic valve	None	Mitral valve	Meropenem	Yes	Alive
9	Present case	Lucknow, India, 2022	47/Male	Rheumatic heart disease, prosthetic valve	Rheumatic heart disease, prosthetic valve, chronic kidney disease	Aortic valve	Piperacillin-tazobactam	No	Dead

[Table/Fig-3]: The review of cases of *Achromobacter xylosoxidans* subspecies *denitrificans* prosthetic valve endocarditis reported till date (N=9) [12-19].
TMT/SMX: Trimethoprim/sulphamethoxazole

CONCLUSION(S)

The management and diagnosis of *Achromobacter* species endocarditis are difficult due to the rare nature and atypical presentation of the disease with immunocompromised conditions and co-morbidities that render the patient susceptible to infections by rarely pathogenic microorganisms. Valve replacement surgery and appropriate antibiotic therapy are the mainstays of treating these cases as complete knowledge of management needs the reference of more rare cases and their treatment strategies to form an effective protocol of treatment.

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