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Prevalence and Factors Associated with Acute Chest Syndrome among Children with Sickle Cell Anaemia in Kitgum General Hospital, Uganda

Peter Omara[1*], Joan Laker[3α], Shiella Gloria Apio[3β], Adama Isah Ladu[2]

[1]Department of Global Health, Faculty of Medicine, Liverpool School of Tropical Medicine, L3 5QA Liverpool, U.K

[2]Department of International Public Health, Faculty of Medicine, Liverpool School of Tropical Medicine, L3 5QA Liverpool, U.K

[α]Head of Department, Palliative Care, Yotkom Hospital, P.O Box 206, Kitgum, Uganda.

[β]Head of Department, Health Management Information System, Yotkom Hospital, P.O Box 206, Kitgum, Uganda.

https://orcid.org/0009-0005-2914-3720

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ABSTRACT

Purpose: This study aimed to identify the prevalence and factors associated with acute chest syndrome among children with sickle cell anaemia in Kitgum General Hospital, Kitgum district, northern Uganda.

Methodology: A retrospective study among children admitted with sickle cell anemia was conducted. Data review was conducted for hospital admissions from January 2020 to December 2022 at the paediatrics unit of Kitgum General Hospital. A summary table (data collection table) was developed in Microsoft Excel sheets. Data collection was done over 4-weeks period to extract secondary data for children aged six (6) months to 17 years admitted with sickle cell anaemia from the month of January 2020 to December 2022. Acute chest syndrome was defined as a respiratory sickness in sickle cell anemia patients that presented with fever and/or symptoms of cough, difficult/fast breathing, and low oxygen concentration of the blood requiring hospitalisation. Data was analysed using software Statistical Package for Social Sciences (SPSS) Version 28.0 (190). Associated factors were measured according to p-values where any '*p*' value less than 0.05 was considered statistically significant.

Findings: Two hundred seventy (n=270) participants were included in the study with the median age (IQR-25% to 75%) of 8.0 years (4.0 – 11.0). There were more males, 57.4% (n=155) than female 42.6%, (n=115). The prevalence of acute chest syndrome was 27.8% (CI 22.0% – 33.0%). Age was found to be a statistically significant factor, (p=0.001).

Unique Contribution to Theory, Policy and Practice: The prevalence of acute chest syndrome among children with sickle cell anaemia was identified as 27.8% with 95% confidence that the true prevalence value lies between 22.0% to 33.0%. There is need for total integration of sickle cell disease care into the routine primary healthcare services instead of the one-day a week clinic.

Keywords: *Acute Chest Syndrome, Children, Sickle Cell Anemia, Uganda*

INTRODUCTION

Sickle cell disease (SCD) is a genetic blood disorder associated with abnormal haemoglobin production called the 'S' haemoglobin (HbS); in deoxygenated condition, the abnormal haemoglobin becomes polymerized and distorts the shape of the red cells into a to generate sickle- shaped red blood cells [1]. These sickle-shaped red blood cells are characterized by rigidity, fragility and easy lysis. The World Health Organization declared sickle cell disease as a global burden that needs to be prioritized by all [1]. Globally, it affects over 300,000 children below 5 years of age every year with majority coming from India and Sub-Saharan Africa. Due to inadequate testing services in low and middle-income countries, most children die before their fifth birthdays [2]. The high costs of admissions, treatment and huge expenditures on research funded by the government and other studies aiming at reducing or preventing sickle cell complications could have provided greater opportunity for cost saving [2]. In Africa, three to four percent of the population have sickle cell anaemia, and this contributes to 5% mortality in children below the age of 5 years [3]. Prevalence study conducted in Uganda reveals that 13.3% of the total population carry sickle cell traits and 25,000 babies are born with sickle cell anaemia yearly [4].

Children with sickle cell anaemia have very high risk of developing complications among which is acute chest syndrome (ACS). "Acute chest syndrome is defined as the presence of fever and/or new respiratory symptoms accompanied by the presence of a new pulmonary infiltrate on chest x-ray" [5]. Early studies point out that acute chest syndrome has high incidence among children aged below 4 years and that previous history of acute chest syndrome is associated with subsequent episodes, though the intervals are not clearly understood [6]. Research study conducted in Uganda showed that the prevalence of acute chest syndrome among children with sickle cell anaemia was 22.7% [7].

Furthers studies done to evaluate factors associated with ACS identified high white cells count and particular genotypes of sickle cell haemoglobin such as HbSS and HbSβ0 thalassemia to be implicated [8]. Other studies identified male gender, younger age, lower concentration of foetal haemoglobin, steady higher level of haemoglobin, the use of morphine in managing painful crisis and history of asthma to be an association [9]. In Uganda, it's estimated that 13.3% of the population are identified with sickle cell trait. An annual average of 25,000 babies are born with sickle cell anaemia and these new-born babies have very high risk of developing complications and death. Mortality among children below 5 years of age is estimated at 5% [4].

Acute chest syndrome is a leading cause of mortality and hospital admissions, yet its causes and associated factors remain compounded [8]. The physical, financial, social and psychological burden to the individual children and their family members as a result of acute chest syndrome cannot be ignored. Similarly, the responsibility of taking care of these children at homes, unexpected medical costs and their unpredictable future lives remain unanswered problems [10].

There are limited studies about the prevalence and factors associated with acute chest syndrome

among children with sickle cell anaemia in Uganda, especially in the region where this study was conducted, the Northern Uganda and specifically Kitgum district, yet we continue to register morbidity and mortality from sickle cell anaemia related complications in our community. Although a study conducted in Uganda [7] pointed out that the prevalence of acute chest syndrome among children with sickle cell in the country was 22.7%, the study used sequential sampling. This sampling method presents an unequal probability sample and therefore subject to selection bias [11]. It cannot be generalized to represent the overall prevalence of acute chest syndrome among children with sickle cell anaemia in Uganda hence this study aimed to conduct this study to identify the prevalence, and factors associated with acute chest syndrome among children with sickle cell anaemia in Kitgum General Hospital.

METHODS:

Study design: This was a retrospective study carried out from January 2020 to December 2022 at the paediatrics unit of Kitgum General Hospital in northern Uganda.

Study site: This study was conducted in Kitgum General Hospital. The hospital was established in the year 1934 and currently located in the urban center of Kitgum Municipality in Northern Uganda. Kitgum General hospital has 246 bed capacity of which 44 are for pediatric wards. It serves as a referral point for most patients with health conditions that cannot be managed in lower-level health facilities. It serves a minimum of one million population from the four districts in East Acholi sub-region including parts of Karamoja, South Sudan and refugees' settlement camp in Lamwo district. The hospital runs a weekly (Fridays) out-patients sickle cell disease clinic and daily in-patients' services for complications of sickle cell anaemia. An average attendance of 30 children with sickle cell anaemia attend the once weekly clinic indicating that over one thousand (about 1,400) children with sickle cell anaemia attend the clinic annually contributing to average two hundred (200) admissions every year. Limited number of laboratory tests associated with acute chest syndrome can be performed in Kitgum General Hospital, for example, white cell counts and haemoglobin levels. The hospital gets inadequate supply of the basic medications such as hydroxyurea used in the management of acute chest syndrome. Only about 230 children are on treatment with hydroxyurea out of the estimated 3,000 registered children attending sickle cell anaemia clinic in the hospital. The hospital also lacks equipment to perform haemoglobin electrophoresis test for sickle cell anaemia. Blood samples for electrophoresis tests are taken to other laboratories situated over 100km away in another district. No secretory phospholipase A2 enzyme test available as an important predictor of acute chest syndrome [12]. Similarly, the hospital doesn't offer culture and sensitivity tests on samples (such as bronchoalveolar secretion and blood) to identify causes of acute chest syndrome and neither does the hospital do baseline fetal haemoglobin screening for newborn [13]. The hospital has oxygen concentrators to maintain blood oxygen saturation at 95% or above, but there is no provision of incentive spirometry to identify the possibility of developing lung collapse (atelectasis).

Study population: This study included only children known to have sickle cell anemia aged 6 months to 17 years of age admitted to the unit between January 2020 to December 2022. This

study did not include children aged below 6 months, because studies revealed that symptoms of sickle cell anaemia do not manifest due to protective effects of high concentration of fetal hemoglobin in their blood [14]. Children admitted outside period between January 2020 and December 2022 were excluded. Files that lacked vital information were also excluded from the study.

Ethical consideration: This study strictly adhered to the Uganda National Council of Science and Technology 2014 (UNCST 2014) guidelines. Ethical principles of respect, beneficence, non-maleficence and justice were duly observed as pointed in section 2.3 of the UNCST 2014 guideline. This study obtained ethical approval from Gulu University Research Ethics Committee under registration number GUREC-2024-806 in Uganda and Liverpool school of Tropical Medicine, LSTM in the United Kingdom under registration number GH24(023). Study secured informed consent waiver from Gulu University Research Ethics Committee since the study involved data review whereby data access and extraction would present no more than minimal risk to the study participants. Approval for data access was obtained from Kitgum General Hospital administration through the District Health Office. Data collection, storage and analysis were conducted in line with the Uganda data Privacy and Protection Act 2019 that aimed at protecting individual's privacy. All study participants were assigned unique identification numbers for anonymity.

Sampling:

To determine the sample size for the study, a simple sample calculation formula (Keish and Leslie, 1965) was used.

$$N = Z^2P(1-P) / d^2$$

Where;

N = Sample size required.

Z = Level of confidence statistics for 95% confidence interval. P = Expected prevalence value.

d = Margin of error.

The prevalence index for computing sample size was chosen based on previous study conducted in Uganda [7] to identify prevalence of acute chest syndrome among children with sickle cell anaemia. The prevalence value of 22.7% with the margin of error set at $\pm$ 5% and 95% confidence interval (C.I = 95) was used to estimate sample. This was based on the fact that, should the true value of the number of children with acute chest syndrome lie at 22.7%, then this result would range between 17.7% and 27.7%. The sample size was calculated as below;

$$N = 1.96^2 \text{ X } 0.227 \text{ X } (1-0.227) / 0.05^2$$

$$N = 3.8416 \text{ X } 0.227 \text{ X } 0.773/0.0025$$

$$N = 0.6741/ 0.0025$$

$$N = 270$$

A total of five hundred thirty-one admission files were found in the archive for the period from January 2020 to December 2022 (n=531). Thirty-two files lacked adequate information (n=32) and were excluded. Total files with adequate information were four hundred ninety-nine, (n=499). Simple random sampling was used to provide equal probability to all the four hundred ninety-nine files to be included in the study. This helped to mitigate selection bias as pointed out by [15]. This random sample (n=270) was used to represent the study population. It was characterized according to sex, age and address categories.

Data collection: To obtain the required information, a summary table (data collection table) was developed in Microsoft Excel sheets. Two (2) trained research assistants and the principal investigator collectively reviewed the hospitals in-patient records over 4-weeks period to extract secondary data for children aged 6 months to 17 years admitted with sickle cell anaemia from the month of January 2020 to December 2022. Participants were identified using unique codes which were obtained from patient's admission files or laboratory request forms. Data also included age, sex, address category (rural or urban) and values of Haemoglobin, white cell count, admitting diagnosis and frequency of admissions. Data cleaning was done to avoid participant's duplication, and the use of unique codes/ numbers was adopted for purpose of identification and anonymity. For multiple admissions, the same unique codes numbers were used for each patient re-admitted. Data collected was entered in tabulated form and saved in secret password-protected personal computer. Variables used in data analysis include age, gender, address category, admitting diagnosis, haemoglobin levels, White cell counts, and admission frequency.

Data analysis: Study used descriptive method for data analysis. Variables used in data analysis include age, gender, address category (rural or urban), admitting diagnosis, haemoglobin levels, white cell counts, and admission frequency. Analysis involved description of sample and data grouping (categorical and continuous). Data was analysed using Statistical Package for Social Sciences (SPSS) Version 28.0 (190). Categorical variables were analysed using Chi-square while continuous variables were analysed using non-parametric/Mann-Whitney test. Data cleaning was done to avoid participant's duplication, and the use of unique codes/ numbers was adopted for purpose of identification and anonymity. For multiple admissions, the same unique codes numbers were used for each patient re-admitted. Data collected was entered in tabulated form and saved in secret password-protected personal computer after which it was imported to analysis software Statistical Package for Social Sciences (SPSS) Version 28.0 (190). Variables used in data analysis included age, gender, address category, admitting diagnosis, haemoglobin levels, White cell counts, and admission frequency.

OPERATIONAL DEFINITIONS:

Acute chest syndrome:

Respiratory sickness in sickle cell anaemia patient with presence of fever and or

symptoms of cough, difficult/fast breathing or requiring oxygen therapy.

Anaemia:

6 months to 2 years	Haemoglobin level below 10.5 (normal range 10.5 –13.5 g/dl).
2 to 6 years.	Haemoglobin level below 11.5 (normal range 11.5 – 13.5 g/dl).
6 years to 12 years.	Haemoglobin level below 11.5 (normal range 11.5 – 15.5 g/dl).
Female 12 to 18 years.	Haemoglobin level below 12.0 (normal range 12.0 – 16.0 g/dl).
Male 12 to 18 years.	Haemoglobin level below 13.0(normal range 13.0 – 16.0 g/dl)

Leukocytosis:

2 months to 6 years	>19 x 10^3 cells/mm^3 (normal range 5.0 – 19.0 x 10^3 cells/mm^3)
6 to 18 years	>10.8x10^3cells/mm^3 (normal range 4.8 – 10.8 x 10^3 cells/mm^3)

RESULTS:

Sample characteristics:

This study was conducted to determine the prevalence of acute chest syndrome among children with sickle cell anaemia in paediatric ward of Kitgum General Hospital in Kitgum district, northern Uganda. Two hundred seventy (n=270) participants were included. There were more males 155 (57.4%) than female 115 (42.6%). The median age (IQR-25% to 75%) was 8.0 years (4.0 – 11.0) (Table 1). The most represented age groups in the sample population were those aged 2 to 4 years60 (22.2%) and 8 to 10 years old 60, (22.2%) followed by age group 5 to 7 years with 51 (18.9%), 11 to 13 years with 46 (17%), 14 to 16 years with 28 (10.4%), < 2 with 21 (7.8%), meanwhile the least represented age group was >16 years old with 04 (1.5%). Geographically, majority population emerged from rural setting, 196 (72.6%) compared to urban setting, 74 (27.4%).

Table 1: General characteristics of the study population

Variables	Median (IQR – 25% to 75%) / Frequency (%).	Observation (n)
Age	8.0 (4.0 – 11.0)	270
Age group:		270
<2	21(7.8)	
2-4	60(22.2)	
5-7	51(18.9)	
8-10	60(22.2)	
11-13	46(17.0)	
14-16	28(10.4)	
>16	04(1.5)	
Gender:		270
Male	155(57.4)	
Female	115(42.6)	
Residence:		270
Rural	196(72.6)	
Urban	74(27.4)	
Admitting Diagnosis:		270
ACS – Yes.	75(27.8)	
ACS – No.	195(72.2)	
Admission Frequency:		270
Single	22(8.1)	
Multiple	248(91.9)	
White Blood Cell	19.0(13.7 – 26.3)	160
Haemoglobin	5.6(4.4 – 7.2)	177
Prevalence of ACS	**27.8% (CI 22% to 33%)**	

ACS = acute chest syndrome

According to the admissions diagnoses, 76 (28.1%) of sickle cell children were diagnosed with Vaso-occlusive crisis (VOC) which takes the highest proportion. This was followed by acute chest syndrome (ACS), 75 (27.8%), anaemia with 43 (15.9%), Dactylitis, 10 (3.7%), Sequestration and Stroke both with 5 (1.85%) for each, Malaria 52 (19.3%), epistaxis 02(0.7%), Pyelonephritis 01(0.4%) and Peptic ulcers disease 01 (0.4%).

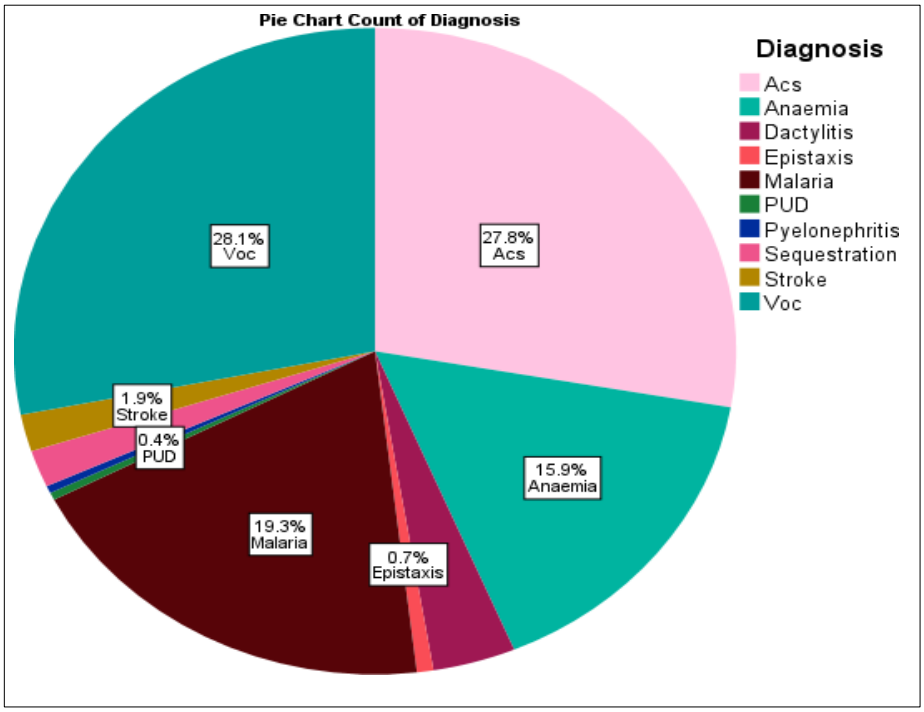

Figure 2 Chart representation of admitting diagnosis

Charts showing prevalence of acute chest syndrome according to gender, age, admissions and resident.

Distribution of acute chest syndrome by gender

According to gender, 41(15.2%) of the total number of male children developed acute chest syndrome while 34(12.6%) of total female children developed acute chest syndrome.

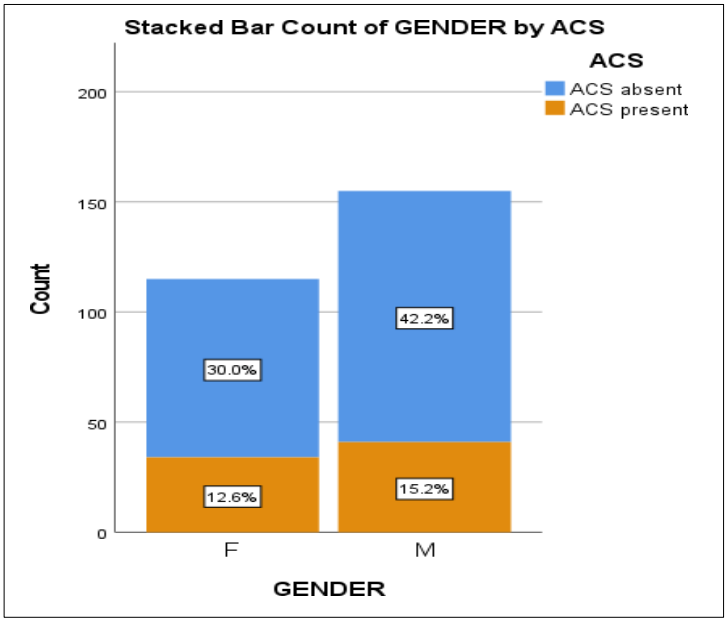

Figure 3 Stacked chart of ACS by gender.

Distribution of acute chest syndrome by age.

According to age, the mean age for those children who developed acute chest syndrome was 5.31(S.D 3.55) while the mean age for children who didn't develop acute chest syndrome was 8.99 (S.D 4.43). children aged 2 to 4 years were more affected by acute chest syndrome, 24(32%); followed by those aged 8 to 10 years with 16(21.3%); 5 to 7 years with 14(18.7%); less than 2 years with 13(17.3%); 11 to 13 years with 8(10.7%); 14 to 16years with 0(0%) and those aged above 16 years with 0(0%).

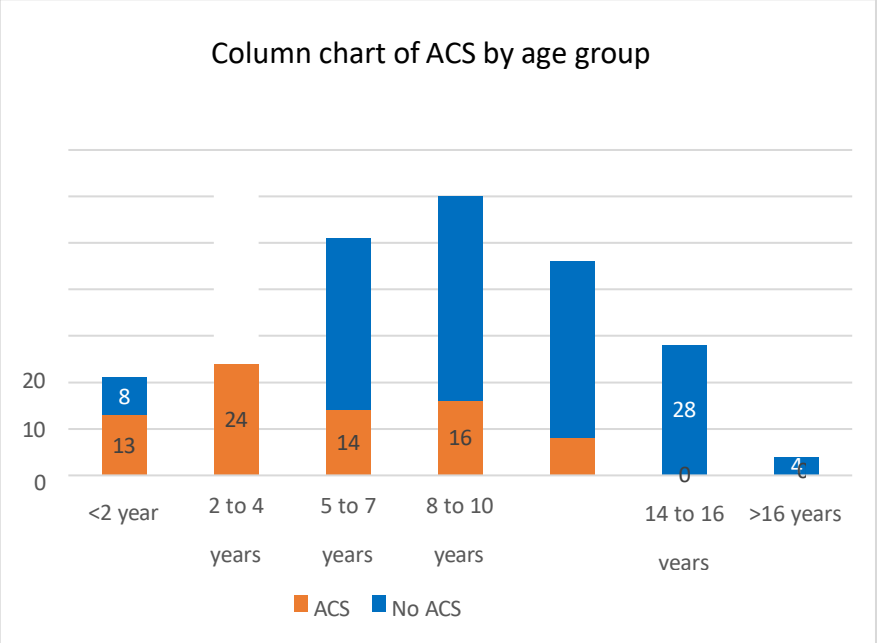

Figure 4: Stacked column of ACS by age group.

Factors associated with acute chest syndrome.

For factors of association, categorical variables (gender, admission history and residence) were analysed using chi-square test for which their level of association was measured in terms of odd ratios (OR). None of the categorical variables above were found statistically significant (table 2). On the other hand, continuous variables (age, white cell count and haemoglobin) were analysed using the Mann-Whitney test (Figs 7 -9). Their associations were measured according to p-values. From this finding, only age was found to be statistically significant, (p=0.001) (Table 2).

Table 2: Representing association of ACS.

Variable	ACS present	ACS absent	P-value	OR (9%% CI).
Age (median, IQR)	5.0(4.57-6.21)	9.0(8.33-9.59)	<0.001	-
Gender, n (%)				
Female	34(45.3)	81(41.5)	0.585	0.86 (0.50-1.46)
Male	41(54.7)	114(58.5)		
Admission frequency, n (%)				
Multiple	5(6.7)	17(8.7)	0.804	1.34 (0.48-3.76)
Single	70(93.3)	178(91.3)		
Geographical location, n (%)				
Rural	51(68.0)	145(74.4)	0.292	1.37 (0.76-2.44)
Urban	24(32.0)	50(25.6)		
White blood cell (WBC), median (IQR)	21.7(19.46-22.13)	18.8(18.83-22.78)	0.145	-
Hemoglobin (Hb), median, IQR	5.75(5.27-6.53)	5.50(5.40-6.11)	0.617	-

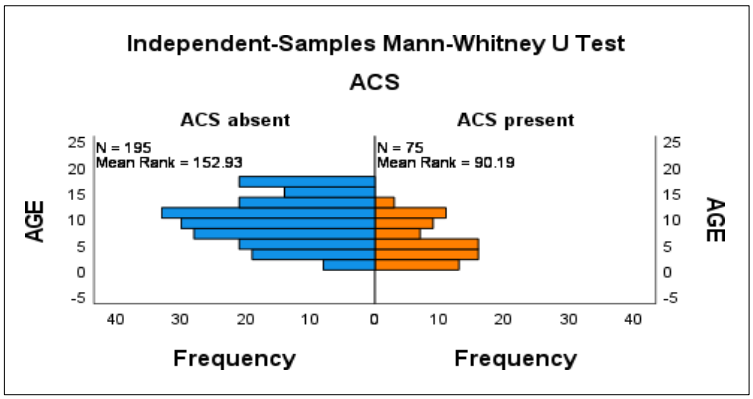

Figure 7 Mann-Whitney test for age in acute chest syndrome

According to the independent-samples Mann-Whitney test for age, the mean rank age is lower (MR=90.19) in acute chest syndrome while it is higher (MR=152.93) in those with no acute chest syndrome.

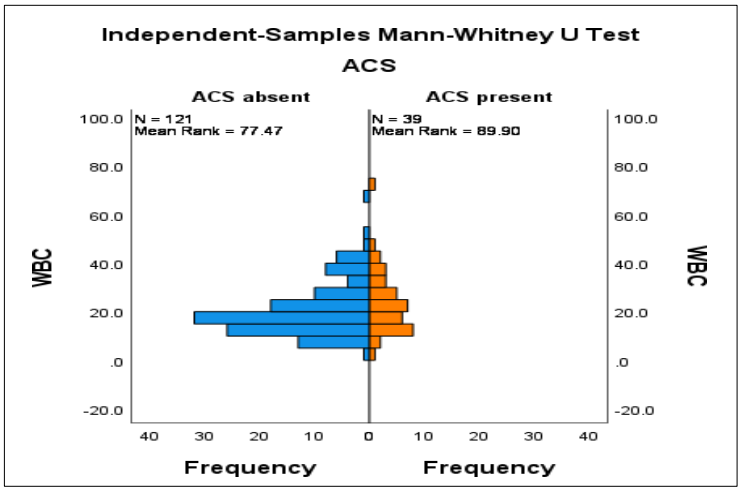

Figure 8 Mann-Whitney test for white cell count in acute chest syndrome

Mean rank for white cell counts in acute chest syndrome is higher (MR=89.90) than for white cell count with no acute chest syndrome, (MR=77.47).

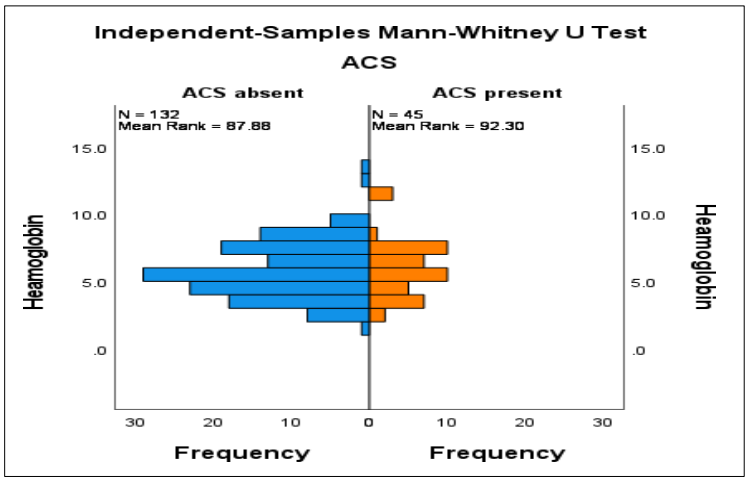

Figure 9 Mann-Whitney test for haemoglobin in acute chest syndrome

For haemoglobin, the mean rank is higher in acute chest syndrome (MR=92.3) than for haemoglobin with no acute chest syndrome (MR=87.88).

DISCUSSION:

This study was conducted to determine the prevalence, and factors associated with acute chest syndrome among children with sickle cell anaemia in Kitgum district, northern Uganda. There were two hundred seventy participants (n=270). This study identified the prevalence of acute chest syndrome among children with sickle cell anaemia admitted in paediatric ward at Kitgum General Hospital at 27.8% (95% confidence interval 22% to 33%).

This prevalence result is similar to the study of acute chest syndrome conducted in Uganda by [7] which found that the prevalence of acute chest syndrome was 22.7%. It's similar because the prevalence value falls within the 95% confidence interval range, the study population were all children, conducted in the same geographical region under the same economy (low-income),

running under the same national healthcare system.

The study is also similar for a hospital-based report from Paris in France that involved children and same study design; that is, retrospective study which showed prevalence of acute chest syndrome at 23% [16]. This is likely to contribute to the similarity of the two studies. However, this research result contradicts study finding conducted in Eastern province of Saudi Arabia by [17] which found that the prevalence of acute chest syndrome was low at 11.67% [17]. These two studies are contrasting because of the existing difference in sickle cell disease haplotypes which are responsible for recurrency of acute chest syndrome in Saudi Arabia and Uganda. The same study from [17] showed that recurrency of acute chest syndrome was lower ($p=0.025$) among people living in the eastern provincial areas of Saudi Arabia than in the African groups. This may contribute to the difference in prevalence of acute chest syndrome in Saudi Arabia and Uganda.

This research finding further contrasts finding by [18] in France which revealed that acute chest syndrome in children was at 3.7% [18]. All the two studies involved children as study population but study in France was conducted following the massive vaccination of children with pneumococcal conjugate vaccine that might have protected most children against the causative organism for acute chest syndrome among children living with sickle cell anaemia while this study was conducted during Covid-19 where cough and difficult breathing were significant contributing signs/symptoms for both Covid-19 infection and acute chest syndrome.

The current study prevalence result is also in contrast with research result conducted in Nigeria, Lagos University Teaching Hospital by [19] which identified acute chest syndrome in children with sickle cell anaemia to be at 3.7% [19]. Case definition for diagnosis of acute chest syndrome for study conducted in Nigeria included chest radiograph results with visible chest infiltrates in the x-ray image while this study diagnosed acute chest syndrome based on presence of cough and /or fever, difficult breathing or requiring oxygen therapy; x-ray results wasn't mandatory in the diagnosis of acute chest syndrome among children with sickle cell anaemia. This might have brought about the difference in prevalence values for acute chest syndrome in the two studies.

This study finding contradicts with the prevalence value of acute chest syndrome for a study conducted in the winter and summer seasons in United States of America by [20] which identified prevalence of acute chest syndrome in children with sickle cell anaemia to be 30.4% and 18.4% respectively. Contradiction also applies to study conducted by [21] in Central Michigan University, United States of America that identified 11.3% as prevalence value for acute chest syndrome among children with sickle cell anaemia. For above two studies, exposure to weather difference may be responsible for the variations in study results; additionally, United States of America is among the countries of the world with the best healthcare systems which cannot be compared to Uganda whose greater percentage of health depends on donor funding and hence the differences in the study results.

There is also a contrast between this study finding and research conducted by [22] that found prevalence of acute chest syndrome among children with sickle cell anaemia to be 17%. [22]

conducted their study in Georgia, it was a multicenter prospective study conducted in two urban centres; the population of study included both children and adults (those aged up to 21 years old). The study population, methodology, and technology used (lung ultrasound) for recruiting participants may account for the differences in study results. This study finding also differ from research conducted by [23] in St. Thomas' teaching Hospital in Central London that identified prevalence of acute chest syndrome in children to be 15.8%. Study in London (St. Thomas Hospital) used presence of chest radiograph infiltrates among other signs and symptoms for diagnosis of acute chest syndrome.

This research result is also not similar to study conducted in Cameroon by [24] that pointed out prevalence of acute chest syndrome among children with sickle cell anaemia at 6.2%. The study in Cameroon excluded all children without chest Xray results and diagnosis of acute chest syndrome was based on presence of alveolar consolidations following x-ray scans among other signs and symptoms; meanwhile this study included all children irrespective of chest x-ray results. The differences in the inclusion and exclusion criteria for these two studies may be responsible for the differences in study results.

This finding isn't similar to study conducted at Brazzaville Teaching Hospital in Congo by [25] that sighted 14% prevalence of acute chest syndrome among children with sickle cell anaemia. 67.5% of sickle cell crises were registered in the hot rainy season. Climatic/weather difference may be responsible for differences in the prevalence results of the two studies.

Factors associated with acute chest syndrome.

In accordance with age, this study found that the most affected age group was those 2 to 4 years. This is consistent with study conducted by [26] all the studies used children and observations as the study population and methodologies respectively. Similarly, according to the age group, this result showed that more children aged ten years and below developed acute chest syndrome than those aged above ten years old. This age-group association is similar to study conducted by [5] who sighted that majority of children with sickle cell anaemia develop acute chest syndrome while at the age bracket of the first decennium. [5] used children who were recruited through chart review and observed prospectively in a hospital-based centre for sickle cell disease study. This study therefore found that low median age was statistically significant contributor to development of acute chest syndrome among children with sickle cell anaemia (p-value <0.001).

According to gender, this study revealed that more male children developed acute chest syndrome than female children. This result agrees with study conducted by [27] which found that more male children were affected by acute chest syndrome than the female. This study is similar as it conducted hospital discharge chart review for children aged less than twenty years (<20 years) and used logistic regression for data analysis to identify prevalence and associated risk factors of acute chest syndrome among children with sickle cell anaemia. Similarly, this finding agrees with study conducted by [28] the study was a retrospective case-control that involved children; they both didn't use very large sample sizes; (n=100 and n=270). This study

results however did not show any statistical significance for gender in relation to development of acute chest syndrome (odd ratio; OR 0.86 (95% CI 0.50 – 1.46).

In relation to geographical location, this study finding revealed that more children from rural areas than urban areas were affected by acute chest syndrome. This finding is similar to study conducted in Sergipe, Brazil by [29] that identified association of acute chest syndrome with living in rural settings. This is similar because the study conducted in Brazil involved only those from low socio-economic background which is identical to the socio-economic status of majority participants in my study. Similarly, for the study in Brazil, control of confounding showed no statistical significance between living in rural area and acute chest syndrome which is the same case with this study; there is no significant association between living in rural area and developing acute chest syndrome among children with sickle cell anaemia (OR 1.37(95% CI 0.76 – 2.44; p=0.292) as seen in table 2. This study also revealed that, acute chest syndrome was more in children with elevated white cell count. This finding is similar to a retrospective case control study conducted by [8]. This was similar because study was conducted as a single centre retrospective study (chart review) involving children where data analysis was done using statistical package of social sciences. However, there's no statistical significance of association between white cell count and development of acute chest syndrome among children with sickle cell anaemia. (p=0.145) as seen in table 2. This study finding showed that, there were fewer re-admissions (multiple admissions) than index (single) admissions among children admitted for acute chest syndrome. This finding relates to the study conducted by [30] in the United States. This is because, [30] considered re-admission as first admission within 30 days after an index admission and therefore re-admissions were few.

However, this study result is contrary to study findings conducted by [31] in Saudi Arabia regarding the admission history. Study in Saudi Arabia only included children diagnosed with acute chest syndrome who were admitted for Vaso-occlusive crisis and excluded cases of acute chest syndrome that were admitted on day one. This may explain the differences in the number of single admissions and re-admissions in these two studies. In this study therefore, frequency of admission was not found to be statistically significant to development of acute chest syndrome among children with sickle cell anaemia because analysis result showed low odd ratio; OR 1.34 (95% CI 0.48 – 3.76), p=0.804 for p-value significance set at 0.05 as in table 2. Similarly, haemoglobin did not show statistical significance after analysis because, the p-value was 0.67 for the p-value significance set at 0.05 as summarized in table 2.

STRENGTH AND LIMITATION OF STUDY:

Sampling method used.

This study used simple random sampling method. This sampling method generated results that can be generalized to the wider population. However, this study was limited by missing data.

Conclusion and recommendation:

The prevalence of acute chest syndrome among children with sickle cell anaemia in Uganda

was 27.8% with 95% confidence interval indicating that the true prevalence value lies between 22.0% to 33.0%. This research provides new finding of prevalence result of acute chest syndrome among children with sickle cell anaemia in Uganda. The study also showed young age as a significant risk factors for ACS. This underscores the importance of having a low threshold and close monitoring of young children with sickle cell anaemia who presents to the hospital with respiratory problems.

Given the high prevalence of acute chest syndrome among children with sickle cell anaemia in Uganda, there is need for total integration of sickle cell disease care into the routine primary healthcare services instead of the one-day a week clinic.

Abbreviations:

ACS	Acute Chest Syndrome
GUREC	Gulu University Research Ethics Committee.
SCA	Sickle Cell Anaemia
SCD	Sickle Cell Disease
sPLS2	Secretary Phospholipase A2 enzyme

Statement for data sharing:

All data that hold up the conclusion are inclusive.

Ethical approval:

This study obtained ethical approval from Gulu University Research Ethics Committee under registration number GUREC-2024-806 in Uganda and Liverpool school of Tropical Medicine, LSTM in the United Kingdom under registration number GH24(023).

Informed Consent

Study secured informed consent waiver from Gulu University Research Ethics Committee since the study involved data review whereby data access and extraction would present no more than minimal risk to the study participants

The participating students provided both written and verbal consent.

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