Case Study

Acinetobacter baumannii Infective Endocarditis in a child with Down syndrome seen at Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria

[1]Khadijat O. Isezuo, [1]Usman M. Sani, [1]Usman M. Waziri, [1]Bilkisu I. Garba, [2] Muhammad Sabitu Zainu, [1]Mansur Abubakar, [1]Fatima I. Abubakar, [1]Monsurat A. Falaye, [1]Ibrahim J. Hano, [2]Yahaya

[1]Department of Paediatrics, Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria.
[2]Department of Medical Microbiology, Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria

Corresponding author: Dr Khadijat Isezuo. *Department of Paediatrics, Usmanu Danfodiyo University Teaching Hospital, Sokoto, Nigeria.khadisez@yahoo.com:+2348036785003*

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Abstract

Background: Gram negative infective endocarditis (IE) accounts for < 5% of cases of IE. *Acinetobacter baumannii* is a pleomorphic, emerging, opportunistic and multi-resistant organism. It is associated with delay in diagnosis and treatment failure.

Objectives: We present a case of *Acinetobacter baumannii* IE in a child with Patent ductus arteriosus (PDA) and features of Downs syndrome.

Case Report: A one-year-old boy presented with high grade fever for six (6) weeks. No cough convulsions, genitourinary or gastrointestinal symptoms. He had fast breathing, suck-rest-suck cycle and forehead sweating since six (6) weeks of age. He was acutely ill looking, febrile with axillary temperature of 39.3oC, in respiratory distress, with dysmorphic features and a systolic murmur at the upper left sternal border. He received intramuscular & oral antibiotics, antimalarials on out-patient basis as parents initially declined admission.

Results: Initial results were negative urine, throat, blood cultures. Echocardiogram showed reduced flow with turbulence across the PDA and pulmonary regurgitation. He was commenced on intra venous (I.V) Cefotaxime, I.V Gentimicin which was changed to I.V Ciprofloxacin, and later I.V Cefepime on account of lack of response. The diagnosis of *Acinetobacter baumannii* I.E was made after six (6) weeks on admission with BACTEC. He responded to I.V Amoxicillin and Ciprofloxacin based on susceptibility pattern.

Conclusion: This case highlights the rare occurrence of Acinetobacter baumannii infective endocarditis in children, particularly those with Down syndrome, a population already predisposed to infections due to immunodeficiency and unique oral microbiome characteristics.

Keywords: Infective Endocarditis, Gram negative, Acinetobacter baumannii, Sokoto, Nigeria.

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Introduction

Infective endocarditis (IE) is a life-threatening infection of the endocardial lining of the heart and great vessels that affects both children and adults.[1] Congenital and acquired heart diseases, cardiac surgeries and interventional procedures with devices, and immunodeficiency are prime among the predisposing factors on a background of poor dental hygiene. Though less common in children, it is associated with more morbidity and mortality in them.[1]

The topmost causative agents are Gram-positive organisms of which more than 90% are *Streptococci, Staphylococci*, and *Enterococci*.[2] They are usually organisms that are commensals on the body surfaces, including the oral cavity and other mucosal linings. Gram negative organisms account for < 5% of causes of I.E and usually result from invasive procedures, nosocomial infections or sepsis.[1, 2] Common Gram-negative organisms responsible include the HACEK group (*Haemophilus species, Aggregatibacter actinomycetemcomitans, Cardiobacterium hominis, Eikenella corrodens, Kingella kingae*) amongst others. Such Gram-negative negative and other uncommon and atypical organisms may be difficult to culture with delayed diagnosis and implications on outcome.[3]

Due to improvements in cardiac care for children with CHD, different risk groups of children have emerged especially those with intervention and prosthetic valves.[1] Some patients may have background immunodeficiency which also predisposes them amongst others.[1] Individuals with Down syndrome have immunodeficiency due to T and B cell lymphopenia.[4] A study has also shown that the oral microbiome in children may be different in patients with Down syndrome which may contribute to an increased incidence of infections like I.E in them.[5] This may also predispose them to infections with uncommon or opportunistic organisms as some reports have shown.
Acinetobacter baumannii is a Gram-negative bacilli which has been found to be responsible for causing nosocomial infections, because of its ability to survive much longer on inanimate surfaces than other Gram-negative bacilli.[6] *Acinetobacter baumannii* is a pleomorphic, emerging, opportunistic and multi-resistant organism. It is associated with delay in diagnosis and treatment failure. Infective endocarditis caused by *Acinetobacter baumannii* is a rare but severe complication that affects seriously ill, hospitalized patients undergoing invasive procedures.[6] It is associated with an increased mortality rate than that of endocarditis due to the HACEK group of Gram-negative bacteria.[7]
We present a case of *Acinetobacter baumannii* IE in a one-year-old with Patent ductus arteriosus (PDA) and features of Down syndrome.

Case Report

Presenting complaints: A one-year-old boy presented with high grade fever for six (6) weeks. He had been having fast breathing, suck-rest-suck cycle and forehead sweating since he was six (6) weeks old.
Fever was high grade, continuous with temporary relieved by the antipyretic Paracetamol syrup. It was worse in the afternoons and evenings. He had nasal discharge at onset which subsided, no ear nor eye discharge. No cough, convulsions, genitourinary or gastrointestinal symptoms. There was slight reduction in appetite and play activity as illness progressed. No body swelling, pain or jaundice.

Fast breathing started since he was six (6) weeks of age, with frequent rests while suckling and forehead sweating. He had occasional cough worse at night but no bluish discolouration of his body. No noisy breathing. There was poor weight gain compared to his peers. He had no history of episodic excessive crying, restlessness or limpness.

He had received antibiotics including intramuscular (I.M) Ceftriaxone, oral Cefixime & Cefuroxime, anti-malarial drugs without improvement on out-patient basis as parents initially declined admission. He was eventually admitted as fever persisted.

Other aspects of the history: He had been diagnosed with CHD, large Patent ductus arteriosus at one (1) month of age for which he had been on regular up and anti-congestive medications as diuretics. He had never been admitted in the past nor had surgery.

His mother who was 35 years old had an uneventful period during his gestation. She received her routine vaccinations. Delivery was uneventful likewise immediate neonatal period. He was observed to have abnormal facies and motor milestones were slow compared to other siblings. There was no family history of similar problems. Both parents had tertiary education and were civil servants. They worked in the hospital as a technician and health information officer.

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Examination findings: He was acutely ill looking, febrile with axillary temperature of 39.3°C, in respiratory distress, not pale nor dehydrated. His oxygen saturation was normal at 97%. He had dysmorphic features of Trisomy 21 (Down syndrome) including upward slanting palpebral fissures, low set ears, flat nasal bridge, protruding tongue, stubby fingers, single palmar crease amongst others. He weighed 6.4 kilograms (64% of expected- wasted) with length of 66 centimetres (cm) (88% of expected- stunted). His occipitofrontal circumference was 43 cm (range:45-49 cm).

His pulse rate was 130 beats per minute and regular with bounding dorsalis pedis pulses. His precordium was hyperactive with apex beat at the 5th left intercostal space at the midclavicular line. There was no heave or thrills He had a systolic murmur grade 3/6 at the upper left sternal border.
He was tachypnoeic with symmetrical chest wall and normal breath sounds. He had no palpable organomegaly on abdominal examination. He was restless with global hypotonia. He had no focal neurological deficit.

Diagnosis and results of investigations: A diagnosis of probable infective endocarditis in a child with Patent Ductus arteriosus and Down syndrome was made. The results of throat, urine and stool cultures were all negative. Initial blood culture was also negative likewise the retroviral screening. Echocardiogram showed reduced flow with turbulence across the large Patent arterial duct and pulmonary regurgitation (Figure 1). No vegetation was seen on echo even on repeat imaging.

Full blood count showed normal white cell count with relative lymphocytosis. Haematocrit and platelets were normal, but red cell indices were low. His urinalysis was normal likewise his renal function tests. Table 1 shows the parameters of full blood counts at weeks one and four, likewise the electrolytes and urea which were normal. The blood film on both occasions were reflective of relative lymphocytosis, monocytosis and microcytosis. Repeat blood culture with BACTEC automated blood culture system medium at 6th week of admission yielded *Acinetobacter baumannii* with sensitivity to Amoxicillin, Ciprofloxacin, Ceftriaxone, Cefuroxime and Ceftazidime which were the antibiotics tested. Table 2 shows the criteria fulfilled for the diagnosis of infective endocarditis according to Duke's criteria.

Table 1: Results of investigations

Parameter	*Week 1*	*Week 4*
FBC		
WBC 10^9/l	10.4	7.9
Lym %	58.7	56.4
Neut %	26 7	22 9
Mxd %	14.1	13.7
RBC 10^9/l	3.79	3.97
HCT %	26.4	30.6
MCV fl	69.7	75.6
MCH pg	26.6	26.7
MCHC g/l	38.3	35.8
RDW	20.2	20.0
PLT 10^9/l	122	154
ESR mm/hr	53	
E/U/Cr		
Na^+ mmol/l	132	135
K^+ mmol/l	3.9	4.0
Cl^- mmol/l	94	96
HCO_3^- mmol/l	23	24
Urea mmol/l	5.6	4.5
Creatinine mg%	0 8	0.6

FBC=Full blood count; WBC=White cell count; Lym=Lymphocytes; Neu=Neutrophils; Mxd=Monocytes; RBC=Red blood cells; HCT=Haematocrit; MCV=Mean corpuscular volume; MCH=Mean corpuscular haemoglobin; MCHC =Mean corpuscular haemoglobin concentration; RDW=Red cell distribution width; PLT=Platelets; ESR= Erythrocyte sedimentation rate

Table 2: Criteria fulfilled for infective endocarditis in the patient (Duke's criteria)

Major		Minor	
	Status		***Status***
Blood culture	*Acinetobacter baumannii*	Fever	6 weeks
Echo criteria	Nil	Pre-existing heart disease	PDA
		Acute phase reactant	Elevated ESR
		Others	Nil

NB: Patient fulfilled 1 major and 3 minor criteria (Required: 2 major OR 1 major and 2 minor OR 5 minor criteria)

Treatment and Response: He was commenced on intravenous (I.V) Cefotaxime, I.V Genticin which was changed to I.V Ciprofloxacin, and later I.V Cefepime. Throughout this period, he had continuous fever. The diagnosis of *Acinetobacter baumannii* I.E was confirmed after six (6) weeks on admission. Intravenous Amoxicillin and Ciprofloxacin were prescribed based on

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the susceptibility pattern which he responded to as the fever subsided gradually within a week. He was continued on the antibiotics for up to 6 weeks but converted to oral suspension after 2 weeks.

Follow up

He has been relatively stable since then but has not been very regular with clinic follow up. He was also booked for PDA closure by the cardiac surgeons, but parents could not afford surgery and defaulted follow up

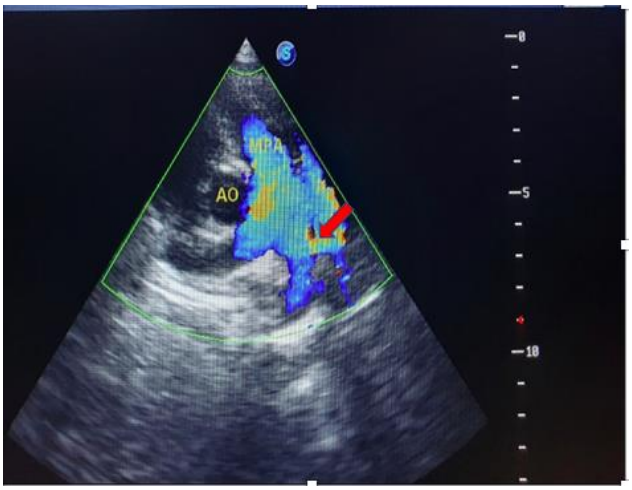

Figure 1: Showing the flow through the PDA at the region of the left branch of the pulmonary artery (red arrow).

Discussion

Acinetobacter spp. is described as non-motile, non-fastidious, non-fermentative, catalase-positive, oxidase-negative, aerobic, gram-negative coccobacilli. They are usually diploid or occur in chains.[3] *Acinetobacter baumannii* is more commonly associated with hospital acquired than community acquired infection and mortality is reportedly higher in the former of up to 62%. Therefore, prolonged treatment is advocated because inadequate empirical therapy can lead to rapid spread of antibiotic resistance and has been associated with increased rates of mortality.[3]

This was the case of a child with I.E caused by this organism which was only diagnosed after six (6) weeks on admission. Ahmadu and colleagues[7] reported a case from Kano in a much younger child of two (2) months. Most other reports are in adults and have been similarly diagnosed after a prolonged illness. Ioannou[3] has also reported in as young as a neonate in a review article on *Acinetobacter baumannii* I.E. Characteristics were more male affectation, prosthetic valves involvement and aortic and mitral involvement.[3] Our case was a male but had no prior intervention with patent duct arteriosus and presented with prolonged fever. Fever and sepsis were the commonest clinical presentations in the review.[3] Aminoglycosides, cephalosporins and carbapenems were the commonest antimicrobials used.[3]

In the review, it was emphasized that *Acinetobacter baumannii* is predominantly associated with hospital acquired infections with potential for substantial antimicrobial resistance.[3, 6] It is widely distributed in hospital on environmental surfaces, the health care workers hands, mechanical ventilators and dialysis machine.[6] Both parents work at the hospital, one as a technician who repairs and maintains equipment and another in the health information section. The child was therefore in the hospital most of the time, being the youngest child and by virtue of his disability. This could probably be a factor in his acquiring a nosocomial infection with an opportunistic organism like *Acinetobacter baumannii.*

Acinetobacter baumannii is said to be an opportunistic, mainly hospital acquired infections with risk for significant antimicrobial resistance.[8] In Iran, Shokouhi[8] reported a case of I.E caused by *Acinetobacter baumannii* that was multidrug resistant (MDR) and also had prolonged hospital stay. This was not the case here as the organism demonstrated sensitivity to the antibiotics tested which included Ceftriaxone and Ciprofloxacin which had been initially used for the patient albeit for a shorter duration before any clinical response was achieved. However, it was found to be sensitive to Amoxicillin which was what eventually he responded to. It is important while treating I.E that multiple blood cultures are drawn to increase the positive yield which could not be done here due to financial constraints. It is also important to monitor response closely to avoid change of antibiotics frequently which may also contribute to AMR.

Another report by Martinez[9] was a case of *Acinetobacter haemolyticus* IE of an interventricular patch device that was sensitive to ampicillin, amongst others. In the report by Ahmadu,[7] from Kano, Nigeria, the organism was sensitive to a similar profile (Ciprofloxacin, Ceftazidime

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and Cefepime) though all were not tested as in the index patient. A similar report in the study centre by Mohammed et al10 confirmed an outbreak of Acinetobacter baumannii in two wards of the hospital. They were confirmed to be 100% sensitive to Meropenem, 75% sensitive to Amoxicillin but 50% resistant to Ceftriaxone and Ceftazidime which were the antibiotics tested.

With respect to I.E and Down syndrome, there have been reports of children and adults with Down syndrome having I.E with uncommon organisms. This includes a report by Duperval[11] where *Leptotrichia buccalis* was cultured and another report in young adult female with Eisenmenger syndrome who had I.E with marked vegetations and could not benefit from surgery and died.[12] Lietaret[13] also reported in an older male with Down syndrome who had severe I.E with a rare organism *Aerococcus urinae* that required surgical excision of the associated vegetation. A 14-year-old boy with Down syndrome also had I.E (about 10 years after corrective heart defect surgery done at three months of age) when he had tooth extraction, however this was caused by the usual Gram-positive organisms but with a severe course.[14] Anecdotal findings in our center have shown that a relatively higher proportion of children with congenital cardiac defects who developed I.E either confirmed or probable I.E had Down syndrome.

Lahmidi[15] reported that *Acinetobacter baumannii* can survive harsh conditions in hospital environment facilitating its spread from health care devises to patients through health workers hands in a report. While in the outbreak reported by Mohammed et al[10], they were able to culture the organism Acinetobacter baumannii from health workers hands in addition to patients' urine.

In terms of antimicrobial resistance, strains of the *Acinetobacter baumannii* complex pose a great challenge to clinicians due to their propensity to acquire resistance via multiple mechanisms. Howard[6] described it as important opportunistic and emerging pathogen that can lead to serious nosocomial infections. This is due to its ability to adhere to surfaces, form biofilms, display antimicrobial resistance and acquire genetic material from unrelated genera or organisms which makes it difficult to control.[4] The World Health Organization (WHO) has recently identified antimicrobial resistance (AMR) as one of the most important problems facing human health.[16] Antimicrobial resistance is a threat to the control of emerging infections that result and it is ranked among the top 10 global public health threats, especially in low- and middle-income countries like Nigeria where four out of every five hospitalized patients in Nigeria are likely to receive at least one antibiotic each day.[16] This was supported by a recent report from the study centre, where in the emergency paediatric unit, out of 352 children, 318 (90.3%) received antibiotics and the commonest diagnosis was severe malaria which should not require antibiotics.[17] This calls for rational use of antibiotics to prevent AMR. In the index case, the patient had been on 2 antibiotics that were changed previously due to lack of response, but the sensitivity test later showed the organism was sensitive to them.

Conclusion

The case of Acinetobacter baumannii infective endocarditis in a child with Down syndrome underscores the critical need for improved diagnostic facilities and rational antibiotic use in low-resource settings. The delayed diagnosis in this case, which took six weeks, highlights the challenges faced in resource-limited environments where advanced diagnostic tools, such as BACTEC blood culture systems, may not be readily available. Additionally, promoting rational antibiotic use through clinician education and antimicrobial stewardship programs is crucial to curb the rise of AMR. Collaborative efforts involving pediatricians, microbiologists, and infectious disease specialists are essential to improve outcomes for patients with complex infections in low-resource settings.

Declarations

Ethical issues: Ethical issues: Ethical approval was sought and obtained from the research and ethics committee of UDUTH, Sokoto (UDUTH/HREC/2020/964). It was part of a research on outbreak of the organism in the hospital. Likewise, informed consent was obtained from the parents of the child. Confidentiality was assured as no identifiable features of the patient were reported in the manuscript.

Other considerations

The manuscript has been reported in line with CARE case reporting guidelines.

No AI tools were used in concept, data collection, analysis and writing the manuscripts.

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Competing interests: None declared by the authors.

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