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Prevalence of Anaemia and its Known Associated Risk Factors among Under Five Children at Mukinge Missions Hospital in Kasempa District

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Abstract

Background: Anaemia is a worldwide major problem known to affect people throughout the world. It has an adverse effect on both the social and economic development. The worldwide prevalence of anaemia is 9% in developed nations. The global estimate indicates that 293.1 million of children under five years, approximately 43%, are anaemic worldwide and 28.5% of these children are found in sub Saharan Africa. In Zambia specifically Kasempa, no documented studies on prevalence have been done. Despite iron supplementation given to pregnant women and the availability of blood transfusion. The burden of the disease remains high as determined by high mortality and morbidity. This study aims at determining the prevalence of anaemia and the known associated risk factors among under-five children at Mukinge Mission Hospital in Kasempa District. Knowledge of prevalence and the known associated risk factors of anaemia will enhance early detection and timely management.

Method: This was a retrospective study review of under-five children that were diagnosed and managed of Anaemia at Mukinge Missions Hospital, over the period of period of 2015, 2017 and 2018. Data of the variables of interest was extracted and analyzed using SPSS software version 23.

Results: A sample population of 52 children was included in this study. The majority of the children were females 28 (53.8 %) and 24 (46.2 %) were Males. It was found that moderate and severe anaemia among anaemic children was 17.3% and 82.7 % respectively. Additionally, Majority of the anaemic children (75%) had Normocytic anaemia. The Pearson Chi square test revealed no statistical relationship between the variables; Malaria (p=0.58), Age (P=0.82), Gender (P=0.91).

Conclusion: According to our study, 39 (75%) had normal mean corpuscular volume which could suggest chronic diseases and sickle cell anaemia. 11 (21.2%) had a low mean corpuscular volume indicating microcytic anaemia which could suggest diseases such as iron deficiency and thalassemia among many other causes. However, we were unable to determine the specific cause of anaemia.

Keywords: Anaemia • Hemoglobin • Plasmodium

Introduction

Background information

Anaemia is defined as a condition characterized by a low concentration of blood hemoglobin due to inadequate red blood cell volume (WHO, 2011). Haemoglobin is an iron rich protein that carries oxygen from the lungs to the rest of the body and also gives colour to the blood. A reduced level of hemoglobin causes fatigue and makes people more susceptible to anemia (UNICEF, 2004). The major pathological result of anaemia is a reduction in the number of the circulating red blood cell (RBC) below normal, which induces the consequence of reduced oxygen carrying capacity and tissue hypoxia.

Anaemia is a worldwide major problem known to affect people throughout the world. It has an adverse effect on both the social and economic development. According to WHO, anaemia is globally classified into mild, moderate, and severe with respect to the hemoglobin concentration: In children aged 0-59 months and pregnant women aged 15-49 years non-anemic (>11.0g/dl), Mild anaemia (10.0-10.9g/dl), moderate anaemia (7.0-9.9g/dl) and severe anaemia is (<7.0g/dl) (WHO, 1968).

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Anaemia is a disease with multifactorial risk factors; it can be nutritional due to iron, folate, and vitamin B12 deficiencies (WHO, 2008). It can also be caused by clinical infectious diseases such as helminths infections, tuberculosis, HIV AIDS, general inflammatory disorders and malaria. Malaria caused by various plasmodium is critical for anaemia in children. Other risk factors include social economic factors such as low house hold income and in addition demographic factors such as age, gender and family size. Anaemia is characterized with adverse negative health consequences which result in high morbidity and mortality. However, there is no adequate and reliable data on the prevalence of anemia and the risk factors leading to anaemia in Kasempa. This study aims at determining the prevalence of anaemia and the associated risk factors among under- five children at Mukinge Mission Hospital in Kasempa District. This study would give us an estimated burden of anaemia in children, the causes related to anaemia in children; furthermore, it will help formulate new strategies of managing anaemia [1].

Problem statement

Zambia is among the nations with a high burden of anaemia, more especially among people with poor access to proper health care, malnutrition or effective preventive measures. Anaemia is the major cause of morbidity and mortality in many parts of the world. Studies done in Nigeria, revealed that case fatality rates of severe anaemia was 13.6% among children under five years, andvariables associated with mortality were malnutrition, tachycardia, coma, and absence of blood transfuse. East Africa has a 63% burden of anemia in children. In 2015 UNICEF reported that the prevalence of anaemia in under-five children in Zambia is about 53%. According to the reports of the increasing morbidity and mortality at MMH in Kasempa, it is necessary to find out the

burden of anaemia in children and the associated risk factors, since thereis no available data.

Literature Review

Anaemia is a major public health problem in developing countries. The global estimate of childhood anaemia indicates that 293.1 million of children under five years, approximately 43%, are anaemic worldwide and 28.5% of these children are residing in Sub Saharan Africa (McLean,2003). In 1993, the World Bank rated anaemia as the eighth leading cause of disease in young girls and women in the developing world. According to World Health Organization-World Health Statistics 2005, the average prevalence of anaemia in the world is 41.8%. In the Middle East, the prevalence of anemia is high with about 63% of children suffering from anaemia. According to a study conducted by Natural Nutrition Monitoring Bureau (NNMB), it was estimated that over 70%of children in India are anemic including high income educated segment of the country, and that about 50% of children, adolescent girls and pregnant women are anemic (NNMB, 2002). According to a survey done in Sri lanka, the prevalence of mild anaemia is higher among rural children, whereas the prevalence of moderate anaemia is higher among estate children. Further studies review that the prevalence of moderate anaemia is high among children in low wealth quintiles (DHS, 2007).

In a study done in Nigeria, anaemia was found to be an important public health problem where 70.5% of children under five were found to be anaemic. Astudy done in Uganda revealed that anaemia was a severe public health problem among children under five years, living around Lake Albert and Lake Victoria, with the prevalence of 68.9% and27.3% respectively. The prevalence of anaemia in Cape Verde was 51.8% . The prevalence of anaemia among preschool children ranges from 42% in Swazilandto 91% in Burkina Faso. The prevalence of anaemia in Kenya was 25%. It was further divided into moderate (14.2%) and mild (10.8%). Higher risk of presenting anaemia was documented for boys, lower household socioeconomic status, malaria infection and anthropometric deficits.

The prevalence of anaemia in Tanzania categorized as mild, moderate and severe anaemia was 16.5%, 33% and 27.7% respectively. In the Democratic Republic of the Congo (DRC), anemia is a serious health problem. According to the most recent Demographic and HealthSurvey (DHS) (2013–2014) done in Democratic Republic of the Congo (DRC), the overall prevalence of anaemia was about 60% of children (6–59 months).

Infants are vulnerable to malaria from the age of approximately three months, when immunity acquired from the mother is wearing off. Malaria causes anaemia through hemolysis and increased splenic clearance of infected and uninfected red blood cells andcytokine-induced dyserythropoe. Severe anaemia probably accounts for more than half of all childhood deaths from malaria in Africa, with case fatality rates in hospitals between 8% and 18% . Malaria in pregnancy has been a cause of severe anaemia. Malaria causes hemolytic anemia and in severe cases is also a risk factor for stillbirths, low birth weight and fetal anemia. A study to determine the prevalence of anemia in Abakaliki, South Eastern Nigeria, revealed that the prevalence rate of severe anaemia was 9.7% and this was attributed to malaria as being the commonest cause of severe anaemia. Other commoncauses included sickle cell anaemia, Septicemia, and malnutrition. Anotherstudy conducted in Tanzania, within the National Health Management and Information system, reported that the case fatality rate of anaemia was 17.8% in hospitalized under five children and that the pattern of child deaths was attributable to anaemia changes with malaria transmission.

Poor nutrition and micronutrient deficiencies may exacerbate the severity of any infectious disease, and there is increasing evidence that they play an important role in the pathogenesis of malaria and anemia. Relatively large amounts of iron are required for erythropoiesis. A recent study from Zimbabwe has shown that maternal anaemia and low birth weight are significant predictors of lowtotal body iron (TBI) in infants, with the odds of subsequent anaemia at 6, 9, and 12 months of agebeing more than three times higher in infants in the lowest TBI quartile compared with those in the highest quartile. According to a study conducted in Yemen, the overall prevalence of anaemia and IDA was 48.7% and 34.2%, respectively with IDA representing 70.2%of all anaemia cases. This was probably because of the high rates of poverty and also folate deficiency as well as vitamin A deficiency, parasitic infestation, haemoglobinopathies (sickle celldisease, thalassemia), infection with HIV and malaria. A study done in Western Uganda revealedthat the overall prevalence of iron deficiency anaemia among children and their mothers was 26.2% and 17.9%, respectively. They attributed this to dietary factors and socio demographic factors which were major factors associated with high levels of anemia among children and their mothers. In these studies, it is evident that the problem of nutritional anemia is predominantly affecting third world countries where poverty levels are high. This is because many families do not manage to eat foods that are rich in iron [2,3].

Aims and Objectives

General objective

To determine the prevalence of anaemia and its known associated factors with mild, moderate and severe anemia among anaemic under five year children admitted at MMH.

Specific objectives

- To determine the prevalence of anaemia among under five children admitted at MMH.
- To determine the anaemia severity using haemoglobin status among anaemic under five children admitted at MMH.
- To assess the known association of anaemia with malaria among under five children admitted at MMH.
- To establish the percentage estimate of IDA through MCV and RBDW determination among anaemic under five children admitted at MMH.

Research question

What is the prevalence of anaemia and factors associated with Mild, Moderate and severe anemia among anaemic under five year's children admitted at MMH?

Justification

The global estimate indicates that 293.1 million under five children are anaemic worldwide and 28.5% of these children are found in sub Saharan Africa. The burden of Anemia is huge more especially in Africa. Anemia shoots from a variety of risk factors other than poor iron but also from other micronutrient deficiencies (folate, vitamin B 12 and even vitamin A), infections like malaria and HIV. Polygamy, educational status and socioeconomic levels. Even where blood transfusions are available there is a significant case fatality rate of 6-18% . Zambia is among the world's poorest and most disadvantaged nations affected by anaemia, approximately 53% of under five children are affected (UNICEF, 2015). In Zambia no detailed studies have been done on the prevalence of anaemia in under five children in relation to the associated risk factors. The problem needs to be continuously reviewed, and researched on. This would enable the design of specific public health interventions. It is expected that the informationobtained from this study will be used through the MOH for further and future programs that will help pave the way for objective intervention measures. This study is presumed to represent prevalence of anaemia among the urban poor in the country [4].

Measurements

Operational definitions

Anaemia: Is defined by using WHO classification of anaemia as haemoglobin level of less than 11g/dl.

Mild anaemia: Is defined by haemoglobin level of 10 to 10.9g/dl. Moderate

anaemia: Is defined by haemoglobin level of 7 to 9.9g/dl. Severe anaemia: Is defined by haemoglobin level of less than 7g/dl.

Normocytic anaemia: normal (76fL-99.9fL) mean corpuscular volume (MCV).

Microcytic anaemia: low MCV < 75 fl.

Macrocytic anaemia: high MCV > 100 fl.

Methodology

Study site

The study was conducted at Mukinge Mission Hospital, outside Solwezi district, it is the only biggest hospital located in Kasempa in the Northwestern part of Zambia. Kasempa is inhabited mainly by the Kaonde people. The main economic activity is farming and some animal husbandry (a few heads of cattle and goats). The study population is children from the age of 6 months to 60 months [5].

Study population

The study population was made up of all Anaemia cases and deaths recorded at MMH over the period of 2015, 2017 and 2018.

Study design

This study was a retrospective study review of under-five children that were diagnosed and managed of Anaemia at MMH.

Study variables

The dependent variable

1. Hemoglobin.

The independent variables

1. Age
2. Gender
3. Hematocrit
4. Mean corpuscular volume
5. Red blood distribution width
6. Parasites

Inclusion criteria

All under five years aged 6-60 months children who were diagnosed and treated for anaemia at Mukinge Mission Hospital.

Exclusion criteria

Any child above the age of 6-60 months.

Data collection

Data of the variables of interest was obtained from medical records of all eligible children screenedand managed for anemia by trained Data Assistants. An excel data-base was created and used to collect and manage the data. An Excel data base was used for accuracy. It was password protectedstandard form. The following information was collected from the medical records: Date of birth, gender, height in centimeters, and weight in kilograms, hemoglobin, hematocrit, mean corpuscularvolume, red blood cell distribution width measure in percent, and the presence parasites. However,weight and Height had missing values hence they were excluded during data collection [6].

Data analysis

Data was entered in an Excel data base for accuracy and easy manipulation. Then the collected data will be processed for comprehensiveness and entered into SPSS software version 23.

Ethical considerations

Ethical approval was obtained from Tropical Disease Research Centre (TDRC), at Ndola central Hospital. The following details were not used for analysis in this study: patient names and addresses. The Excel data base was password protected to prevent unauthorized third party access.This information was obtained under the supervision of the Hospital Records Department. All children's information was confidential and was only used in this particular study.

Study limitation

The study had incomplete data and all variables that had missing values were excluded from the analysis hence a small sample size. It is also possible that the sample size was not a representative of the entire population in Kasempa. Additionally, the study was not able to determine the specifictype of anaemia.

Presentation of findings

A total of 5,050 children were admitted in the year 2015, 2017 and 2018 at MMH. The year 2016was excluded from the study because in that year Anaemia was being diagnosed clinically, the machine used to measure Full blood count (FBC) was not operational. Of these, 1,725 Children met the eligibility criteria and 3,250 were out of age limit. Of the 1,725 eligible candidates, 52 children`s data was extracted from Medical records and cleaned. The sample included a total of 52 children that were diagnosed with Anaemia aged between 6- 60months with a mean age of 2.94 (Standard Deviation 1.30). The age group 3-5 years representedthe majority of the study population with 33 (63.5%) and 19 (36.5%)<2years. The majority of thechildren were females 28 (53.8 %) and 24 (46.2 %) were Males.

Figures 1 to 3 shows the presence of anaemia, measured by hemoglobin levels of <7, 7-9.9 and <11g/dl. It was found that mild, moderate and severe anaemia was 0%, 9 (17.3%) and 43 (82.7 %)respectively. Median hemoglobin was 5.5g/dl (STD=1.61).

In this study population of the anemic patients, only 9 (17.3%) children had a blood slide that was positive for malaria parasites and 43(82.7%) had a

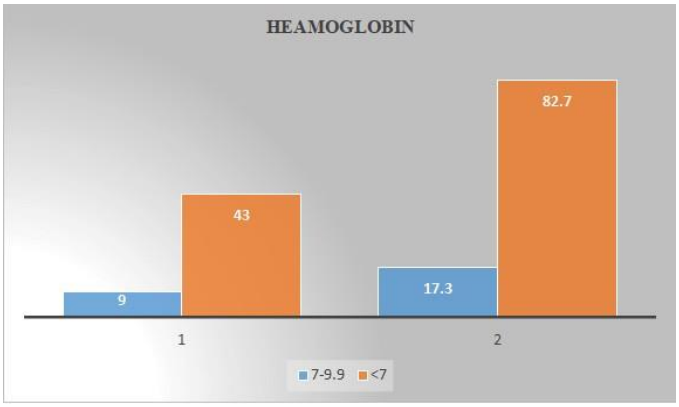

Figure 1. Severity of anaemia.

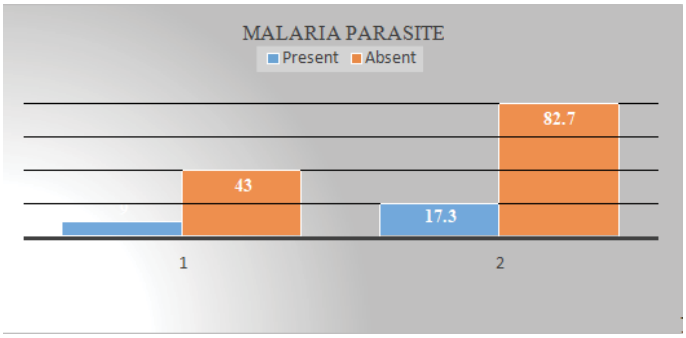

Figure 2. Malaria Parasite.

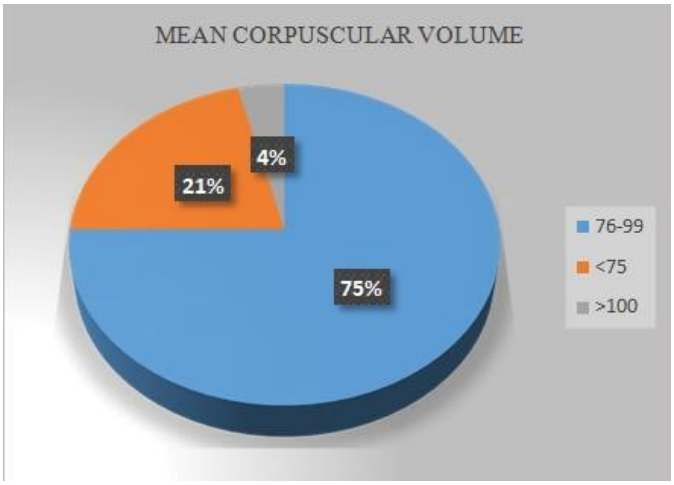

Figure 3. Mean corpuscular volume.

Type of variable	Variable	Measurement of variable
Dependent	Hemoglobin	Continuous
Independent	Mean Corpuscular Volume	Continuous
	Hematocrit	Continuous
	Malaria	
	Age	Continuous
	Gender	
	Red blood distribution Width	Continuous

Table 1. Measurements of variables.

Factor	Frequency	Percent
Patient Sex		
Female	28	53.8
Male	24	46.2
Total	52	100
Age		
<2	19	36.5
>3-<5	33	63.5
Total	52	100

Table 2. Distribution of demographic characteristics of under-five patients.

Prevalence of Anaemia (N= 1,725)	Number	Percentage
Non anaemic (Hb>11g/dl)	16 73	96.90%
Anaemic (Hb<11g/dl)	52	3. 1%
Total	1225	100%
Severity of anaemia (N=52)		
Mild	0	0
Moderate	9	17.30%
Severe	43	82.70%
Total	52	100%

Table 3. Prevalence and severity of anaemia among under five children.

negative blood slide for malaria parasite.

The pie chart above shows 39 (75.0%) of patients had normal mean corpuscular volume, 11 (21.2%) had a low mean corpuscular volume and 2 (4%) high mean corpuscular volume. 21.2 %of anemic children had a mean corpuscular volume below 75 fl indicating a microcytic anaemia. 4% of anaemic children had an MCV above 100, indicating macrocytic anaemia. Additionally, 75% of anemic children had a mean corpuscular volume between 76 fl and 99 fl indicating a normocytic anaemia (Tables1, 2).

According to WHO, percentage of IDA can be estimated using Red cell width and mean cell volume apart from mainly using haemoglobin levels

Variable	Recommended values	% of estimated IDA
Mean corpuscular volume	≥75fl	21.20%
Red blood distribution width	≤15	9.60%

Table 4. Indices used to measure iron deficiency anaemia among children.

Variables		Hemoglobin		P value
		7-9.9	<7	
Mean corpuscular volume total	76-99	8	31	0.54
	<75	1	10	
	>100	0	2	
		9	43	
Red blood distribution width total	<15	0	5	0.282
	>16	9	38	
		9	43	
Gender	Male	4	20	0.91
Total	Female	5	23	
		9	43	
Age	<2	3	16	0.822
	>3	6	27	
Total		19	33	
Parasite	Present	1	8	0.58
	Absent	8	35	
Total		9	43	

Table 5. Association between the dependent variable and the independent variables.

(WHO, 2001). Percentage of children with IDA based on mean cell volume and red cell width was 21.2 % and 9.6% respectively (Tables 3-5).

Pearson Chi square was used to check for associations between the dependent and independent variables. In this study, the association revealed no statistical relationship between the variables and haemoglobin. The p value was greater than 0.05. The variables analyzed malaria (p=0.58), Age (P=0.82), Gender (P=0.91), MCV (P=0.54), and RBDW (P=0.282). It was noted that children who had a MCV of 76-99fl were more likely to have a hemoglobin value of <7g/dl compared to the children who had a MCV of <75fl. Additionally, children that had a MCV >75fl were less likely to have severe anemia. Additionally, children who were >3 years of age had a higher chanceof developing severe anaemia [7,8].

Discussion

This study analyzed the inclinations of anaemia among cases diagnosed and admitted at MMH forthe period of 2015, 2017 and 2018. In this study the prevalence of anaemia was 3.1%. This is consistent with the findings in a study in Nigeria in which the prevalence ranged from 2.7% to 12.5%. 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. From this study, the percentage of severe anaemia among anaemic children was foundto be high (82.7%). This percentage is higher than the total number of those with severe anemia found by Rehema 2015 in a study among under-fives in Bugando Medical Centre, Tanzania. Thehigh percentage could be due to several factors which include chronic diseases and sickle cell disease.

Malaria has consistently been demonstrated to be the commonest cause of severe anaemia amongchildren. Rehema 2015 reported that malaria was strongly associated with severeanaemia. This has been affirmed in the study where malaria was the etiologic cause of severe anaemia in most of the cases, with *P. falciparum* being the only species of malaria parasite demonstrated in the blood films of study subjects. This trend was also observed in other Nigerianstudies where malaria was noted to be responsible for most cases of severe anaemia in under five children. The high prevalence of anaemia following malaria in these studieswas linked to the fact that study areas were within the known malaria endemic zones and that immunity levels developed

by this age group is not protective enough. In thisstudy, 9 children were found to have a positive blood slide for malaria parasite, however there wasno statistical significance (p=0.58). These results are similar to the outcome of the study done in Dominica. Our results may be explained by the study probably being based in Kasempa which is not a predominantly malaria endemic area.

It is known that age is associated with decrease in haemoglobin. Mbise *et al*, 2000 found that children above 2 years of age were at a higher risk of anaemia. In this study, children were grouped into two categories of less than 2 years old, and greater than 3 years old, to determine if there was a difference in the prevalence of anemia based on age. Although the majority of children includedin our study sample were at least 3 years of age, there was no statistical association (p=0.82) between age and anaemia and this is consistent with another study done among children in Myanmar. Furthermore, in our study the majority of the children were females,however we did not find any statistically significant (p=0.82) differences in the prevalence of anemia based on gender. A study done in Dominica did not also find a statistically significant difference in the prevalence of anemia based on gender [9-11]. The mean corpuscular volume (MCV) is very helpful in classifying anemia based on whether thevalue is low, normal, or high. In this study microcytic anaemia was found tobe the most predominant type and normocytic anaemia was the second most common. These results are consistent with the outcomes in a study in which 22% of anemic children had microcyticanemia, and 78% of anemic children had normocytic anaemia. On the other hand, these results are not consistent with Rehema`s study in which microcytic anaemia was the main type then normocytic anaemia was the second most common. Microcytic anemia could suggest diseases such as iron deficiency and thalassemia among many other causes. Normocytic anemia could suggest chronic disease and sickle cell anemia among many others. Additionally, macrocytic anemia encompasses the deficiencies of vitamin B12 and folate. Percentage estimate of IDA was determined using Red Blood Distribution width and mean cell volume, and it was found to be 21.2 % and 9.6% respectively. However, this is lower than the percentage of children with IDA found among children in Kenya which was 75% based on haemoglobin value, 70.1% and 74% mean cell volume and red blood distribution width respectively. Worldwide IDA is estimated at 25% (UNICEF, 2009). Nutritional factors are also key determinants of anaemia risk. The difference in results shows that iron deficiency anaemia was not common among anaemic under-five children that were admitted at Mukinge Mission Hospital. This could be due to the efforts being made by the Zambian government to reduce Iron Deficiency Anaemia. Such efforts include the initiative of fortifying food substances with iron among many other [12-15].

Conclusion

Prevalence of moderate and severe anaemia among anaemic children admitted at MMH was foundto be 17.3% and 82.7% respectively. Although there are many challenges to the management of anemia, one model is to prevent anemia and rightly diagnosing the type of anemia. There is need to step up with severe anaemia prevention and management of anaemia. Microcytic anemia (suggests iron deficiency and thalassemia among many other causes) and Normocytic anemia (suggests chronic disease and sickle cell anemia among many others) were the common types of anaemia in this age group. However, we were unable to determine the specific cause of anemia.

Recommendations

Since this study serves as a reference for further studies, we also recommend that another study be done in which morphological types of anaemia among anaemic children under five years be determined. There is need to carry out a follow up study on the relationship between nutritional status and IDA along with associated factors in children.

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