**Citrobacter freundii: A Cause of Cardiac Tamponade and Empyema Thoracis in a Nigerian Child**

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Abstract

Citrobacter infection is an uncommon but serious, difficult to treat infection associated with high mortality. Accumulation of pus or fluid in a pericardial space causes restriction of cardiac filling and consequent decrease in cardiac output. We herein report *Citrobacter freundii*, a rare infectious cause of this uncommon disorder. Our patient is a 10yr old male referred with complaints of cough productive of mucoid sputum and associated chest pain of two weeks duration, difficulty in breathing and orthopnea for one week. He was acutely ill looking in respiratory distress with tachypnoea and tachycardia. Blood pressure was normal with pulsus alternans, there was increased jugular venous pressure, diffused apex beat and distant heart sounds with pericardial rub. Retroviral screening and gene Xpert for Mycobacterium tuberculosis were negative. Chest radiograph showed enlarged heart of “water bottle” appearance with cardiothoracic ratio of 0.77 and right sided pleural effusion which was drained. Transthoracic Echocardiogram confirm pyopericardium with multiples echoes in cardiac tamponade. Echo-guided percutaneous pericardiocentesis yielded 600mls of purulent aspirates. *Citrobacter freundii* Sensitive to gentamycin, co-amoxiclav but resistant to cefuroxime and cefixime was cultured from pericardial aspirates and sputum. Patient recovered fully after pericardiocentesis and intravenous antibiotics. In this case report, we describe *Citrobacter freundii* causing cardiac tamponade and empyema in a Nigerian immunocompetent child which to our knowledge has thus far not been reported. Pyopericardium may follow rare causes as *Citrobacter freundii* which require high index of suspicion.

Keywords: Cardiac tamponade, *Citrobacter freundii*, Empyema thoracis, Nigerian, Pyopericardium

Introduction

*Citrobacter* species are facultative anaerobic Gram-negative bacilli that are typically motile by means of peritrichous flagella. They belong to the family *Enterobacteriaceae* which has 11 species.[1] *Citrobacter* species are commonly found in water, soil, food, and the intestinal tracts of animals and humans. They can be a source of various infections affecting the urinary tract, hepatobiliary tract, respiratory tract, wound, bone, and central nervous system.[2] *Citrobacter freundii* can cause infections in neonates and immunocompromised hosts such as neonatal meningitis and hepatobiliary tract infections.[3] Cardiac tamponade is the accumulation of fluid, blood, pus, or air within the pericardial space leading to increase in intrapericardial pressure and restriction of cardiac filling with the subsequent reduction in cardiac output.[4] Herein, we report a case of *C. freundii* causing massive pericardial effusion and empyema thoracis in an immunocompetent Nigerian child. To the best of our knowledge, this is the first of its kind to be reported.

Case Report

M.A. W is a 10-year-old male referred with complaints of cough, productive of mucoid sputum, and associated chest pain, all of 2-week duration. He also had difficulty in breathing and inability to lie flat on his back for 1 week before the presentation. There was a history of high-grade fever at the onset of cough. However, the patient had received oral antibiotics. He presented acutely ill looking in respiratory distress with tachypnoea and tachycardia. Blood pressure was normal with pulsus alternans, there was increased jugular venous pressure, diffused apex beat and distant heart sounds with pericardial rub. His chest radiograph showed an enlarged heart consistent with cardiac tamponade with cardiothoracic ratio of 0.77 and right sided pleural effusion which was drained. Trans-thoracic echocardiogram confirmed pyopericardium with multiple echoes in cardiac tamponade. Echo-guided percutaneous pericardiocentesis yielded 600mls of purulent aspirates. *Citrobacter freundii* was cultured from pericardial aspirates and sputum. Patient recovered fully after pericardiocentesis and intravenous antibiotics.

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and intravenous antibiotics before the presentation, with subsequent resolution of fever.

At admission, he was acutely ill looking and in respiratory distress. There was no documented fever and pallor. The pulse rate was 120 beats/min small volume with pulsus alternans. Blood pressure was 110/90 mmHg. He had distended jugular veins, diffused apex beat, and distant heart sound. There was also a pericardial rub. Other pertinent findings were respiratory rate of 64 cycles/min, tracheal deviation to the left, stony dull percussion note, and absent breath sound over the lower and middle right lung zones. There was dull percussion note and bronchial breath sound on the right upper lung zones. He also had tender hepatomegaly of 12 cm below the right costal margin. A clinical diagnosis of the right lobar pneumonia complicated by empyema thoracis and pericardial effusion in heart failure was made.

Chest radiograph showed right-sided pleural effusion, upper lung zones consolidation, and cardiomegaly with “water bottle” appearance. The cardiothoracic ratio was 0.77 [Figure 1]. The patient had immediate drainage of empyema at the emergency pediatric ward. Retroviral screening and GeneXpert of Mycobacterium tuberculosis were negative. Transthoracic echocardiograph revealed massive tamponade with multiple echodensities in the fluid, suggestive of possible purulent pericarditis. There was sustained inferior vena cava dilatation and diastolic right atrial and ventricular collapse. The heart was also swinging in the pericardial fluid.

A diagnosis of massive pericardial effusion in cardiac tamponade was made. An emergency pericardiocentesis with echo guidance was done through the subxiphoid window. It yielded 600 ml of yellowish purulent aspirate with tinge of blood [Figure 2a and b]. C. freundii sensitive to gentamicin, co-amoxiclav, and cefpodoxime but resistant to cefuroxime and cefixime was cultured. Aspirate cytology showed numerous neutrophil polymorphs on necrotic background suggestive of acute suppurative inflammation. Sputum, pleural, and pericardial aspirates were all negative for GeneXpert and Ziehl–Neelsen Staining. The retroviral screening was also nonreactive.

Post pericardiocentesis, the patient achieved a clinical improvement with a reduction in the respiratory rate of 20 cycles/min, and the PR reduces to 80 beats/min. He received intravenous antibiotics (ciprofloxacin and gentamycin) for 12 days and was discharged home on oral amoxicillin–clavulanic acid. Echocardiography at 2-week follow-up showed a minimal effusion with no diastolic right ventricular collapse.

**Discussion**

*Citrobacter* is a Gram-negative bacterium belonging to the family of *Enterobacteriaceae*. It usually causes infections among patients with underlying comorbidities or immunosuppression. This infection is difficult to treat and is associated with high mortality.[5] The index case is immunocompetent and has normal weight for age, making the clinical presentation an unusual one. Studies have reported *Citrobacter* infections in different organ tissue sites, such as abdominal cavity, hepatobiliary tract, and perianal region in patients with malignancy. It has also been reported in two patients with diabetic mellitus: one with iliopsoas abscess and another with renal and liver abscess.[3]

Purulent pericarditis can occur in association with preexisting or concurrent infections such as pneumonia with or without empyema, liver abscess, septic arthritis, or other soft tissues infections.[6] Common causes of purulent pericarditis are *Mycobacterium tuberculosis, Staphylococcus aureus, Haemophilus influenzae, Neisseria meningitidis*, and *Streptococcus pneumoniae*. In Nigeria, Jaiyesimi et al.[7] studied 53 children with purulent pericarditis between 1967 and 1976. They found that each of *S. aureus* and *M. tuberculosis* accounted for 20.8% among the causes of pyopericardium in children. Peter et al. in Kano, Nigeria, reported two different cases of pyopericardium in children. One was caused by *Klebsiella pneumoniae*, which hematogeneously spread from a distant right hip joint septic arthritis. The other case was caused by either *S. aureus* or *M. tuberculosis* in a child with acute osteomyelitis.[8] Pyopericardium caused by *Citrobacter* infections is rare. Notably, none has been reported in the literature.

Cardiac tamponade can be suspected using Beck’s triad which includes distended neck veins, distant heart sound, and hypotension, but these are late and inconsistent findings. Only 30% of patients with massive pericardial effusion

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**Figure 1:** (a) Water bottle appearance of the cardiac silhouette. (b) Apical four-chamber view showing the right diastolic atrial collapse

**Figure 2:** (a) Subcostal pericardiocentesis. (b) 600 ml of purulent aspirates
manifest the classic triad.\textsuperscript{[10]} The index patient presented with distended neck veins and distant heart sound but the normal blood pressure. Therefore, two-dimensional echocardiography was used to confirm the diagnosis of massive pericardial effusion with low densities echoes and cardiac tamponade. Echocardiography-guided pericardiocentesis, which is a lifesaving intervention, was done. However, further interventions such as surgical drainage or streptokinase instillation were not done due to limited resources.

**Conclusion**

This case report highlights *C. freundii* as a rare cause of pyopericardium and empyema thoracis in children. Thus, a high index of suspicion is required to diagnose it. This may also underscore a change in the choice of empirical antimicrobial use by considering agents against Gram-negative organisms. This is in contrast to the existing knowledge.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.

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