ORIGINAL ARTICLE

Frequency of Common Causes of Severe Anemia in Children under 5 Years of Age Admitted in Children Hospital, Lahore

RUBAB HAFEEZ[1], SADIA AMIR[2], AMMARA SARDAR[3], NAGHAM NAWAZ AWAN[4], MADIHA JAMEEL[5], SUMBAL ABBAS[6]
[1]MBBS, FCPS Pediatrics Child Specialist Medical Squadron PAF Base, Samungli
[2]FCPS pediatrics, Senior Registrar Department of Pediatric Medicine CMH , Lahore
[3]FCPS, Pediatrics Consultant THQ Hospital Pasrur, Sialkot
[4]MBBS, FCPS Fellow Neonatalogy Children Hospital PIMS, Islamabad
[5]MBBS FCPS Pediatrics Fellow Pediatrics Oncology Hematology, Shaukat Khanum Memorial Cancer Hospital and Research Center, Lahore
[6]MBBS, FCPS Pediatrics Fellow Pediatrics Oncology Hematology, Shaukat Khanum Memorial Cancer Hospital and Research Center, Lahore
Correspondence to: Rubab Hafeez, Email: dr.rubabhafeez@gmail.com, Cell: +92 335 5454194

ABSTRACT

Objective: To determine the frequency of common causes of severe anemia in children under 5 years of age admitted in children hospital, Lahore

Design of the Study: Cross sectional study

Study Settings: The study was conducted at Department of Pediatric Medicine, Children Hospital, Lahore from 5 Sep 2018 to 5 March 2019.

Material and Methods: Patients were evaluated for the severity of anemia by the Hb level, baseline investigations, CBC with peripheral film and retics count, Hb electrophoresis, osmotic fragility test, G6PD assay, serum bilirubin, coomb's test and bone marrow biopsy ,if required. The demographic characteristics of patients and WHO criteria for Hb level was noted on the specifically designed study proforma. A blood sample was drawn and was sent to hospital laboratory for analysis of related causes of severe anemia. The collected data was entered and analyzed using SPSS software version 17.0.

Results of the Study: The mean age of patients was 30.41 ± 18.60 months with minimum and maximum age as 1 and 60 months. There were 169(46.3%) boys and 196(53.7%) girls with slightly higher female to male ratio. The mean Hb level was 5.15 ± 1.06 g/dL with minimum and maximum Hb as 3.40 and 6.90 g/dL. The common causes of anemia were assessed that showed 232(63.6%) patients had iron deficiency, 7(1.9%) cases had Sickle cell anemia, 37(10.1%) cases had Septicemia and 89(24.4%) cases had malaria

Conclusion: According to the findings of current study, the common causes of severe anemia in local children are found to be, iron deficiency anemia in 232(63.6%) cases, Sickle cell anemia in7(1.9%) cases ,septicemia in 37(10.1%) cases and malaria in 89(24.4%) cases. So during clinical evaluation of patients it must be kept in mind that these factors can contribute to severe anemia. So, preventive and therapeutic strategies must be ensured to minimize the risk of severe anemia in these children

Keywords: Anemia, Prevalence, Nutritional status, Risk factors, malaria, iron deficiency, Septicemia, sickle cell anemia

INTRODUCTION

More than a quarter of the world's population suffers from anaemia, which is the most common nutritional deficit in children and women of childbearing age. If untreated, anaemia in children can impair a child's ability to learn, grow physically, and maintain a healthy immune system.[1] Morbidity and mortality in children under the age of five are exacerbated in underdeveloped nations by the prevalence of anaemia. About 43 percent of children under the age of five worldwide are anaemic, and two-thirds of them live in sub-Saharan Africa.[2] According to some estimates, 47.4 percent of all children under the age of five are anaemic over the world.[3] Anemia can have a variety of underlying causes, many of which are interrelated, but the most common is iron deficiency, which accounts for almost half of all instances of anaemia worldwide. The creation of neurotransmitters, myelination, and energy metabolism all depend on iron, a mineral that is found in abundant quantities in the brain and other nervous system tissues.[4] Anemia is a public health issue, so the WHO created a classification system to make international comparisons easier. Anemia prevalence of 40% is considered severe, 20 percent to 39.9 percent is moderate, and 5 percent to 19.9 percent is light.[5]

Iron deficiency (ID) is the most common and widespread dietary deficiency. Because there are no global prevalence statistics for ID, anaemia is sometimes used as a surrogate (IDA). ID is thought to be half the cause of childhood anaemia globally. Anemia in young children is caused by malnutrition during the first two years of life when the body switches from milk to solid foods and iron needs increase. [6,7] Thus, iron supplementation is recommended in the WHO anaemia prevention guidelines for young children. ID may lead to anaemia in children of various ages and populations.[8] Infections, G6PD deficiency, and hemoglobinopathies are unknown causes of anaemia in tropical conditions.[9,10]

A study reported that most common cause for severe anemia was iron deficiency anemia (IDA) i.e. 38%.[11] In another study common causes of severe anemia included, Malaria in 90 (64.3%) cases, Sickle cell anemia in 20 (14.3%) cases and Septicemia as the cause of severe anemia in 21 (15%) cases.[12]

The rationale of this study is to find causes of severe anemia under 5 years of age in local population as no data is published and causes of severe anemia in children are also not well established in global literature. This study can be a land mark in establishing the local data and hence after identifying the causes we can accordingly design the preventive strategies among high risk children with previous positive histories.

MATERIAL AND METHODS

After receiving approval from the hospital's ethical committee the study was carried out. The study was conducted at Department of Pediatric Medicine, Children Hospital, Lahore from 5 Sep 2018 to 5 March 2019. Sample size is estimated as 365 using percentage of iron deficiency anemia (IDA) i.e.63% as cause of severe anemia.[11] The sample is calculated using 5% margin of error and 95% confidence level. Both male and female patients age between 1 month to 5 years (1 to 60 months) with severe anemia Hb<7 g/dl were included in this study. Patients with comorbidities other than anemia (Jaundice, congenital defects, syndromes) were excluded from the study.

Patients were evaluated for the severity of anemia by the Hb level, baseline investigations, CBC with peripheral film and retics count, Hb electrophoresis, osmotic fragility test, G6PD assay, serum bilirubin, coomb's test and bone marrow biopsy was done ,when needed. Informed consent was taken from parents and patients were selected as convenience sampling technique. Sampling was done on admitted patients in the ward of hospital. Baseline investigations were recorded. The demographic characteristics of patients and WHO criteria for Hb level was noted on the specifically designed study proforma. A blood sample was drawn and was sent to hospital laboratory for analysis of related causes of severe anemia.

Collected data was entered and analyzed using SPSS software version 17.0. Mean ± S.D was used for quantitative data like age, Hb level and weight of baby. The qualitative data like gender and causes of severe anemia was presented as frequency (%). Data was stratified as age, gender, BMI, socioeconomic status, mother education, living area and duration of anemia to address effect modifiers. Post stratified chi-square test was applied by taking ≤ 0.05 as significance.

STUDY RESULTS

The mean age of patients was 30.41 ± 18.60 months with minimum and maximum age as 1 and 60 months. There were 169(46.3%) boys and 196(53.7%) girls with slightly higher female to male ratio. The mean weight of cases was 15.72 ± 4.08 kg with minimum and maximum weight as 9 and 22 kg. The mean Hb level was 5.15 ± 1.06 g/dL with minimum and maximum Hb as 3.40 and 6.90 g/dL as shown in Table 1.

Table 1: Descriptive statistics of age, weight & Hb

Parameter	Mean	S.D	Range	Minimum	Maximum
Age (months)	30.41	18.60	59	1.00	60.00
Weight (kg)	15.72	4.08	-	9.00	22.00
Hb (g/dl)	5.15	1.06	3.50	3.40	6.90
Gender	Male			Female	
	169(46.30%)			176(53.70%)	

Table 2: Frequency of Causes of anemia in different age groups (months)

Age groups (months)	Causes of anemia				Total
	Iron deficiency	Sickle cell Anemia	Septicemia	Malaria	
1-30	123(66.1%)	3(1.6%)	19(10.2%)	41(22%)	186(100.0%)
31-60	109(60.9%)	4(2.2%)	18(10.1%)	48(26.8%)	179(100.0%)
Total	232(63.6%)	7(1.9%)	37(10.1%)	89(24.4%)	365(100.0%)

Chi-square = 1.43 P-value = 0.698 (Insignificant)

Table 3: Frequency of Causes of anemia with respect to gender

Gender	Causes of anemia				Total
	Iron deficiency	Sickle cell Anemia	Septicemia	Malaria	
Male	102(60.4%)	6(3.6%)	20(11.8%)	41(24.3%)	169(100.0%)
Female	130(66.3%)	1(0.5%)	17(8.7%)	48(24.5%)	196(100.0%)
Total	232(63.6%)	7(1.9%)	37(10.1%)	89(24.4%)	365(100.0%)

Chi-square = 5.77, P-value = 0.123(Insignificant)

Table 4: Frequency of Causes of anemia with respect to BMI

BMI	Causes of anemia				Total
	Iron deficiency	Sickle cell Anemia	Septicemia	Malaria	
Under weight	109(64.9%)	4(2.4%)	18(10.7%)	37(22%)	168(100.0%)
Normal weight	123(62.4%)	3(1.5%)	19(9.6%)	52(26.4%)	197(100.0%)
Total	232(63.6%)	7(1.9%)	37(10.1%)	89(24.4%)	365(100%)

Chi-square = 1.247, P-value = 0.742 (Insignificant)

Table 5: Frequency of Causes of anemia with respect to SES

Income (RS)	Causes of anemia				Total
	Iron deficiency	Sickle cell Anemia	Septicemia	Malaria	
<15000	120(62.5%)	492.1%)	19(9.9%)	49925.5%)	192(100.0%)
15000-50000	112(64.7%)	3(1.7%)	18(10.4%)	40(23.1%)	173(100.0%)
Total	232(63.6%)	7(1.9%)	37(10.1%)	89(24.4%)	365(100%)

Chi-square = 0.368, P-value = 0.947 (Insignificant)

The common causes of anemia were assessed as i.e. 232(63.6%%) patients had iron deficiency, 7(1.9%) cases had Sickle cell anemia, 37(10.1%) cases had Septicemia and 89(24.4%) cases had malaria as shown in Table 2. Stratification of frequency of causes of anemia with respect to gender, BMI, SES and mother's education is given in table no. 3, 4, 5 & 6 respectively.

Table 6: Frequency of Causes of anemia with respect to mother's education

Mother's Education	Causes of anemia				Total
	Iron deficiency	Sickle cell Anemia	Septicemia	Malaria	
Illiterate	105(64%)	5(3%)	13(7.9%)	41(25%)	164(100.0%)
Literate	127(63.2%)	2(1%)	24911.9%)	48(23.9%)	201(100.0%)
Total	232(63.6%)	7(1.9%)	37(10.1%)	89(24.4%)	365(100.0%)

Chi-square = 3.478, P-value = 0.324 (Insignificant)

DISCUSSION

In the United States, approximately 20 percent of children will suffer from anaemia at a certain point in their childhood. A haemoglobin (Hb) or red blood cell (RBC) mass below the 5th percentile for age is considered anaemia. For the diagnosis of anaemia, the Hb level of the patient must be compared to standards based on their age, which is why many labs use adult norms as a reference.[13] The mean corpuscular volume (MCV) is commonly used to classify anaemia (MCV). If the MCV is below 80 m3 [80 fL], the anaemia is considered microcytic. If the MCV is in the 80 to 100 m3 [80 to 100 fL] range, the anaemia is considered macrocytic. As an indicator of RBC variability, the distribution width of RBCs can be measured. Uniform cell size is suggested by narrow RBC distribution, but a wide distribution (more than 14 percent) reveals different sizes of RBCs.[14]

Pediatric Nutrition Surveillance System Reports have shown an increase in anaemia prevalence in children of low-income from 13 percent in 2002 to 15 percent in 2007.[15] Age-specific causes of anaemia can be found. Anemia is a discovery that needs to be investigated further rather than a diagnosis. Due to lower RBC production or greater RBC turnover, it is more common among youngsters than adults.[16]

RBC production is often reduced in patients with iron insufficiency. Consumption of more than 24 oz. of cow's milk a day, preterm, poor diet, and chronic blood loss are all risk factors. Reduced RBC production can also be caused by inflammation, renal failure, pharmaceutical use, viral infections, and diseases of the bone marrow. Hemolysis, mechanical destruction of RBCs, or blood loss can all cause an increase in RBC turnover. The sex, race, and family history of a person are all possible risk factors for hemolysis. Immune-mediated hemolysis or oxidative stress may produce anaemia as a side effect of medication use. People with mechanical valves or splenomegaly may experience mechanical damage. Acute bleeding can also cause RBC loss.[17]

Children under the age of five admitted to a children's hospital in Lahore, Pakistan, are the focus of the present investigation. The mean age of patients in this study was 30.41 18.60 months, with a range of 1 to 60 months. The prevalence, cause, and outcome of severe anaemia in children aged 6 months to 5 years have recently been studied. According to their findings, the majority of the patients were under the age of two (63.6 percent).[18]

In current study there were 169(46.3%) boys and 196(53.7%) girls cases with slightly higher female to male ratio and no significant difference in anemia prevalence between different age groups was found. In another study there was no difference between anemia prevalence in boys and girls , prevalence was higher in aged 6-23 months then in those aged 24-59 months.[19]

In current study the mean Hb level was 5.15 ± 1.06 mg/dL with minimum and maximum Hb as 3.40 and 6.90 mg/dL. The most common cause of anemia was assessed as iron deficiency i.e. 232(63.6%) patients.Another study including 227 children with

median age of 4.5 years showed iron deficiency anemia as the most common cause in all age groups (38%).[11]

In current study the common causes of anemia were assessed as 232(63,6%) cases had iron deficiency anemia, 7(1.9%) cases had Sickle cell anemia, 37(10.1%) cases had Septicemia and 89(24.4%) cases had malaria. Another study including 140 patients of severe anemia showed most common causes of severe anemia as Malaria in 90 (64.3%), Sickle cell Anemia in 20 (14.3%) and Septicemia as cause of severe anemia in 21 (15%) children.[12]

In current study no significant difference in prevelance of anemia in children having literate vs illiterate mothers and low socioeconomic status vs high status was found while in another study high risk factors for anemia were found to be lower maternal schooling and lower socioeconomic status.[1]

CONCLUSION

This study concluded that the common causes of severe anemia in local children are found as 232(63.6%%) cases had iron deficiency, 7(1.9%) cases had Sickle cell anemia, 37(10.1%) cases had Septicemia and 89(24.4%) cases had malaria. As anemia is a global health problem and can badly impact on cognitive and physical development of children it must be kept in mind that in future these factors can contribute to severe anemia. So, preventive and therapeutic strategies must be ensured to minimize the risk of severe anemia in these children.

REFERENCES

1. Leite MS, Cardoso AM, Coimbra CE, Welch JR, Gugelmin SA, Lira PCI, et al. Prevalence of anemia and associated factors among indigenous children in Brazil: results from the First National Survey of Indigenous People's Health and Nutrition. Nutr J. 2013;12(1):69.
2. Simbauranga RH, Kamugisha E, Hokororo A, Kidenya BR, Makani J. Prevalence and factors associated with severe anaemia amongst under-five children hospitalized at Bugando Medical Centre, Mwanza, Tanzania. BMC Hematol. 2015;15(1):13.
3. Ayoya MA, Ngnie-Teta I, Séraphin MN, Mamadoultaibou A, Boldon E, Saint-Fleur JE, et al. Prevalence and risk factors of anemia among children 6–59 months old in Haiti. Anemia. 2013;2013.
4. Gari T, Loha E, Deressa W, Solomon T, Atsbeha H, Assegid M, et al. Anaemia among children in a drought affected community in south-central Ethiopia. PloS one. 2017;12(3):e0170898.
5. Pita GM, Jiménez S, Basabe B, García RG, Macías C, Selva L, et al. Anemia in children under five years old in Eastern Cuba, 2005-2011. Medicc Review. 2014;16(1):16-23.
6. Cardoso MA, Scopel KK, Muniz PT, Villamor E, Ferreira MU. Underlying factors associated with anemia in Amazonian children: a population-based, cross-sectional study. PloS one. 2012;7(5):e36341.
7. Petry N, Olofin I, Hurrell RF, Boy E, Wirth JP, Moursi M, Donahue Angel M, Rohner F. The proportion of anemia associated with iron deficiency in low, medium, and high human development index countries: a systematic analysis of national surveys. Nutrients. 2016 Nov;8(11):693.
8. Jamnok J, Sanchaisuriya K, Sanchaisuriya P, Fucharoen G, Fucharoen S, Ahmed F. Factors associated with anaemia and iron deficiency among women of reproductive age in Northeast Thailand: a cross-sectional study. BMC Public Health. 2020 Dec;20(1):1-8.
9. Desalegn Wolide A, Mossie A, Gedefaw L. Correction: Nutritional Iron Deficiency Anemia: Magnitude and Its Predictors among School Age Children, Southwest Ethiopia: A Community Based Cross-Sectional Study. PLoS One. 2018 Aug 9;13(8):e0202380.
10. AlFaris N, ALTamimi J, AlKehayez N, AlMushawah F, AlNaeem A, AlAmri N, AlMudawah E, Alsemari M, Alzahrani J, Alqahtani L. Prevalence of Anemia and Associated Risk Factors Among Non-Pregnant Women in Riyadh, Saudi Arabia: A Cross-Sectional Study. International journal of general medicine. 2021;14:765.
11. Ben-Ami T, Natour M, Rekhtman D, Ariel T, Revel-Vilk S. Iron Deficiency Anemia As a Leading Cause of Severe Anemia in Children May be Associated with Unnecessary Red Blood Cells (RBCs) Transfusion. Am Soc Hematology 2015;126(23):4454.
12. Muoneke V, Chidilbekwe R. Prevalence and aetiology of severe anaemia in under-5 children in Abakaliki South Eastern Nigeria. Pediatr Therapeut. 2011;1(3):107.
13. Brugnara C, Platt OS. The neonatal erythrocyte and its disorders. Nathan and Oski's hematology of infancy and childhood. 2003;1:36-66.
14. Robertson J, Shilkofski N. The Harriet Lane handbook: a manual for pediatric house officers: Mosby; 2005.
15. Rienold C, Dalenius K, Smith B, Brindley P, Grummer-Strawn L. Pregnancy Nutrition surveillance 2007 report. Atlanta: US Department of Health and Human Services. Center for Disease Control and Prevention. 2009.
16. Bizzarro MJ, Colson E, Ehrenkranz RA. Differential diagnosis and management of anemia in the newborn. Pediatr Clin North Am. 2004;51(4):1087-107, xi.
17. Wright RO, Tsaih S-W, Schwartz J, Wright RJ, Hu H. Association between iron deficiency and blood lead level in a longitudinal analysis of children followed in an urban primary care clinic. J Pediatr. 2003;142(1):9-14.
18. Muoneke V, Chidilbekwe R. Prevalence and aetiology of severe anaemia in under-5 children in Abakaliki South Eastern Nigeria. Pediatr Therapeut. 2011;1(107):2161-0665.
19. Pita GM, Jiménez S, Basabe B, García RG, Macías C, Selva L, et al. Anemia in children under five years old in Eastern Cuba, 2005-2011. Medicc Review. 2014;16(1):16-23.