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Acute Chest Syndrome in Children with Sickle Cell Anaemia: An Audit in Port Harcourt, Nigeria

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Abstract

Background: Acute chest syndrome (ACS) is a leading cause of death from sickle cell disease worldwide accounting for about 25% of all deaths. The aim of this study was to determine the prevalence, clinical features and outcome in Port Harcourt, Nigeria. Materials and Methods: A retrospective cohort study during a five year period. Records of all patients with sickle cell anaemia (SCA) admitted into the Wards were examined. Those enrolled for the study satisfied two criteria: 1) lower respiratory tract symptoms and 2) new pulmonary infiltrates on the chest radiograph. Sociodemographics, genotype, clinical and laboratory features, treatment given and outcome were obtained. Data were analysed by descriptive statistics. Variables were compared by students' t-test. P value ≤ 0.05 was regarded as significant. Results: A total of 345 children with sickle cell anaemia were admitted during the 5 year period. Twelve of them had acute chest syndrome (3.5%). Majority 7 (58.3%) of them were under 5 years. There were more males 8 (66.7%) than female 4 (33.3%). The most common clinical features were fever 12 (100%), cough 10 (83.3%), chest pain 5 (41.7%), pulmonary consolidation 12 (100%), and respiratory distress 12 (100%). The admitting diagnosis were bronchopneumonia 6 (50%), severe malaria 3 (25%) and vaso-occlusive crises 3 (25%). There were very high levels of leukocyte. Received ceftriaxone or ampicillin + gentamicin ± oral erythromycin), paracetamol 12 (100%), ibuprofen 8 (66.7%), tramadol 3 (25.0%), pentazocine 8 (66.7%) and blood transfusion 9 (75%). The average length of stay was 7 days (range 4 - 14 days). One patient died (8.3%). Conclusion: ACS is not uncommon in children with SCA in Port Harcourt. Education of parents on the need to recognize early symptoms of the disease is essential. Clinicians must be trained to correctly diagnose and manage it promptly and efficiently to avoid its related disastrous consequences.

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Keywords

Acute Chest Syndrome, Clinical Features, Treatment, Outcome, Port Harcourt

1. Introduction

Sickle cell anemia is one of the most prevalent genetic diseases worldwide [1] [2]. It frequently poses a task to health care providers for whom the disease can be considered one of the most significant haemoglobinopathies. Amid a diverse range of complications of varying complexity, none can become as rapidly disastrous as acute chest syndrome (ACS) [2]. It is the leading cause of death from sickle cell disease (SCD) worldwide accounting for about 25% of all deaths.

ACS is defined as a new pulmonary infiltrate on chest X-ray, combined with one or more manifestations such as fever, cough, sputum production, tachypnoea, dyspnoea, or new onset hypoxia [3]. It has a varied pathogenesis that includes occlusion of the pulmonary vascular bed by sickle erythrocytes, infection, embolized marrow fat, and lung infarction. It often follows a painful event, particularly in adults and although many pathologic processes may coexist establishing a specific cause is often difficult. Infections due to bacteria like *Mycoplasma*, *Chlamydia*, *Legionella*, *Streptococcus pneumoniae*, *Haemophilus influenzae* and viruses are more likely in children [4].

ACS is a frequent cause of hospitalization for patients with SCD. In the cooperative study of sickle cell disease (CSSCD), the mortality rate in patients with ACS was 1.1% in children [5]. In another multicenter study in the USA [3], the national ACS study group analyzed 671 episodes of ACS in 538 patients, with a mortality rate of 3%. In a 5-year study on the impact of seasonal variation of climatic factors on morbidities associated with vaso-occlusive crisis (VOC) among patients with sickle cell anaemia (SCA) in Maiduguri and Kano Teaching Hospitals, Nigeria, Ahmed *et al*. [6] found 56 episodes of ACS out of 2652 patients of VOC, giving a proportion of 2.11%.

Treatment for ACS is largely supportive in most cases. Early detection and supportive treatment may limit its severity and prevent death. Treatment includes continuous pulse oximetry and delivery of supplemental oxygen to patients with hypoxemia, adequate pain management, empiric antimicrobial therapy, monitoring of the haemoglobin concentration, blood transfusion, and maintenance of good hydration [7].

There are limited data on ACS in Nigeria and none has been reported in Port Harcourt, the capital city of Rivers state, Nigeria. In view of this, we decided to retrospectively audit all children with sickle cell anaemia with diagnosis of ACS. We hope to establish the prevalence, common clinical features and outcome of treatment in Port Harcourt, Nigeria.

2. Materials and Methods

A retrospective cohort study during a five year period beginning January 2009 and ending December 2014 was done. The records of all patients with sickle cell anaemia who were admitted to the Children Emergency and Paediatric Wards of the University of Port Harcourt Teaching Hospital (UPTH), Port Harcourt, Nigeria, during the period stated by the study were carefully examined. Ethical clearance was obtained from the Ethical Committee of UPTH. Those admitted to the study satisfied two criteria: 1) lower respiratory tract symptoms and 2) new pulmonary infiltrates on the chest radiograph. Information obtained included age, gender, haemoglobin genotype, clinical features, laboratory parameters (full blood count, chest X-ray and thick and thin film for malaria parasite), treatment given and outcome. Data were spread in excel sheets and analysis done by descriptive statistics in form of means and percentages. Variables were compared by student t test. P value ≤ 0.05 was regarded as significant.

3. Results

A total of 345 children with Sickle cell anaemia were admitted during the 5 year period. Twelve of them satisfied being diagnosed for acute chest syndrome (3.5%). They were aged 3 - 15 years with 7 (58.3%) of them under 5 years. There were more males 8 (66.7%) than female 4 (33.3%) (**Table 1**).

The presenting symptoms are reported in **Table 2**. The most common presenting symptoms were fever 12 (100%), cough 10 (83.3%), and chest pain 5 (41.7%). Two (16.7%) of the patients had wheeze/rhonchi. The most common physical findings were pulmonary consolidation 12 (100%), fever 12 (100%) and signs of respiratory distress 12 (100%). The admitting diagnosis were bronchopneumonia 6 (50%), severe malaria 3 (25%) and vaso-occlusive crises 3 (25%) but subsequently developed ACS during their hospital stay.

Table 1. General characteristics of the study group.

Characteristics	Number (12)	Percentage (%)
Age group (years)		
<5	7	58.3
>5	5	41.7
Gender		
Male	8	66.7
Female	4	33.3
Regular follow up		
Yes	3	25
No	9	75
On antibiotics prophylaxis		
Yes	0	0
No	12	100

Table 2. Clinical features of ACS.

Clinical features	Number	Percentage (%)
Initial symptoms		
Fever	12	100
Cough	10	83.3
Chest pain	5	41.7
Bone pains	3	25
Weakness	4	33.3
Abdominal pains	3	25
Vomiting	2	16.7
Wheeze	2	16.7
Clinical signs		
Anaemia	11	91.7
Jaundice	5	41.7
Haemoglobinuria	1	8.3
Respiratory distress	12	100
Bone tenderness	2	16.7
Rhonchi	2	16.7
Chest X-ray findings		
Lobar consolidation	4	33.3
Diffuse consolidation	8	66.7
Malarial parasitaemia		
Negative	2	16.7
Positive	10	83.3

ACS = Acute chest syndrome.

Laboratory test results showed very high levels of leukocytes, neutrophils and relatively high packed cell volume (Table 3). CRP and LDH results were not available. Chest X-ray mainly showed diffuse pulmonary consolidations 8(66.7%).

Patients were placed on two to three antibiotics: ceftriaxone or ampicillin + gentamicin ± oral erythromycin) (Table 4). Analgesics in the form of paracetamol 12 (100%), ibuprofen 8 (66.7%). tramadol 3 (25.0%) and pentazocine 8 (66.7%) were administered. Nine (75%) had blood transfusion. The average length of stay (LOS) was 7 days (range 4 - 14 days). One patient died giving a mortality rate of 8.3%.

4. Discussion

This study showed that ACS accounted for 3.5% of SCA children admitted in our hospital. This rate is lower than the 10% - 20% rate of hospital admissions reported by Miller and Gladwin in their review [8]. Also, Alkali and Ambe [9] in their retrospective study reported that of the 120 cases of SCA admitted 80 were found to have ACS. This lower rate of ACS in this study may be underestimated as some unknown SCA patients may have

Table 3. Laboratory parameters of children with ACS.

Laboratory parameters	Steady state	At presentation	P-value
Packed cell volume	21 ± 2.1	23 ± 3.4	>0.05
Leucocytes mm^3	12,541 ± 3.8	27,437 ± 5.1	<0.05
Neutrophil	45 ± 2.8	48 ± 3.2	>0.05
Platelet	180 ± 5.8	182.4.3	>0.05
Eosinophil	2.3 ± 0.3	3.4 ± 0.8	>0.05

ACS = Acute chest syndrome.

Table 4. Treatment and outcome of children with ACS.

Treatment and outcome	Number	Percentage (%)
Antibiotics therapy		
Ceftriaxone	8	66.7
Ampicillin	5	41.7
Gentamycin	7	58.3
Erythromycin	2	16.7
Antimalaria		
No	0	0
Yes	12	100
Analgesics		
Ibuprofen	8	66.7
Tramadol	3	25
Pentazocine	8	66.7
Oxygen		
No	1	8.3
Yes	11	91.7
Transfusion		
No	3	25
Yes	9	75
Duration of admission (days)		
<5	2	16.7
>5	10	83.3

ACS = Acute chest syndrome.

presented with this condition without relevant laboratory workup and diagnosis and thus missed been enrolled. Furthermore, it is also possible that due to parents' financial constraints, the only chest X-ray done during hospitalization could have been normal given that radiographic findings in some case of ACS may progress over time [5].

We observed a male predominance in line with previous studies [8] [10] [11]. Fever (100%), cough (83.3%) and chest pains (41.7%) were the main symptoms among our patients. This is in keeping with previous reports [5] [12].

There was significantly high leukocyte counts 27,437 mm^3 compared with steady state leukocyte count of 12,541 mm^3 [$P \leq 0.05$]. This may suggest that infection may precipitate the development of ACS among our patients, validating previous reports elsewhere [11] [13] [14]. It also has been reported in the literatures that microorganisms such as *Streptococcus pneumonia*, *Chlamydiae pneumonia*, *Mycoplasma pneumonia*, *influenza virus* A H1N1, *parainfluenza virus*, *respiratory syncytial virus* and *coronavirus* among others have been associated with ACS [5]. The predominant radiological finding in our study was diffuse lung involvement, in form of bronchopneumonia. This has been reported by Alkali and Ambe [9].

All of our patients were initially diagnosed as bronchopneumonia, severe malaria and vaso-occlusive crisis but subsequently developed ACS. Several studies [5] [8] have shown that ACS may develop 1 - 3 days after admission for VOC as there may exist a close relationship between ACS and VOC.

In line with the literatures [15] [16], our management of ACS included broad-spectrum antibiotics, analgesics, supplemental oxygen and transfusion. Early transfusion of SCA patients presenting with ACS should be encouraged, especially transfusion of packed red blood cells [17].

The average duration of hospitalization of 7 days is comparable to the 7 days-duration reported by Bertholdt *et al*., [14] but lower than what has been reported by Vichinsky *et al*. [5]. Introduction of other supportive care in our practice like bronchodilators and incentive spirometry as elsewhere, along with systematic oxygen supplementation and early blood transfusion could substantially reduce the duration of hospital stay [8] [17].

One of our patients died, hence a mortality rate of 8.3% which is higher than the 4% percentage obtained by Bertholdt *et al*. in Belgium [14].

5. Conclusion

ACS is not an uncommon complication among children with SCA in Port Harcourt, Nigeria. There is need to educate parents on the need to recognize early symptoms of the disease, and seek help promptly. More so, clinicians must be trained to correctly diagnose ACS, and manage it promptly and efficiently to avoid its related disastrous consequences.

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