Case Series

Challenges in diagnosis and management of *Corynebacterium striatum* infective endocarditis – A case series

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Abstract

Corynebacterium striatum, being a skin commensal and environmental organism, is traditionally considered a contaminant of clinical specimens. However, the organism has emerged as a significant opportunistic pathogen causing native valve infective endocarditis (NVIE), especially in immunocompromised patients. We present a case series of three patients with *C. striatum* NVIE encountered within six months at a teaching hospital in Sri Lanka. All patients were immunocompromised with underlying conditions, namely multiple myeloma, tuberculosis, and malignancy with diabetes. Two cases had left-sided endocarditis and one was right-sided. Treatment consisted of prolonged antimicrobial therapy (4-6 weeks) with vancomycin-based regimens. One patient died despite appropriate therapy. This finding highlights the requirement of high clinical suspicion and aggressive management with prolonged antibiotic treatment. This is the first case series of *C. striatum* NVIE published in Sri Lanka.

Keywords: *Corynebacterium striatum, Drug resistance, Multiple myeloma, Sri Lanka, endocarditis, Diabetes immunocompromised, opportunistic pathogen, vancomycin, antimicrobial resistance, biofilm*

Introduction

Infective endocarditis (IE) is a formidable clinical syndrome that carries high mortality and morbidity globally despite advances in diagnostic techniques and therapeutic approaches. The evolving landscape of causative pathogens in IE necessitates ongoing vigilance and updated clinical approaches, particularly regarding emerging pathogens.

Coryneform bacteria or non-diphtheria *Corynebacterium* spp. represents a diverse group of pleomorphic, irregular shaped Gram positive bacilli that are ubiquitous in nature and the hospital environment. These organisms are widely distributed in soil and water. At the same time, they are established commensals of the skin and mucous membranes in both humans and animals. The bacterium has been isolated from various hospital environments, including surfaces and medical

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equipment, highlighting its potential role in healthcare-associated infections. Although they are considered contaminants in clinical specimens, *Corynebacterium* spp, particularly *Corynebacterium striatum,* have increasingly been recognized as significant emerging opportunistic pathogens capable of causing serious infections, especially in immunocompromised patients.[1] Evidence is mounting showing the clinical significance of *C. striatum* in severe infections including bacteraemia, pneumonia, meningitis, osteomyelitis, and notably, NVIE.[2,3]

This case series aims to document and analyse our experience with NVIE caused by *C. striatum*. Through obtaining a detailed history and thorough examination of three patients encountered at a teaching hospital within a six-month period, we present the clinical presentation, diagnostic challenges, therapeutic approaches, and outcomes associated with this emerging pathogen.

By sharing our experience, we hope to enhance awareness among clinicians of the role of emerging pathogens in NVIE to facilitate earlier diagnosis and optimise management strategies to improve patient outcomes.

The BD Phoenix automated identification system was used for microbial identification and antibiotic susceptibility testing of blood culture isolates.

Case 1

A 54-year-old male with recently diagnosed multiple myeloma was admitted with intermittent fever and urinary symptoms for 3 days. He had a positive urine culture with a multi-drug-resistant coliform which was sensitive only to meropenem. The patient was started on meropenem suspecting a relapse of a catheter associated urinary tract infection (CAUTI). He had been treated for a CAUTI with intravenous (IV) piperacillin / tazobactam for 5 days at a previous admission two weeks ago. The blood culture at that admission was positive for diphtheroids which were considered a contaminant. He had been given radiotherapy one month ago and had recent hospital admissions for bortezomib injection and blood transfusions. However, the patient continued to have high fever spikes with a new murmur in the mitral valve area. Splinter haemorrhages were noted on examination.

On admission, his white blood count (WBC) was 15.5×10^3 cells/µl with neutrophil predominance. Haemoglobin was 10.0 mg/dL. Platelets were 150,000/µl. C-reactive protein (CRP) was 85 mg/dL. ESR was 90 mm/1st hour. 2D-echocardiogram was positive for a mitral valve (MV) vegetation. Two blood cultures became positive for *C. striatum* which were confirmed at the reference laboratory, fulfilling a major Duke criterion for IE. IV vancomycin was started and subsequently IV gentamicin was added due to continuing fever spikes. The antibiotic regimen was changed to IV teicoplanin and oral doxycycline due to increasing serum creatinine. Due to unavailability of teicoplanin and the settling of renal function, vancomycin was re-started again in combination with doxycycline. Following 6 weeks of antibiotics, the patient responded clinically, biochemically, and radiologically, and was discharged. Time line of the patient's illness is shown in Figure 1. Antibiotic susceptibility of the isolate is given in Table 1.

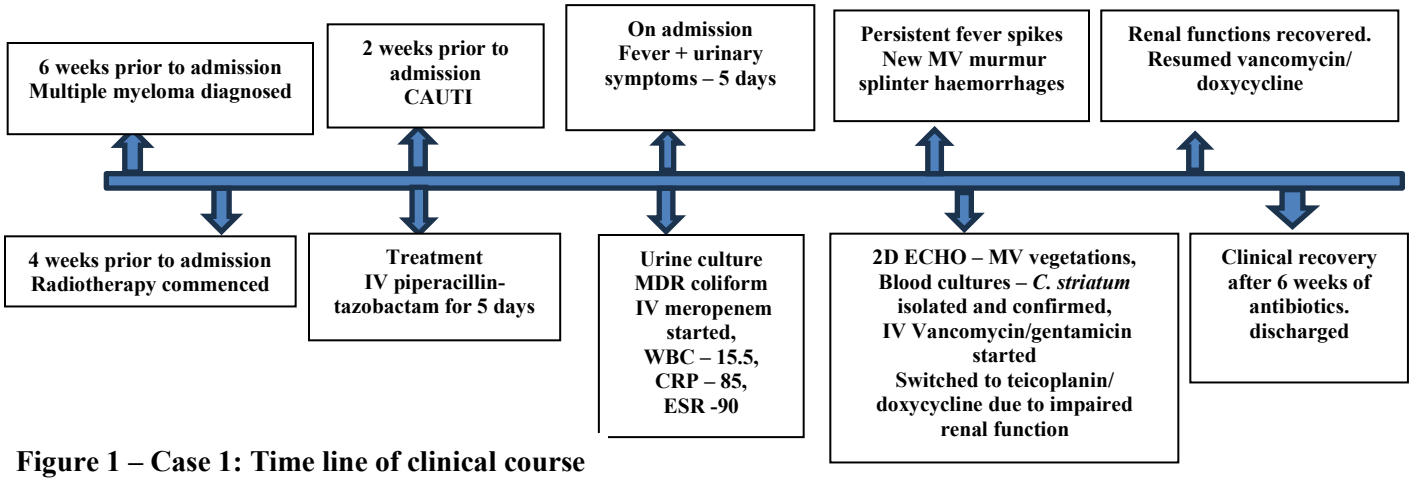

Figure 1 – Case 1: Time line of clinical course

Table 1 – Antibiotic susceptibility pattern of isolate – Case 1

Antibiotic	Interpretation
Penicillin G	R > 8 mcg/ml
Gentamicin	S <=2mcg/ml
Erythromycin	R >4 mcg/ml
Clindamycin	R > 2 mcg/ml
Tetracycline	S <= 0.5 mcg/ml
Vancomycin	S <= 1 mcg/ml
Linezolid	S <= 1 mcg/ml

Case 2

A 56-year-old male with type 2 diabetes mellitus who was diagnosed with pulmonary tuberculosis and was on anti-tuberculous therapy presented with fever, malaise, loss of appetite, drowsiness, on-and-off dry cough and back pain for 3 days. Examination revealed a systolic murmur. His WBC was 20.5×10^3 cells/µl with neutrophil predominance. Haemoglobin was 9.5 mg/dL. Platelets were 114000/µl. CRP was 135 mg/dL. ESR was 103 mm in the 1st hour. IV ceftriaxone was started empirically after taking blood cultures suspecting community acquired pneumonia. Two of two blood cultures were positive for Gram positive bacilli which were later identified as *C. striatum*. 2D ECHO revealed aortic valve vegetation with aortic and MV regurgitation. IV vancomycin was started as two major criteria of NVIE were fulfilled. The patient developed altered level of consciousness, and his computed tomography (CT) of the brain revealed multiple infarctions, most probably due to septic emboli from cardiac vegetations.

Blood culture isolates were identified at the reference laboratory as *C. striatum* by the automated identification system (BDphoenix), and IV ceftriaxone was omitted and IV vancomycin was started. After one week of admission, the patient developed watery diarrhoea. Stool for *Clostridioides difficile* toxin was positive, and the patient was treated with oral metronidazole as per local policy though the international policy has been moved to oral vancomycin.[4] However, the patient clinically deteriorated subsequently with persistent fever spikes. Upon deterioration of renal function, IV vancomycin was switched to teicoplanin and IV meropenem. The patient died fourteen days after admission. The exact cause of the death could not be traced.

Time line of the patient's illness is shown in Figure 2. Antibiotic susceptibility of the isolate is given in Table 2

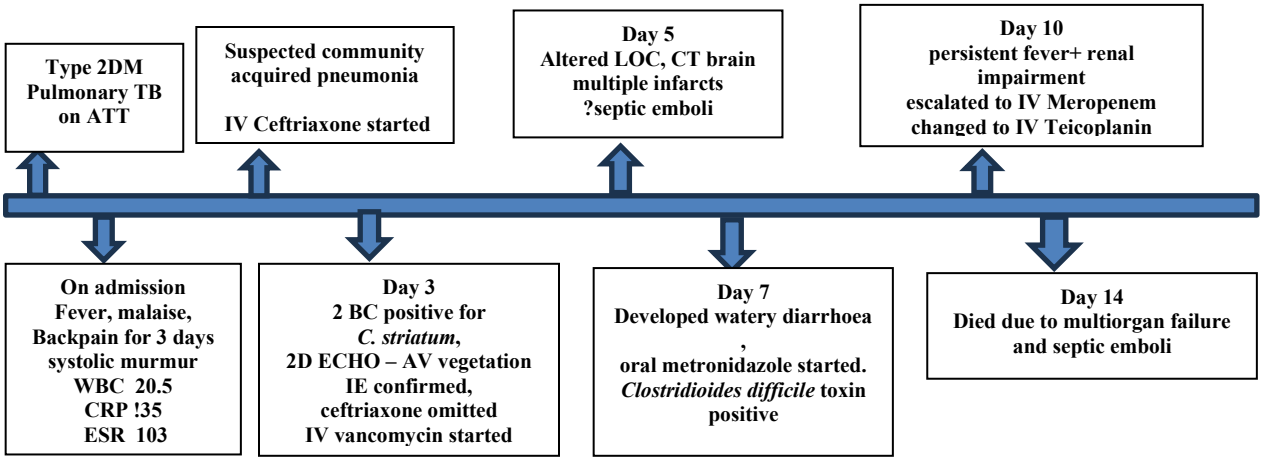

Figure 2 – Case 2: Time line of clinical course

Table 2 – Antibiotic susceptibility pattern of isolate – Case 2

Antibiotic	Interpretation
Penicillin G	R > 8 mcg/ml
Gentamicin	S <= 2 mcg/ml
Erythromycin	R > 4 mcg/ml
Clindamycin	R > 2 mcg/ml
Tetracycline	S <= 0.5 mcg/ml
Vancomycin	S <= 1 mcg/ml
Linezolid	S <= 1 mcg/ml

Case 3

A 58-year-old male presented with fever and cough for five days. He had a history of rectosigmoid colonic carcinoma complicated with lung metastasis requiring neoadjuvant chemotherapy. He was diagnosed with methicillin resistant *Staphylococcus aureus* (MRSA) tricuspid valve (TV) infective endocarditis (blood culture positive) 6 months previously and recurrent lower respiratory tract infections. He was oxygen dependent with bilateral coarse crepitations and bilateral shadows in his chest X-ray.

IV meropenem and oral clarithromycin were started empirically suspecting hospital-acquired pneumonia. His WBC was 31×10^3 cells/µl with neutrophil predominance and CRP was 111 mg/dL. Three blood cultures were positive for diphtheroids, confirmed later as *C. striatum,* and IV vancomycin was started. Vegetations of the same size were shown on the tricuspid valve in the 2D ECHO. The patient became fever free and IV meropenem was stopped after ten days. However, 2 days later the patient developed high fever spikes again and IV meropenem was restarted. The repeat urine and blood cultures remained sterile, while the UFR revealed pyuria. Repeat ultrasound of the kidneys, ureters and bladder (USS KUB) revealed bilateral pyelonephritis with acute kidney injury (AKI). Repeat 2D ECHO revealed two large vegetations on TV leaflets which were

increased in size, complicated with mitral regurgitation. The patient had a gradual improvement with both meropenem and vancomycin. Renal function was closely monitored.

IV meropenem was given for 28 days for complicated pyelonephritis. A 6-week course of antibiotic therapy was completed for IE, comprising 35 days of IV vancomycin and 1-week course of oral linezolid. Although surgical intervention for IE was considered, due to clinical improvement, it was postponed. A multidisciplinary team recommended early surgery for his colonic carcinoma post discharge.

Time line of the patient's illness is shown in Figure 3. Antibiotic susceptibility of the isolate is given in Table 3.

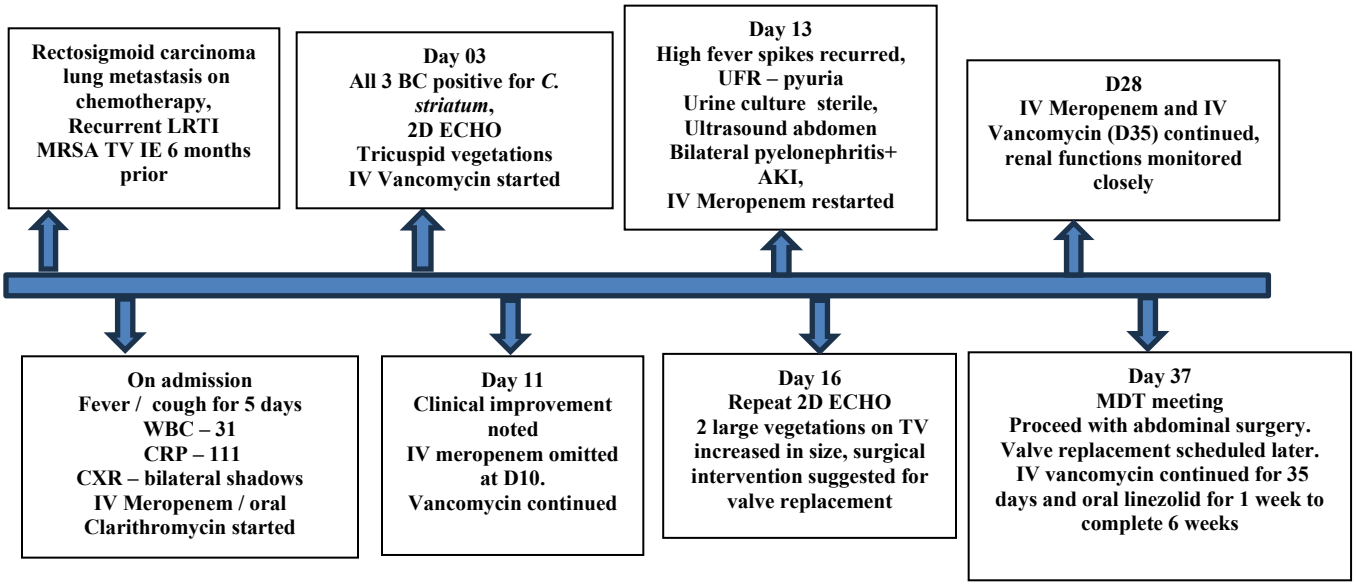

Table 3 – Antibiotic susceptibility pattern of isolate – case 3

Antibiotic	Interpretation
Penicillin G	R > 8 mcg/ml
Gentamicin	R > 8 mcg/ml
Erythromycin	R > 4 mcg/ml
Clindamycin	R > 2 mcg/ml
Tetracycline	S <= 0.5 mcg/ml
Vancomycin	S <= 1 mcg/ml
Linezolid	S <= 1 mcg/ml

Discussion

Infective endocarditis is a life-threatening clinical syndrome. This case series highlights the emerging significance of *Corynebacterium* spp. as a causative pathogen of IE, particularly in immunocompromised hosts. *C. striatum* is the most common IE-causing *Corynebacterium* spp. followed by *Corynebacterium jeikeium*.[3] In our case series, all isolates were identified as *C.*

striatum. The cases presented the complex interplay between host immune status, comorbid conditions, and opportunistic pathogenicity of an organism which is traditionally considered a commensal.

Corynebacterium endocarditis typically infects the left heart of adult males and nearly one third of patients have underlying valvular disease. Other risk factors are male gender, old age, frequent hospital admissions, invasive procedures and intravenous cannulations.[8]

All our patients had native valve infection with one having a previous history of IE. All were adults with multiple comorbidities including diabetes, complicated tuberculosis, and haematological/ solid organ malignancies which had led to frequent hospital admissions and invasive procedures. Two patients had left side IE and the third right side endocarditis. Recurrent history of blood transfusions is also a major risk factor for *C. striatum* bacteremia which was seen in the first case with multiple myeloma.[5]

It is important to understand the new behavior of coryneform bacteria as a clinically significant pathogen rather than a mere contaminant. Our observations strengthen the growing body of literature documenting *C. striatum* as an emerging opportunistic pathogen capable of causing serious infections, including IE. These cases emphasise the importance of considering this organism as the causative agent predominantly in immunocompromised patients, particularly those with multiple myeloma, tuberculosis, malignancies and diabetes.[5]

There is a profound humoral immune dysfunction in patients with multiple myeloma leading to hypogammaglobulinaemia and impaired antibody response. Similarly, patients with active or recently treated tuberculosis demonstrated vulnerability, possibly reflecting the compromised cell-mediated immunity and the systemic inflammatory state associated with mycobacterial infection. Diabetic patients are also complicated with more severe disease manifestations, consistent with the known effects of hyperglycaemia on neutrophil function, cellular immunity, and microvascular circulation. Hence immunosuppression creates an environment permissive for opportunistic infections in these patients.[1,6,7]

The pathogenicity of *C. striatum* in IE appears multifactorial. Recent studies have elucidated several virulence factors that may contribute to its invasiveness and persistence. The ability to form biofilms is one of the most important virulence factors. It enables the organism to adhere and colonise damaged native valves and prosthetic materials which play a crucial role in the pathogenesis of endocarditis. Additionally, *C. striatum* demonstrates remarkable ability to evade host immune responses, particularly in the setting of compromised immunity.[1]

The normal balance between colonisation and invasive infection is disrupted in immunocompromised hosts. There is breakdown of mucocutaneous barriers either from indwelling catheters, mucositis from chemotherapy in multiple myeloma or poor wound healing in diabetics in our patients. These may contribute to invasion of organisms into deeper tissues and blood. Subsequently, the impaired cellular and humoral immunity fails to contain the infection, allowing haematogenous spread and endocardial seeding.

The diagnosis of *C. striatum* endocarditis presents several challenges. First, there is the persistent perception of coryneform bacteria as contaminants, which may lead to delayed recognition of their pathogenic potential. Our experience suggests that multiple positive blood cultures with identical antibiograms strongly support a true infection rather than contamination. We also suggest that a single blood culture positivity in an immunocompromised patient should not be considered as a contaminant without further investigations such as performing repeat blood cultures. Belmares J A et al (2007), using results of a retrospective study, state that positivity of *C. striatum* in a single blood culture can be taken as a true infection.[8] Furthermore, subtle and nonspecific clinical presentations, especially in immunocompromised hosts who may not mount typical inflammatory responses, can delay diagnosis.

In a systematic review done in Serbia regarding antimicrobial treatment of invasive infections by *C. striatum*, all isolates were found to be susceptible to vancomycin, linezolid, teicoplanin, piperacillin-tazobactam, amoxicillin-clavulanate and cefuroxime. On the other hand, all the isolates tested for levofloxacin, cephalothin, cefoperazone, aztreonam, and doxycycline were found to be resistant. Isolates of *C. striatum* also showed a high degree of resistance to penicillin, cefazoline, ceftriaxone, ceftazidime, gentamicin, erythromycin, tetracycline, cotrimoxazole, ciprofloxacin and particularly to clindamycin.[10]

Antimicrobial susceptibility testing of our isolates was performed using the BD Phoenix automated system, which employs broth microdilution methodology to determine minimum inhibitory concentrations (MICs) The isolates in our series demonstrated significant antibiotic resistance, with over 100% showing resistance to penicillins, macrolides, clindamycin and cotrimoxazole. Vancomycin and linezolid demonstrated the most consistent in vitro activity.

According to the literature, the duration of therapy averaged 6 weeks, though extended courses (8-12 weeks) were employed in cases with persistent bacteraemia or metastatic foci of infection.[11] The management of immunosuppression poses a particular challenge, especially in patients with multiple myeloma requiring ongoing chemotherapy. In these cases, careful coordination between clinical microbiologists, haematologists, and cardiac surgeons is essential to balance the competing priorities of infection control and cancer treatment.

Both monotherapy and combination therapy have been used. Vancomycin was the most commonly used antibiotic followed by piperacillin-tazobactam, rifampicin and amoxicillin.[10] We treated the 3 patients with vancomycin as the first line antibiotic. Teicoplanin was used when there was deterioration of renal function and combined with oral linezolid and doxycycline when the response was slow. Even though surgical intervention was needed for some patients, it was challenging to perform surgery in these patients due to multiple comorbidities with underlying immunosuppression leading to poor prognosis.

The reported mortality associated with *C. striatum* infective endocarditis approaches 25%, underscoring the severity of this emerging pathogen.[5] Consistent with this, one of the three patients in our series died, reflecting the complex interplay of host and pathogen factors that characterise this infection. The predilection of *C. striatum* for immunocompromised individuals, combined with the burden of multiple underlying comorbidities, creates a particularly challenging clinical setting. Furthermore, our series highlights the compounding impact of nosocomial complications;

notably, antibiotic-associated diarrhoea secondary to *Clostridioides difficile* infection and CAUTI contributed significantly to clinical deterioration. These findings reinforce the need for vigilant infection control practices, judicious antibiotic stewardship, and early aggressive management in patients with *C. striatum* infective endocarditis, particularly in those with significant comorbidities or immunosuppression.

Conclusion

This case series highlights *C. striatum* as an emerging pathogen in IE, particularly among immunocompromised patients. Diagnostic challenges included the potential dismissal as a contaminant and subtle clinical and echocardiographic findings. Management required aggressive antimicrobial therapy, consideration of surgical intervention, and careful attention to underlying immunocompromising conditions.

According to the cases presented, we advocate for increased awareness of *C. striatum* as a potential pathogen in bacteraemic immunocompromised patients, lower thresholds for echocardiographic evaluation, and early involvement of multidisciplinary teams in management. Careful monitoring of the antibiogram and further research into optimal treatment strategies and preventive measures for this emerging pathogen is warranted.

Declaration

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Authors' contributions:
Data collection: WKM, HAAOT, WTMTA, GNK.
Patient management: WKM, HAAOT, WTMTA, GNK, KDN.
Manuscript was drafted by WKM.
Overall supervision was by KDN.

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