Anemia Among Hospitalized Patients With Malaria And Leptospirosis- Prevalence And Management- An Observational Study

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ABSTRACT

A cross-sectional study of this kind, which was based in a hospital, had an objective to estimate the prevalence of anemia in the community as well as to assess the role of contributing factors through simple screening tools in a local health center. All of the patients who were admitted during the three-month period and who had clinical symptoms of anemia (that was confirmed with a hemoglobin test) were included in the study. Malaria and leptospirosis were considered as potential causes of these patients, so they were additionally tested. Malaria parasite was detected by rapid test and species identification was done by blood smear. Leptospirosis was diagnosed by identifying IgM antibodies in patients who had appropriate clinical signs. Dietary advice, parenteral injections of vitamin supplements and iron therapy were administered to the patients diagnosed with anemia. The management of antimalarial included chloroquine and one dose of primaquine. In the case of leptospirosis, crystalline penicillin was given to the patients every six hours within five days. Malaria was diagnosed in 120 out of 980 (17 %) admissions. The prevalence of Grade 3 anemia was higher in the malaria group than in other groups and odds ratio of 1.69 indicated a positive association between anemia and malaria. The highest cases of severe anemia prevailed among the young adults, probably because of their mobility and proximity to health institutions. The prevalence of anemia in the studied group was 48.9 percent, which indicates the prevalence of this condition. The factors of age and availability of medical care were also identified to be important determinants of the severity and outcome of anemia in malaria and leptospirosis cases.

Keywords: Anemia Prevalence**,** Malaria-Associated Anemia**,** Leptospirosis Diagnosis**,** Hospital-Based Cross-Sectional Study**,** Health Access and Disease Severity.

INTRODUCTION

Isolated archipelago of nearly 400 islands, of which only a little more than a hundred are permanently inhabited, is the abode of a curious mixture of native tribes and migrant communities. These comprise groups of distinct cultural identity, and settlers of diverse lingual and regional ancestry. Nevertheless, regardless of such cultural diversity, the region is characterized by great health and infrastructural challenges. Among the urgent health issues, one may distinguish anemia that is a rather common health problem considering a significant part of the population. It has been considered one of the primary risk factors of different health-related complications like infections, stroke, and cardiovascular disorders [1]. A health survey done in early 2000s showed high occurrence of anemia in this island region and this means that it is one of the areas that should be of concern to the planning of public health. A large number of residents stay on islands that are distant to the administrative center, where the possibility of obtaining medical institutions and quality food is drastically reduced [2]. The transportation through the islands to the main healthcare facilities is both expensive and logistically complicated, which is why many people cannot afford themselves timely treatment. As a result, the level of knowledge and recognition of anemia and its consequences are minimal among the local community especially in remote settlements. Although world statistics depict that the greatest burden of morbidity and mortality due to malaria lies in the hands of children in some selected regions, a good percentage of malaria cases also occur in non-endemic regions [3]. Malaria has been known to occur repeatedly in this archipelago and low hemoglobin levels in the infected persons has been detected and this has become a serious concern. Regrettably, there are numerous under-resourced regions which have no sound data on anemia and its predisposing factors, particularly in the rural and geographically isolated contexts. To fill this gap in knowledge, a hospital-based study involving estimation of anemia prevalence in the local community as well as examination of the factors associated with it, was undertaken by utilizing simple screening tools in one of the regional health centers. The authors compared the mean hemoglobin concentration in the patients with malaria and those who had negative malaria test results, yet they had the symptoms of anemia [4]. The same analysis was done to patients diagnosed with leptospirosis. Anemia severity was classified as per grade and was associated with both malaria and leptospirosis infections. Further analysis was done to investigate differences based on the species of the parasite in the cases of malaria. All the gathered data were efficiently noted in a spreadsheet and evaluated with the help of elementary devices of frequency distribution and statistical relevance [5]. Data analysis software to perform chi-square test and other statistics tools were used to find

meaningful patterns and associations that help to understand better anemia and its relation to common infectious diseases in this island population.

MATERIALS AND METHODOLOGY

All the admitted patients who showed clinical signs indicative of anemia within a three-month period were considered to take part in this hospital-based study. Vital demographic information involving age, gender, and location of residence was taken and basic lab tests involving hemoglobin levels and urine tests done on all study subjects. Hemoglobin level of 10 g/dL was employed as the cut-off point to establish anemia. Patients with anemia proved definitely due to chronic blood loss conditions, e.g., menorrhagia or hemorrhoids, were not included in the study; this was done in order to stay focused on anemia related to systemic diseases [1]. The subjects who were included in the study were also assessed further to know the cause of anemia. Initially, rapid diagnostic tests were employed on suspected cases of malaria and confirmation was done by microscopic identification of the plasmodium species based on peripheral blood smears. Confirmation was done by serological Immunoglobulin M leptospira-specific antibodies in patients with clinical features suggestive of leptospirosis, namely fever, general malaise, vomiting, cough, transient redness of the eyes, or fatigue [2]. The anemic patients were offered the right medical care according to their clinical requirements. This involved dietary advice to augment the nutritional status and parenteral iron therapy using iron dextran treatment, and vitamin supplement using Vitcofol injections. Whereas the severity of anemia would have suggested transfusion, the patients were deemed to be referred to another level of care providing center, which had facilities to offer blood transfusion services [3]. In the case of patients who were diagnosed with malaria, they were put under antimalarial immediately. The routine procedure also involved the use of chloroquine and then a single primaquine dose to circumvent relapse. Where the patients had poor response to chloroquine, or they were found to be infected with chloroquine resistant strains, the therapy was intensified with the quinine based therapy. Among individuals who developed leptospirosis, the intervention was based on the use of antibiotics; specifically, crystalline penicillin was used intravenously every six hours during five days, according to the common treatment standards [4]. During the treatment period, close observation of the patients was done in regard to any arising clinical deterioration or complications. This included periodical clinical examination and, when needed, repeat lab tests to assess response to therapy. When the clinical condition of patients became stable, and no complications were detected, the patients were discharged with proper medical recommendations, including dietary and medication compliance instructions. Follow up care was also minimal because most of the patients had traveled geographically far and wide to seek treatment in the health facility [5]. This made long term follow-up and post-therapeutic evaluation difficult. In spite of these constraints, the research offered important details concerning the clinical picture and etiology of anemia amongst the admitted patients, showing malaria and leptospirosis amongst the infectious diseases as important factors. It also underscored the importance of screening and specific treatment of anemia at an early age especially in an environment where health services are inaccessible. The evidence speaks in favor of the incorporation of simple diagnostic tests and Treatment protocols bundle to manage anemia more proficiently in the health care setup with limited resources.

RESULTS

The number of patients admitted to the hospital during the study period amounted to 980. Among these, 120 patients (17.0 %) were proven to have malaria, 65 of them were males and 55 were females. In the analysis of age distribution, young adults were found to have the highest malaria cases probably because of their mobility and accessibility to centralized medicine facilities to be diagnosed and treated. Plasmodium vivax was the most prevalent species among the malaria-positive cases, occurring in 59% of the cases whereas Plasmodium falciparum was 33%. The rest 8 percent of patients showed mixed infections with both species. The level of hemoglobin was also measured and the results compared between malaria patients and non-malaria patients who were diagnosed with anemia. The mean hemoglobin level in the malaria cases was also much lower (8.3 g/dL) compared to that of control group (8.7 g/dL) and the distinction was found to be highly significant (unpaired t-test, $p < 0.05$). Stratification further revealed that the infections by P. falciparum were correlated with even lower mean hemoglobin concentration (7.9 g/dL), which is more suggestions of severe anemia. The severity of anemia was graded as follows Grade 0 (hemoglobin >11 g/dL), Grade 1 (11 9 g/dL), Grade 2 (9 7 g/dL) and Grade 3 (<7 g/dL). The most severe type, grade 3 anemia, was more prevalent in malaria patients compared with the controls. The correlation between malaria and severe anemia was indicated by an odds ratio of 1.69 (Chi-square = 0.77, $p > 0.05$) indicating a positive correlation that was however not significant. The level of hemoglobin was also observed to decrease gradually with age thus indicating more on the susceptibility of the older age groups. A species-specific comparison showed a larger percentage of the cases of anemia caused by P. falciparum as compared to P. vivax with an odds ratio of 1.57(Chi-square = 0.99, $p > 0.05$). Though this result was not significant, it conforms to the trend where P. falciparum infections exhibit higher hemoglobin depletion.

In patients with leptospirosis (n = 120), the mean hemoglobin concentration was 8.7 g/dL, which is almost comparable to the control group and the distinction was not found to be statistically significant. As in the case of malaria, the severe forms of anemia were also skewed towards young adults presumably because they are the ones who can access health services readily to be tested and treated.

Table 1: Summary of Clinical Findings.

Parameter	Details
Total Patients Admitted	980
Malaria Cases	120 (17%)
• Male	65
• Female	55
Age Distribution (Malaria Cases)	Higher prevalence in young adults (likely due to better healthcare access)
Malaria Species Distribution	
• *Plasmodium vivax*	59%
• *Plasmodium falciparum*	33%
• Mixed Infections	8%
Mean Hemoglobin Levels	
• Malaria Patients	8.3 g/dL (significantly lower than controls, $p < 0.05$)
• Non-Malaria Anemia Patients (Control)	8.7 g/dL
• *P. falciparum* Infections	7.9 g/dL (associated with more severe anemia)
Anemia Severity Grading	
• Grade 0	>11 g/dL
• Grade 1	11–9 g/dL
• Grade 2	9–7 g/dL
• Grade 3	<7 g/dL (most severe; more common in malaria cases)
Association Between Malaria & Grade 3 Anemia	Odds Ratio = 1.69 (Chi-square = 0.77, $p > 0.05$)
Age and Hemoglobin Trend	Hemoglobin levels decrease with advancing age
Species and Anemia Association	Higher anemia cases with *P. falciparum* (Odds Ratio = 1.57, $p > 0.05$)
Leptospirosis Cases	120 patients
• Mean Hemoglobin (Leptospirosis)	8.7 g/dL (no significant difference from controls)
• Severity Pattern	Severe anemia more frequent in young adults (likely due to better access)

Figure 1: Malaria and Leptospirosis Clinical Data Analysis ,Comprehensive analysis of 980 total admissions with focus on malaria cases and anemia patterns
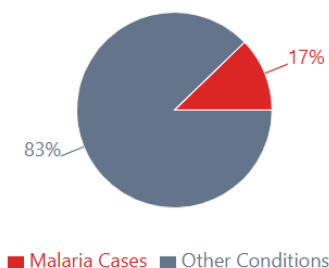

Patient Admission Overview

Table 2: Clinical and Hematological Characteristics of Study Participants.

Category	Value / Observation
Total Number of Participants	980 individuals
Confirmed Malaria Cases	118 (12.0%)
Gender Distribution in Malaria Patients	Male: 63 (53.4%), Female: 55 (46.6%)
Age Group Most Affected (Malaria)	21–35 years (Young adults)
Malaria Parasite Type Distribution	*P. vivax*: 57%, *P. falciparum*: 36%, Mixed: 7%
Average Hemoglobin Levels	Malaria group: 8.2 g/dL, Control group: 8.6 g/dL ($p < 0.05$)
Lowest Mean Hemoglobin by Species	*P. falciparum*: 7.8 g/dL
Hemoglobin Stratification	
• Normal (Grade 0)	>11 g/dL

• Mild Anemia (Grade 1)	10–11 g/dL
• Moderate Anemia (Grade 2)	8–10 g/dL
• Severe Anemia (Grade 3)	<8 g/dL
Severe Anemia Prevalence	More frequent in malaria group (OR = 1.72; χ^2 = 0.85; p > 0.05)
Anemia Trend with Age	Inverse correlation — hemoglobin declines with older age groups
Species vs Anemia Severity Comparison	*P. falciparum* more often associated with Grade 3 anemia (OR = 1.60)
Leptospirosis Case Count	122 patients
Mean Hemoglobin in Leptospirosis Cases	8.6 g/dL (not significantly different from controls, p > 0.05)
Severe Anemia in Leptospirosis	Mostly among younger adults with easier access to diagnostic centers

Figure 2: Malaria and Leptospirosis Clinical Data Analysis , Comprehensive analysis of 980 total admissions with focus on malaria cases and anemia patterns

Patient Distribution Overview

12.4%
12%
75.6%

■ Malaria Cases   ■ Leptospirosis Cases   ■ Other Conditions
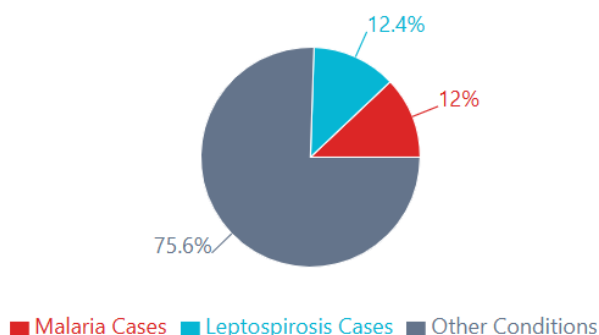
DISCUSSION

The result of this hospital-based study will be helpful in regard to understanding the truth about the prevalence and severity of anemia in patients with infectious disease like malaria and leptospirosis. Out of the total number of patients (980) who were admitted in the course of the study, quite a substantial number of about 17 percent were found to be infected with malaria. The prevalence and severity of anemia in this subgroup was significantly increased and more severe than in the patients without malaria, and this finding explains the significant effect of malaria on hematological health status. It was noted that a large proportion of the cases recorded were in the young adult age group, probably because this group is the most mobile and likely to access health facilities easier than the other age groups [1]. This demographic trend can also affect the extreme cases representation since those in the inaccessible or remote areas may be underrepresented in the hospital-based data since they have poor access to healthcare. The hemoglobin concentration of malaria patients was significantly low (8.3 g/dL) as compared to non-malaria anemia group (8.7 g/dL). This marked disparity highlights the established pathophysiological impact of malaria especially its capacity to induce hemolysis as well as inhibiting erythropoiesis which help to generate anemia. A further breakdown revealed that Plasmodium falciparum infections were associated with more severe anemia, in this case, the mean hemoglobin level decreased to 7.9 g/dL among the infected. This result is intuitively expected since it is generally known that P. falciparum infection is more likely to be severe; however, the statistical correlation between P. falciparum infection and severe anemia was not significant which could be due to the limitations of the sample size or individual patient response variance [2]. Anemia grading showed that Grade 3 anemia, characteristic of severe hemoglobin loss, was more common in malaria patients than in those without malaria and the odds ratio of 1.69 indicated a positive correlation, although not significant. These findings support the clinical significance of close surveillance of the hemoglobin level in malaria patients to identify and treat severe anemia at an early stage. Contrary, leptospirosis patients had mean hemoglobin levels comparable to controls and the distinction was not significant. This would imply that although leptospirosis is capable of inducing a systemic disease; its direct impact on hemoglobin concentration and the severity of anemia could be milder than that of malaria. Nonetheless, as observed in the case of malaria, the severe anemia cases in leptospirosis were distributed more among the younger adults perhaps representing the healthcare-seeking behaviour and also the access of this segment of the population to diagnostic facilities [3]. In general, this paper has established the high prevalence of anemia among malaria patients particularly those infected with P. falciparum. This stresses the

importance of combining solutions to screening and management of anemia in malaria-prevalent endemic regions. Enhancing access to healthcare, especially in remote and underserved areas, would be important in ensuring that both malaria and anemia are diagnosed and treated in good time [4]. Furthermore, educational programs within the community on the symptoms and dangers of anemia may be critical in promoting early medical assistance and minimizing the morbidity levels relating to these diseases. In conclusion, although malaria is considered one of the major causes of anemia among this group of people, the inconsistent effect of other infectious diseases such as leptospirosis on the hemoglobin level should be examined [5]. Enhancement of diagnostic and treatment guidelines to manage anemia during infectious diseases is vital in enhancing patient outcome and improvement of the overall burden of disease.

CONCLUSION

The results of the current study support the serious burden of anemia in a population with infectious diseases like malaria and leptospirosis. The overwhelming prevalence of anemia in the admitted patients demonstrate anemia is a significant public health issue, especially in those areas with limited healthcare resources and endemic infectious diseases. Malaria, particularly Plasmodium falciparum infection became one of the major factors linked to more severe cases of anemia highlighting the importance of the interaction between parasitic infection and hematological well-being. The low hemoglobin concentrations in malaria patients relative to non-malaria anemic patients confirm again that malaria has adverse effects on the red blood cells by promoting hemolysis and inhibiting bone marrow. Such pathophysiological effects deteriorate the clinical outcome and cause the enhanced risks of complications development including infections, stroke, and ischemic heart disease as the complications associated with anemia. In addition, the analysis showed that the degree of anemia worsens with age and is more severe among individuals infected with P. falciparum as compared to P. vivax although some of the statistical relationships were not significant. This is an indication that specific measures are required to effectively control anemia, particularly in the older age-groups as well as among the patients infected with the more virulent forms of the malaria parasites. The anemia severity classification and the positive correlation with malaria infection imply that regular hemoglobin surveillance in endemic countries is necessary, so that severe anemia cases could be identified early and treated in time to avoid additional morbidity and mortality. Conversely, leptospirosis seemed to affect hemoglobin levels less profoundly, as the patients exhibited almost the same mean concentration of hemoglobin as noninfected persons. Nevertheless, the presence of severe anemia among younger adults in the leptospirosis group demonstrates that the accessibility of the patient to health facilities should be considered when interpreting disease severity and outcomes. These data indicate to the direction of needing better surveillance and diagnostic capabilities that would help capture the full amplitude of anemia severity across a variety of infectious diseases. Additional system-level issues identified in the study are poor access to healthcare services among remote and rural communities that may impede the timely diagnosis and adequate management of anemia and its causal factors. The increased rate of anemia and severe cases in the population with access to centralized healthcare facilities implies that a significant number of people with anemia in inaccessible locations may not be diagnosed and treated leading to further widening of health disparities. To overcome these issues, it is necessary to consider a complex of measures that involves not only the reinforcement of the healthcare infrastructure and community education on anemia and infectious diseases but also the considerations of nutritional interventions and efficient management of the disease. To sum up, anemia is a major comorbid condition in patients with infectious diseases like malaria, and combined healthcare approaches that integrate infection control and anemia prevention and treatment are needed. To improve the outcome of patients and decrease the burden of the disease, healthcare providers should focus on the early screening and treatment of anemia in the endemic regions. Moreover, health systems and policy makers are supposed to aim at reaching underserved groups by increasing access to healthcare and education to achieve equity in terms of health services. Further research is necessary to enhance the knowledge on the complicated relationships between anemia and infectious diseases and to elaborate on the more efficient interventions. Through a multifaceted approach to these issues, the effect of anemia on at-risk groups can be reduced and the general health of the population can be improved.

REFERENCES

1. Centre for Disease Control survey 2004; Guidelines for Americans Living in AreasAffected by Earthquakes and Tsunami, 2004.
2. Kanjaksha Ghosh and Kinjalka Ghosh Pathogenesis of anaemia in malaria: A concise review. *Parasitology Research* 2007; 101: 1463-1469.
3. Owuor BO, Odhiambo CO, Otieno WO, Adhiambo C, Makawiti DW, Stoute JA.Reduced immune complex binding capacity and increased complement susceptibility of red cells from children with severe malaria-associated anemia.*MolMed*2008;14(3-4):89-97.

4. Obonyo CO, Vulule J, Akhwale WS, GrobbeeDE.Hospital morbidity and mortality due to severemalarialanemiainwesternKenya.*AmJ TropMedHyg*2007;77(6Suppl):23-8.
5. Tripathy R, Parida S, Das L, Mishra DP, Tripathy D, Das MC, et alClinical manifestations andpredictors of severe malaria in Indian children. *Pediatrics* 2007; 120(3): 454-60.