

Anemia among Children living with HIV/AIDS on HAART in Mekelle general Hospital, Northern Ethiopia – a cross-sectional study

Feven Tesfay^{1*}, Abrha Gebregreges¹, Haftay Gebrehiwot¹, Haftu Hailekiros¹, Letegebriel Girmay¹, Hadush Bekuretsion², Gebrekidan Gebrezigher³, Gebreslassie Gebremariam¹

¹Department of Medical laboratory Science, College of Health Sciences, Mekelle University, Mekelle, Ethiopia

²Tigray Health Research Institute, Mekelle, Ethiopia

³Department of Biochemistry, College of Health Sciences, Mekelle University, Ethiopia

*Corresponding author: Feven Tesfay, Department of Medical laboratory Science, College of Health Sciences, Mekelle University, Mekelle, Ethiopia; Tel: +251912102948; Email: feva.tesfay@gmail.com

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ABSTRACT

Background

Anemia is a common complication of pediatric HIV infection, facilitating HIV disease progression, and decreasing survival. In Ethiopia, there is limited evidence on the prevalence of anemia among HIV positive children.

Objective

To determine the prevalence of anemia in HIV infected children on HAART aged 6 months to 14 years in Mekelle Hospital antiretroviral treatment (ART) clinic, Tigray region, Northern Ethiopia, from October- April 2018.

Methods

An institution-based cross-sectional study was conducted on 241 HIV infected children attending Mekelle Hospital ART clinic from October to December 2018. Data on socio-demographic were collected using a structured pretested questionnaire. Hemoglobin values were determined by cell sysmex xp-100 machine. To define anemia, WHO Cut off values of hemoglobin were utilized after adjusting the values for to altitude of the study area.

Results

Among 241 participants, 16 (7%) were anemic in this study. Of the anemic children, 56%, 19%, and 25 % had mild, moderate, and severe anemia, respectively. Nearly half of 47.7% (7/16) of the anemic children had normocytic-normochromic anemia type followed by macrocytic-normochromic anemia, 38.6 % (93/241). CONCLUSION: In this study, the prevalence of anemia among participants was found to be 7% and 25 % of them had severe anemia.

Keywords: Anemia, Children, HIV, Hemoglobin, HAART, Mekelle general Hospital, Ethiopia

Introduction

Anemia is a condition characterized by a reduction in the number and size of red blood cells or hemoglobin levels below the standard cut-off values, subsequently impairing the blood from delivering oxygen to the body tissues [1, 2]. It is one of the most common and widespread disorders worldwide, causing various public health problems, particularly in young children and women of childbearing age living in resource-poor areas [2]. As per WHO, about 1.7 billion people were estimated to be affected by anemia and the condition has the most dramatic health impact in women and children with an estimated global prevalence at 29% in pregnant women, 38% in no pregnant women, and 43% in children [3, 4]. In Ethiopia, according to 2016 national survey conducted by Public Health Institute (EPHI), the prevalences of anemia adjusted for altitude among preschool children and school-age children were 34.4 (1 in 3 children), and 25.8 (1 in 4 children), respectively, with 31.6% and 2.9% in preschool children and 24.5 % and 1.3% of the school children had moderate and severe anemia, respectively [5].

Although half of all anemia cases in children are attributed to iron deficiency, pediatric anemia is also a common hematological complication seen in children living with HIV/AIDS [4]. In HIV/AIDS infected children, anemia is associated with negative impacts on quality-of-life, rapid HIV- disease progression and mortality [6-8] and the impact and severity of anemia depend mainly on the stage of HIV disease, sex, age, the definition of anemia used, the nutritional status of the children and their countries' economies. HIV infected children living in developing countries, attributed to iron deficiency compounded by poor socioeconomic status, tend to have a high prevalence of anemia, posing a substantial compromise on their clinical outcome and quality of life [9-11].

In Ethiopia, a recent systematic review and meta-analysis, reports 22.3% as the overall prevalence of anemia in HIV infected children [12]. This metanalysis pooled evidence on the prevalence of anemia among HIV/AIDS infected children reported in cross-sectional and cohort studies from 1990 to 2017. However, due to a lack of eligible studies, it did not include a single study conducted in Tigray regional state, one of the regional states of Ethiopia. This shows the lack of evidence on the prevalence of anemia among HIV infected children receiving highly active antiretroviral therapy (HAART) in our region, which the current study aimed to generate. This, to the best of our knowledge, is the first attempt on assessing the prevalence of anemia in HIV infected children taking HAART in our setting and our finding could be important for local ART clinic managers and service providers working towards improving the quality of life and health status of children living with HIV. Also, the finding could be a good source of data for future systematic reviews in this space to show complete prevalence data in Ethiopia.

Methods

Study setting and population

A facility-based cross-sectional comparative study was employed in this study. The study population included HIV Infected children in the range of 6 months to 14 years, who had been attending HIV/AIDS care and HAART treatment in Mekelle general Hospital ART clinic from October to April 2019. Mekelle general hospital (MGH) is found in Mekelle City, the capital city of the Tigray regional state located in the northern part of Ethiopia, 783 km away from the capital city Addis Ababa.

Sample size determination and sampling procedure

The minimum sample size required was calculated using a single population proportion formula and prevalence of anemia in children, which is 16.2 %, reported in a study conducted in Northwest Ethiopia was used for this calculation [13]. After considering a 5 % margin of error at 95 % confidence level, and 15 % non-response rate, the calculated sample size was 219. However, at the time of data collection, there were only 241 HIV infected children attending the ART clinic, and we included all of them to see the overall figure of anemia in the clinic.

Data collection

We approached the study subjects/caregivers during their respective follow-up appointments and explained the purpose of the study to get their consent for participation. After getting the consent, trained health professionals (nurse and laboratory technicians) collected the data using a pre-tested semi-structured questionnaire interview. The questionnaire was translated into the local language, Tigrigna, and back to English to maintain its consistency. The pre-tested semi-structured questionnaire interview was employed to collect socio-demographic characteristics including religion, education level, and employment status.

Blood Samples and laboratory analysis

Following standard operating procedures (SOPs), blood samples (3-mL) were collected from the study participants by qualified laboratory technologists using vacutainer tubes (purple cap) containing 2.0 mg/mL ethylenediaminetetraacetic acid (EDTA-K2). The collected blood samples were thoroughly mixed to avoid clump and clot formation. The value of the concentration of hemoglobin was determined using a hematology auto analyzer (SYSMEX-XT 4000i, Sysmex Corporation, Kobe, Japan) within 2 hours of blood collection. Hematology analyses were performed according to the hydrodynamic focusing (DC Detection), flow cytometer (using a semiconductor laser), and traditional impedance technology. The performance of the instrument was monitored by running three levels of controls and samples were analyzed only when the controls are in the accepted range for all parameters.

Data analysis and interpretation

The data was cleaned, edited, checked for completeness, and exported to SPSS version 24.0 (SPSS INC, Chicago, IL, USA) for further processing. All required variable recoding and transformation were done before the final data analysis. Frequency distributions, cross-tabulations, and graphs were used to describe the variables under the study.

To determine the prevalence of anemia among the study children, we considered the following cut off values of Hgb after altitude adjustments: <11 g/dl for children <5 years old, <11.5 g/dl for children 5–11.9 years old and <12 g/dl for children 12–14.9 years old. Hgb values were adjusted by subtracting 0.08 g/dl considering an altitude of 2254m in the study area [14]. The presence of anemia and its severity were categorized based on blood hemoglobin (Hgb) level according to the UNICEF/WHO guideline as: anemia (< 10.9 g/dl); mild anemia (10-10.9 g/dl); moderate anemia (7.0-9.9 g/dl); and severe anemia (\leq 7.0g/dl) [14].

Ethical considerations

The study was conducted after the study protocol was ethically reviewed and approved by the Department of Medical Laboratory Science Research and Ethical Review Committee (DRERC), College of Health Sciences, Mekelle University. After approval of ethical issues, permissions were obtained both from the Tigray health bureau (THB) and the authorities of the hospital to undertake the study. The aim, risk, and benefit of the study as well as their right for withdrawal from the study at any time were verbally explained for the study participants and their caregivers using local language in the study area, and their informed consent was obtained before data and sample collection. Samples were coded and confidentiality of patient data was maintained throughout the study.

Results

Socio-demographic and clinical characteristics

All the HIV infected children (n=241) attending the clinic were interviewed and involved in the study, giving the response rate of 100%. Table 1 presents the socio-demographic characteristics of the participants/guardians. A total of 241 HIV positive children in Mekelle Hospital, aged between 6 months and 14 years old, participated in the study. The mean age of the study participants was 9.3 ± 3.3 years. More than half (52.2 %) of the participants were in the age group of 5–11.9 years. One hundred twenty-four (51.4%) were males and 117 (48.6%) were females, giving almost 1:1 (male: female) ratio. Many of the respondents 221(91.7%) were orthodox Christian by religion. A total of 216 (89.6%) of the participants' guardians attended one of the primary, secondary, or tertiary school education while 25(6.3 %) of them were illiterate. Almost one-third of guardians 72 (29.9%) were daily laborers and 15(6.3%) of them were farmers.

Table 1: Socio-demographic characteristics of HIV positive children on ART at Mekelle general hospital, Tigray region, North Ethiopia from November 2018-April 2019.

Variable	Frequency (n)	Percentage (%)
Age group		
0.6-4.9	22	9.2
5-11.9	126	52.2
12-14.9	93	38.6
Gender		
Male	124	51.4
Female	117	48.6
Religion		
Orthodox	221	91.7
Muslim	19	7.8
Protestant	1	0.5
Educational status (Guardian)		
Illiterate	25	10.4
Primary education	109	45.2
Secondary education	79	32.8
Tertiary education	28	11.6
Employment status (Guardian)		
Employed	58	24
Farmer	15	6.3
Daily laborers	72	29.9
Merchant	53	22

Unemployed	43	17.8
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Prevalence and type of Anemia

Among the study participants, 6.6% (16 /241) were anemic in this study. Percentage of anemic participants with their severity of anemia is illustrated

Figure 1. Among the anemic children, more than half of the participants 56 % (9/16) had mild anemia and a quarter of them 25 % (4/16) were found to be severely anemic.

Fig 1: Distribution of percentage of anemic participants with the severity of anemia at Mekelle general hospital, Tigray region, North Ethiopia from November 2018-January 2019.

On the type of anemia, about 47.7% (8/16) of anemic children had normocytic-normochromic anemia followed by macrocytic-normochromic anemia 38.6 % (6/16) (**Figure 2**)

Fig 2: Distribution of percentage of participants with type of anemia at Mekelle general hospital, Tigray region, North Ethiopia from November 2018-January 2019.

Discussion

In Children infected with HIV, anemia is a commonly encountered hematologic complication with a significant impact on clinical outcomes and quality of life [12, 13]. Although several studies investigated the anemia prevalence in HIV-infected children in other parts of Ethiopia, there is a lack of evidence on the prevalence of anemia among children living with HIV and on HAART in our region, where this study aimed to characterize. Accordingly, the prevalence of anemia in HIV-infected children taking HAART was 6.6% in this study. This result seems to be low as compared to the results reported by other studies conducted in Ethiopia, which ranged between 11.4-39.4 % [12, 15, 16]. This variation could be attributed to the difference in socio-demographic characteristics, geographical factors (altitude), nutritional factors, socioeconomic status and lifestyle, study design, time of study or a combination of these factors [9-12, 15]. HIV infection and its treatments are known to be among the possible underlying anemia causes in HIV-infected children [12, 17, 18]. Evidence show that children on HAART treatment are less likely to be anemic compared with their pre-treatment anemia status or non-treated HIV infected children [12-14]. The lower prevalence of anemia in our study seems to suggest that HAART are less likely to cause anemia and they could even contribute towards improving HIV-associated anemia [12, 15, 17]. Proper adherence to HAART could also further contribute for lower prevalence in this study as HIV infected children with poor adherence to ART drugs are more likely to be anemic compared with good adherence [19].

From anemic children, majority (56.0%) of them had mild anemia in this study, which is in agreement with studies reported in Northwest Ethiopia (60.5%) [13], Southwest Ethiopia (60.5%) [14] and Uganda (62.2%) [20]; and in variance with a study done in Southern Ethiopia [16] and Eastern Ethiopia [21], which reported 51.6% and 44.7% of participants, respectively, were moderately anemic. Our study results also showed that

one-third (25%) of the participants were severely anemic. This result is higher than the study done in Northwest Ethiopia (2.3%) [13], Southwest Ethiopia (14.3%) [16], Southern Ethiopia (6.5%) [16], Eastern Ethiopia (7.8%) [21], Uganda (4.8%) [20], and India (8%) [17] and lower than the finding (27.7%) reported in Tanzania [18]. Given the mortality rate of HIV infected children with lower hemoglobin level (< 8 g/dl) is higher compared with those with higher level (≥ 8 g/dl) in the same setting [22], our finding seems to provide a signal on the need for routine screening of anemia status in children for better and appropriate management before it causes substantial morbidity and mortality.

On the type of anemia, we found majority of the participants had normocytic-normochromic (47.7%) anemia. This agrees with Engdaw et al. (2015) and Fenta et al. (2020) which reported the occurrence of normocytic-normochromic anemia in 46.5% and 64.5% of participants, respectively [13, 16]. Whereas, microcytic-hypochromic anemia was reported as the predominant type of anemia in the study conducted in Uganda (44.9%) [15] and Tanzania (37.5%) [18].

Our research findings should be considered in light of several limitations. The findings may not be generalizable given the study population is not representative of the whole HIV-infected children population in the region. Besides, the study did not explore various factors that may affect hemoglobin levels of the study participants. Undertaking a more in-depth study to explore the underlying factors is deemed necessary.

CONCLUSION

Our finding reveals that the prevalence of anemia among participants was 6.6% and most of the anemic children had mild anemia followed by severe anemia. Although our finding is relatively lower than the findings reported in other studies conducted in Ethiopia, it is still imperative to regularly monitor anemia for timely and adequate clinical management to further improve the clinical outcomes and quality of life of the children. Large scale researches are required to further study the prevalence of anemia in HIV positive children at the regional

level to explore the problem in depth and showcase conclusive evidence.

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