Pediatrics & Therapeutics
ISSN: 2161-0665

Muoneke et al., Pediatr Therapeut 2011, 1:3
DOI: 10.4172/2161-0665.1000107

Review Article Open Access

Prevalence and Aetiology of Severe Anaemia in Under-5 Children in Abakaliki South Eastern Nigeria

Vivian Uzoamaka Muoneke* and Roland Chidilbekwe

Department of Paediatrics, Ebonyi State University/ Teaching Hospital, Abakaliki, Ebonyi State, Nigeria

Abstract

Background: Severe anaemia is a common childhood problem which is associated with various degrees of morbidity and mortality especially in children under five years of age. It remains a major public health challenge in Nigeria and sub-Saharan Africa.

Objectives: To determine the prevalence, aetiology and outcome of severe anaemia in children aged 6 months to 5 years.

Methods: This was a prospective study of children less than 5 years that presented with severe anaemia at the Children's Emergency Unit and the Outpatient Department of Ebonyi State University Teaching Hospital Abakaliki (EBSUTH), Abakaliki. Severe anaemia was defined as PCV ≤ 15%. Biodata of subjects selected included age, sex, and socio-economic status. Laboratory tests carried out included haemoglobin levels, haemoglobin electrophoresis, blood film examination, blood culture, urinalysis, microscopy, and other relevant tests.

Results: One hundred and forty subjects out of the 1450 patients admitted during the period of study had severe anaemia giving a prevalence rate of 9.7%. Majority of the patients (63.6%) were less than 2years of age. Malaria was the commonest cause of severe anaemia 64.3% (90). Other common causes included sickle cell anaemia 13 (9.3%), Septicemia 19 (13.6 %), and malnutrition 10 (7.1%). One hundred and seventeen (83.6%) patients recovered and were discharged home while 19 died giving mortality rate was 13.6%.

Conclusion: The study revealed high prevalence of severe anaemia while malaria was observed to be the commonest cause among under-5 children seen at EBSUTH Abakaliki.

Introduction

Severe anaemia is a major paediatric problem in Nigeria [1-4]. It is associated with many unwanted effects on the patient, one of which is congestive cardiac failure. Severe anaemia which is a life threatening condition is a common occurrence in children's emergency units in most hospitals in the developing countries [2-6]. Most anaemia related deaths encountered are usually due to severe anaemia [1-3]. It is a common blood disorder in children and imposes an economic burden on the parents/caregivers and the country as a whole [7,8]. In various African settings, about 12 to 29%of hospitalized children have severe anaemia with thein-hospital case fatality rate ranging between 8 and 17% [1-4].

Reasons like malaria endemicity, poor nutrition including micronutrient deficiency, haemoglobinopathies, frequent bacterial infections and high parasitic infestations have been given for these high prevalence rates [2,8-11]. Late presentation of patients to health facilities, ignorance and poverty on the part of the parents/ caregivers are other factors which compound these high prevalence rates [2,7,8]. In most African studies, including reports from Nigeria, severe anaemia occurs more commonly in children less than 5 years of age and is predominant among the males, occurring most often during the rainy seasons (in the tropics) when the incidence of malaria infection is at its peak [3,4,6,9].

The need to carry out this study was informed by the paucity of literature on the prevalence and aetiological factors of severe anaemia among children in the vulnerable age-group of under-5 years. It is hoped that the information obtained in this study would be helpful to health care practitioners and health policy makers in this area, in curbing this preventable but potentially fatal disorder particularly among children in this vulnerable age group.

Methods

The study area

This study was done at the Children's Emergency Unit and the Children's Outpatient Department of Ebonyi State University Teaching Hospital, Abakaliki, Ebonyi State. Abakaliki is the capital of Ebonyi State, located in the South Eastern part of Nigeria and covering an area approximately 51km^2, with an average atmospheric temperature of 30°C. Abakaliki, like most part of southern Nigeria is in the holendemic zone for malaria transmission and thus has intense malaria transmission all year round.

The study design

Between January 2007 and June 2007, a consecutive sample of children(140 patients) who presented at the Outpatient Departmentand the Children's Emergency Room with a primary diagnosis of severe anaemia(defined as a haemoglobin concentration of ≤5.0g/dl or PCV of ≤15%) were recruited into this prospective, cross sectional and

***Corresponding author:** Uzoamaka.V. Muoneke, Department of Paediatrics, Ebonyi State University/ Teaching Hospital, Abakaliki, Ebonyi State, Nigeria, Tel: 234-8037432258; E-mail: vizym@yahoo.com

Received November 24, 2011; **Accepted** December 16, 2011; **Published** December 18, 2011

Citation: Muoneke VU, Chidilbekwe R (2011) Prevalence and Aetiology of Severe Anaemia in Under-5 Children in Abakaliki South Eastern Nigeria. Pediatr Therapeut 1:107. doi:10.4172/2161-0665.1000107

descriptive study. Additional inclusion criteria were an age between 6 and 60 monthsand no history of blood transfusion within the previous 3 months (to exclude probable errors that may occur in some conditions such as G-6-PD deficiency states). Recruited subjects in obvious life-threatening conditions such as cardio-respiratory and neurological complications were first stabilized before history was taken.

The study was approved by the ethics committee of the Ebonyi State University Teaching Hospital, Abakaliki while written informed consent was obtained from a parent or a guardian of each child.

Clinical/ Systemic assessment and management

On enrolment, detailed history including medical and dietary history, socio-demographic data, was collected. Social class was determined using the highest educational qualification and occupation of both parents as suggested by Oyedeji et al. [12]. Physical/ systemic examination was carried out for each of the patients. The subjects were weighed in (Kg) standing on a standard bathroom weighing scale after making the zero correction and nutritional status was assessed using Wellcome classification [13]. Samples of blood, urine, and stool were collected according to standard technique; subjects were then admitted into the children emergency wards.

Laboratory tests, procedure / technique

All the samples were collected and sent to the laboratory for analysis within 24hrs of collection, those not analysed were refrigerated at temperatures between 4 and 8°C. Collected blood samples were used for packed cell volume/Haemoglobin concentration estimation, WBC count /differential analysis, haemoglobin electrophoresis, preparation of peripheral blood films for determination of presence of malaria parasites and blood culture.

Urine was collected for urinalysis, microscopy, culture and sensitivity while stool samples were collected for microscopy and culture. Results from each of them were compared and analyzed before reaching a consensus which was then recorded in the data proforma.

Packed cell volume levels, haemoglobin levels, haemoglobin electrophoresis, blood film examination, urinalysis / microscopy and stool microscopy were carried out for every patient. Other tests like blood, urine and stool cultures were done for selected subjects based on their presenting history, clinical condition and on the outcome of their initial laboratory tests.

Haematologic tests

Packed cell volume (PCV) and Haemoglobin were assessed using the micro haematocrit technique and cyanmethaemoglobin method respectively. Haemoglobin electrophoresis was carried out using the cellulose acetate electrophoresis method. All the tests were done for all the patients with 5mls of blood collected from the median ante cubital vein.

The mean cell haemoglobin concentration (MCHC) was used as suggesting the presence or absence of iron deficiency (iron studies were not done) and was calculated from the values of haemoglobin and PCV, using the formula below:[14]

$$\text{MCHC} = \frac{\text{Haemoglobin g/dl}}{\text{Packed Cell Volume (\%)}}$$

MCHC values 31-37g/dl = normal, <31g/dl = low while >37g/dl= high [14]. Children with low MCHC were assumed to have iron deficiency anaemia [15].

Parasitologic tests

Malaria parasite count and species determination were carried out with thick and thin peripheral smears respectively. Presence of asexual forms of *P.falciparum* malaria parasites in the peripheral films was noted as malaria infection [16].

Stool samples were collected from all the subjects and analyzed immediately. Each sample was subjected to a microscopic examination to determine the presence of leucocytes, ova and larvae of parasites [17].

Bacteriologic tests

Urine samples collected from all the subjects were immediately analyzed using dipsticks and followed up immediately with microscopic examination. Samples with positive dipstick findings (positive urine nitrate) and microscopic findings (high WBCs per high power field and presence of bacteria) qualified for urine culture using blood agar. All those with fever and positive urine cultures were regarded as having urinary tract infections.

Blood culture was done according to standard methods for only subjects with a history of fever, abnormal white cell count/ differentials on admission and in other subjects who continued to have fever despite initial medical treatment. 1ml of blood collected from peripheral veins was incorporated into a liquid culture media [17]. All subjects with positive blood cultures and urinary tract infection were regarded as having sepsis. No stool culture was carried out on any of the subjects.

Treatment administered and outcome of treatment

All the subjects recruited were admitted and managed in the paediatric emergency unit of the hospital by the unit on take. The standard protocol for management of severe anaemia was applied on all the patients to ensure that all had a uniform management.

Outcome following treatment was determined based on the number that survived, died or were discharged against medical advice.

Data analysis

The data collected were entered into the data editor of statistical package for social sciences (SPSS) software package version 11.0. Analysis was based on simple percentages, proportions, charts and tables. The influence of aetiological causes on the severity of anaemia was assessed. Differences in Proportions were compared using the chi square statistic. Where figures in the table were too few for the chi square test, Yates correction test was used. Statistical significance was set at $p < 0.05$.

Results

In the period under review 1450 children under the age of 5 years presented to the hospital for treatment out of which 140 had severe anaemia. The prevalence rate of severe anaemia from this study is thus 9.7%. The PCV levels ranged between 5 and 15 % with a mean level of 11.8 ± 3.0%. Fifty four (38.6%) children had PCV levels of ≤10% while 86 (61.4%) had PCV levels >10%.

The sex and age distribution of the study subjects is as shown in table 1, there were 76(54.2%) males and 64(45.8%) females with a male: female ratio of 1.2: 1.0. The mean age of the patients was 25.1 ± 16.7 months with majority of the patients, 89 (63.6%) were aged less than 24 months. The social class distribution among the study subjects is

shown in Figure 1, majority of the patients, 114 (81.4%) belonged to the lower social classes (III&IV).

Figure 2 demonstrates the identified causes of severe anaemia among the study population.

- **Malaria** was the most common cause of severe anaemia in 90 (64.3%) of the patients. Seventy six (84.4%) of them werebelow 24 months of age. Fifty-five percent and 9.3% of the patients had malaria existing alone and in combination with other disorders respectively. Nineteen (21.1%) children had malaria hyperparasitaemia (number of malaria parasites in blood ≥3+). Plasmodium falciparum was the only species obtained in all the positive blood films.
- **Sickle cell Anaemia** was seen in 20 (14.3%) of the study patients. Six (30%) children with SCA also had malaria while 1 (5.0%) had septicaemia. The cause of severe anaemia in the rest 13 (65%) could not be determined besides attributing it to possible hyperhaemolysis in SCA.

AGE (MTHS)	SEX		TOTAL
	MALE	FEMALE	
6 - 12 13-24	28(20%) 24(17.1%)	12(8.6%) 25(17.9%)	40(28.6%) 49(35.0%)
25 – 60	24(17.1%)	27(19.3%)	51(36.4%)
Total	76(54.2%)	64(45.8%)	140(100%)

Table 1: Age and sex distribution of under five children with severe anaemia.

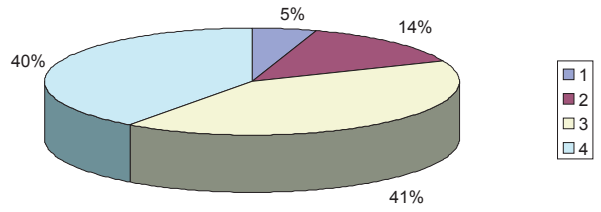
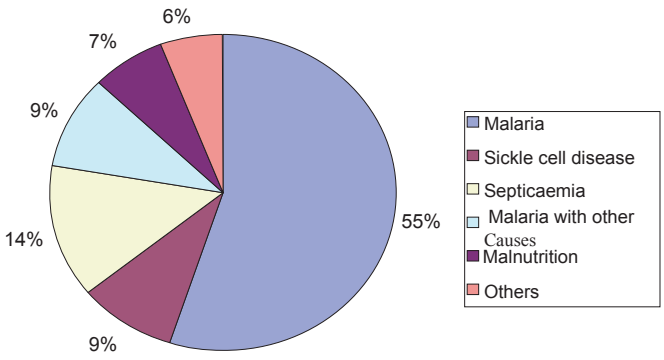


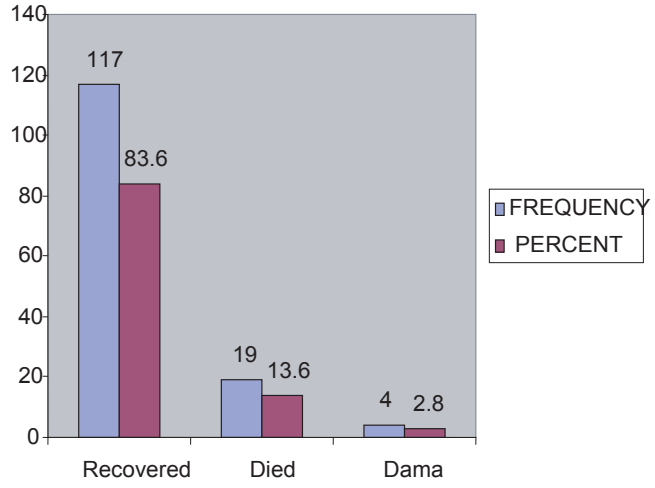
Figure 1: Social class distribution among the 140 subjects with severe anaemia.



N.B: Malaria combined with other causes viz: Malaria with sickle cell disease and Malaria with septicaemia.
Others viz:

- Helminthiasis
- Disseminated tuberculosis) ,
- Hepatoblastoma
- HIV / AIDS

Figure 2: The aetiology of severe anaemia in 140 children.



N.BDama = Discharged against medical advice

Figure 3: Outcome of 140 patients with severe anaemia.

- **Septicaemia** was the cause of severe anaemia in 21 (15%) children.Septicaemia was the sole cause of severe anaemia in 19 (90.5%) patients while in 2(9.5%) patients there was co morbidity with malaria and SCD respectively. The blood culture results in all 21 patients isolated the following organisms: *Salmonella* species (6), *Escherichia coli* (4), *Staphylococcus aureus* (4), *Klebsiella* (3), *Streptococcus pyogenes*(1) and *Pseudomonas* (1). However, 2 of the blood cultures grew organisms, which could not be identified. No organisms were cultured either from the stool or urine.
- **Malnutrition** was associated with severe anaemia in 10 (7.1%) children. Three (30.0%) children had severe malnutrition and 7 (70%) were undernourished.These children had no other reason for their severe anaemia.

Other causes of severe anaemia were Helminthiasis 2 (1.4%), disseminated tuberculosis 1(0.7%), HIV / AIDS 1 (0.7%) and Hepatoblastoma 1 (0.7%).

Table 2 highlights the association between PCV levels and some aetiological factors. Packed cell volume levels appear to be lower in children with low MCHC (iron deficiency) (X^2 = 165, p < 0.01), haemoglobin SS (SCD) (X^2 = 6.8, p = 0.03) and increasing malarial parasitaemia (X^2 = 7.86, p = 0.04). However, the association between PCV levels and malnutrition (X^2 = 2.59 [a] P = 0.27), or septicaemia (X^2 = 1.83 P = 0.18) was not statistically significant.

Outcome of severe anaemia: One hundred and seventeen (83.6%) patients recovered, 4(2.8%) were discharged against medical advice and 19(13.6%) died. Fourteen of the 19 children (73.68%) died within 24 hours of admission. Severe malaria was the most common diagnosis in the deceased (n=11) with septicaemia (n=5) next to it. Thirteen children (68.42%) were transfused while 6(31.58%) did not receive blood transfusion. All the children that were not transfused died within 2 hours of presentation while those that were transfused survived for longer periods. Most of the deaths 13 (68.4%), were among children less than 24 months of age.

Variables	PCV		X^2	df	p
	5-10 %	11 –15%			
Malaria parasitemia	27	63	**7.86**	**3**	**0.04**
+	18	23			
++	4	26			
≥ +++	5	14			
S C D					
Genotype AA	32	68			
AS	10	10	**6.8**	**2**	**0.03**
SS	12	8			
Sepsis					
Culture positive	10	9	**1.83**	**1**	**0.18**
Culture negative	44	77			
Iron deficiency anaemia					
Low MCHC	18	15	**165**	**100**	**<0.01**
Normal MCHC	36	71			
Weight					
Normal	39	65			
Undernourished	15	18	**2.59**	**2**	**0.27**
Severe Malnutrition	0	3			

Table 2: The relationship between pcv levels and aetiological causes of anaemia in under 5 children.

Discussion

The present finding of severe anaemia prevalence of 9.7% in under-5 children with majority (63.6%) of them being younger than 2years is consistent with the findings of previous Nigerian workers who reported prevalence rates ranging from 2.7% to 12.5% [1-4,18,19]. Similar high prevalence rates had also been reported in most tropical countries which contrast with rates of <1.0% obtained in the developed countries [20]. Several factors were linked to these high rates which include malaria, poor nutrition, frequent bacterial infections and high parasitic infestations [5-11]. These are consistent with the finding in this study site.

Malaria has consistently been demonstrated to be the commonest cause of severe anaemia among children living in malaria endemic regions [7-9,19]. This has been affirmed in the present study where malaria was the aetiologic cause of severe anaemia in 64% of the cases, with *P. falciparum* being the only species of malaria parasite demonstrated in the blood films of the study subjects. This trend was also observed in other Nigerian studies where malaria was noted to be responsible for 51.5% [1] and 52.6% [4] of severe anaemia in under-5 children respectively. The high prevalence rates of severe anaemia following malaria in these studies were linked to the fact that the study areas are within the known malaria endemic zones and that the immunity levels developed by this age is not protective enough [9,11]. The observation of progressive fall in PCV levels with increasing malarial parasitaemia had also been reported previously [2,4]. This finding may justify the need of post treatment malaria parasite assessment to ensure complete eradication of the parasite.

Septicaemia was responsible for severe anaemia in 15.0 % of the study patients. Seriki et al. [1] in his study also observed the role of septicaemia in causation of severe anaemia in both sicklers and non-sickler. Of the 27.3% of his severe anaemic patients who had septicaemia, 17% were sicklers while 10.3% were non-sicklers, thus confirming the well-recognized susceptibility of these sicklers to infection. He thus concluded that in sicklers, infection is often the major precipitating factor for sickle cell crisis with resultant rapid drop in the haematocrit [1]. The finding from this study is not dissimilar though malaria appear to precipitate severe anaemia more commonly among sicklers than septicaemia. While *Salmonella typhi* and *Streptococcus pneumoniae* were the commonest organisms isolated by Esemia et al. [11] in their severely anaemic subjects with septicaemia, majority of whom were children with sickle cell disease, among our subjects Salmonella species, Escherichia coli, and Staphylococcus aureus were more prevalent. The difference could be because most of our subjects were non sicklers and were not as prone to infection with encapsulated organisms like children with sickle cell anaemia.

Sickle cell anaemia accounted for 14% of severe anaemia among the study population. Though in majority of the cases no other obvious causes of anaemia were found, malaria was the commonest associated conditions while septicemia was an uncommon cause of severe anaemia among children with sickle cell anaemia in this study site. This finding differ from the finding of Juwah et al. [21] which noted that the commonest causes of severe anaemia among children with sickle cell anaemia was respiratory infections closely followed by malaria and bacterial infections. The role of malaria in severe anaemia among children with sickle cell anaemia highlights the need of giving routine malarial prophylaxis among children with sickle cell anaemia in this environment.

The mortality rate of 13.6% in this study is comparable to 2.5-18% obtained from earlier studies in Nigeria and other African countries [1-6,18,19]. This mortality rate is however higher than the 5.6% reported by Ojukwu et al. [4] from the same centre. This difference may be due to subject selection since the subjects in this study were under-5 children while Ojukwu's [4] subjects were aged between 3 month and

14 years. The significance of this difference is highlighted by the finding that majority of the deaths in this study 68.7% were children less than 24 months old.

The following conclusions could be reached from this study: Severe anaemia is a major health problem among under-5 children in EBSUTH and it is a significant cause of mortality especially in the first 2 years of life. Malaria is the predominant aetiological factor in this environment. There is need to step up malarial control policies and their implementation in order to reduce the morbidity and mortality associated with severe anaemia in EBSUTH, Abakaliki.

References

1. Seriki O (1974) Severe anaemia in the first two years of life. Nig J Paediatr 1: 33-35
2. Ernest SK, Anunobi NE, Adeniyi A (2002) Correlates of emergency response interval and mortality from severe anaemia in childhood. West Afr J Med 21: 177-179.
3. Jiya NM, Yusuf T, Airede KI (2006) Severe anaemia in childhood in Sokoto, Nigeria. Sahel Med J 9: 52-55.
4. Ojukwu JU (2002) Severe anaemia in childhood. Abstracts of proceedings: Annual General and scientific conference of Paediatric Association of Nigeria. Asaba 2001. Nig J Paediatr 29:84.
5. Emordi I J (1999) Anaemias. In: Azubuike J.C, Nkangineme K.E.O, edsPaediatrics and Child Health in a Tropical Region. Owerri: African Educational services 186-193.
6. Anonymous (1986) Anaemia in children in tropical Africa. J Trop Paed 32: 263-264.
7. WHO. The global picture of anaemia. Technical report series 2000: Report of a WHO Scientific group. Geneva: WHO 2000.
8. deBenoist B (2004) Focusing on anaemia -Towards an intergrated approach for effective anaemia control. A joint statement by the World Health Organization and United Nations Children's Fund 10-12.
9. Anonymous (1998) Relationship between anaemia and malaria in Tropical Africa. *Trans R Soc Trop Med Hyg J* 92: 556-567.
10. Walter T, De Andraca I, Chadud P, Perales CG (1989) Iron deficiency anemia: adverse effects on infant psychomotor development. Pediatrics 84: 7-17.
11. Esimai V C (1983) An investigation into the relative roles of factors commonly implicated in the aetiology of severe anaemia in Ilesha, Nigeria. National Postgraduate Medical College of Nigeria Dissertation. 7-14.
12. Oyedeji G A (1985) Socio-economic and cultural background of hospitalized children in Ilesha. Nig J Paed 12: 111.
13. WHO/ FAO. Expert committee on Wellcome classification of Protein energy Malnutrition. WHO 1971.
14. Evatt BL, Lewis SM, Lothe F, McArthur JR (1985) Fundamental diagnostic haematology. Center for Disease control (CDC). 1093: 61-73.
15. Rowland HA (1966) Anaemia in Dar-es-Salaam and methods for its investigation. Trans R Soc Trop Med Hyg 60: 143-169.
16. Roger H, Robert G.M (1986) Medical Laboratory Haematology. London: Butterwort 94-113.
17. Baker FJ, Silverton RE (1985) Introduction to Medical Laboratory Technology. London: Butterworths 316-333.
18. Azubuike JC, Izuora GI, Obi GO (1977) Anaemia in non-sickling Nigerian children around Enugu. Trop Geogr Med 29: 365-368.
19. Eleje G U, Muojieje CC, Ulebe AO, Malizu EV (2005) Severe anaemia among children admitted in a tertiary health care institution: the experience at NnamdiAzikiwe University Teaching Hospital Nnewi, Nigeria. MedizikJ 7: 32-36.
20. Schwartz E (2000) The Anaemias. In: Behrman RE, Kliegman RM, Jenson HB eds, Nelson's Textbook of Paediatrics 15th Ed. Philadelphia: WB Saunders Co. 1461-1487.
21. Juwah AI, Nlemadim A, Kaine W (2003) Clinical presentation of severe anemia in pediatric patients with sickle cell anemia seen in Enugu, Nigeria. Am J Hematol 72: 185-191.