Blood Count Characteristics of Children Hospitalized in General Pediatrics at the Gabriel Touré Teaching Hospital

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Abstract

Objective: The main objective was to study the disturbances of the Blood Count of children hospitalized in the general pediatric of the Gabriel Touré teaching hospital. **Methods:** This was a prospective and descriptive study conducted from September 1 to November 30, 2018 in the general pediatrics department of the Gabriel Touré teaching hospital in Bamako. Data were collected on patient records using a survey sheet. **Results:** We collected 512 files of children out of 1030 admissions during the study period; the rate of completion of the blood count is 50%. The male sex was predominant with a sex ratio of 1.3. The majority of patients were under 5 years old (58%). The majority of fathers (56%) and mothers (64%) of children had no education; they are mainly farmers (61%) and housewives (88%). Pallor was the reason for consultation in 29% of patients and present in 60%. On blood count, anemia was present in 92% of patients, half of whom (50%) had severe anemia with a hemoglobin level below 7 g/dL. The anemia was mainly microcytic (72%) and hypochromic (66%). Hyperleukocytosis (62%), eosinophilia (68%) and basophilia (58%) were the abnormalities observed in the white line. Thrombocytopenia accounted for 40%. Severe malaria (53%) was the main discharge diagnosis and almost all patients (99%) were alive at discharge. **Conclusion:** The characteristics of anemia require a study of the complete blood count in

healthy children with dosage of serum iron and ferritin for a better understanding of the phenomenon.

Keywords

Characteristic, Blood Count, Child

1. Introduction

In Mali, for the period of the last 5 years prior to EDSM-VI (period 2014-2018), the risk of infant mortality is estimated at 54 deaths per 1000 live births and the risk of juvenile mortality at 49‰. As for the components of infant mortality, they stand at 33‰ for neonatal mortality and 22‰ for post-neonatal mortality. Globally, the risk of infant-juvenile mortality, *i.e.* the risk of death before the age of 5, is 101‰ [1].

Globally, infectious diseases, including pneumonia, diarrhea and malaria, as well as premature birth, birth asphyxia, trauma, and congenital anomalies remain the leading causes of death in children under 5 [2]. Undernutrition as a whole, including fetal growth retardation, stunting, wasting and vitamin A and zinc deficiencies, as well as inadequate breastfeeding, is responsible for 3 to 1 million child deaths a year, or 45% of all child deaths in 2011 [3].

According to 2018 data from the pediatrics department, the number of hospitalizations rose from 7989 in 2016 to 8462 in 2018, with a bed occupancy rate of 80.94%. The most common pathologies are malaria (1624 cases or 19.32%), acute respiratory infections (638 cases or 7.59%) and severe acute malnutrition (400 cases or 4.76%).

Complementary examinations, in particular blood counts, play a key role in the diagnosis and management of these pathologies.

The objective of this work was to study the haematological disturbances observed in children hospitalized in the general paediatric department.

2. Material and Methods

Study setting: Our work was carried out in the general paediatrics department of the Gabriel Touré teaching hospital in Bamako. In addition to general pediatrics, neonatology and pediatric emergencies, the pediatrics department includes:

- A pediatric oncology unit;
- A sickle-cell and haemophilia unit;
- A center of excellence for the care of HIV-infected children and follow-up of children born to HIV-positive mothers (Protection of mother-to-child transmission);
- A nutritional care unit (URENI);
- A mother-kangaroo care unit (SMK) for premature and low-birth-weight babies.

The Pediatrics Department is the national benchmark for pediatric care, and a

training center for health students and future pediatricians. With the exception of neonatology patients, all other patients from other units pass through the general paediatrics department before their definitive diagnosis or during ad hoc hospitalizations.

2.1. Type and Period of Study

This is a prospective descriptive study conducted from September 1 to November 31, 2018 in children aged 1 month to 15 years hospitalized in the pediatrics department of Gabriel Touré teaching hospital.

Inclusion criteria:

The child hospitalized for any pathology must have a CBC and a usable medical record.

Non-inclusion criteria:

Children were excluded from our study:
- Outpatient follow-up.
- Not having carried out an NFS.
- Whose medical record was not usable.

2.2. Ethical Considerations

For this study, we obtained the authorization of the administrative authorities of the Gabriel Touré University Hospital for the use of the files and the verbal agreement of the children's parents or guardians. The information gathered from the files remained confidential.

2.3. Operational Definition [4] [5]

- Moderate acute malnutrition (MAM): Malnutrition is moderate if the weight/height ratio is between −2 and −3 z-score.
- Severe Acute Malnutrition (SAM): Acute malnutrition is severe if the weight/height ratio is below −3 z-score.
- Anemia was defined by a hemoglobin (Hb) level < 11.5 g/dL and typed, according to mean corpuscular volume (MCV) into:
- Macrocytic anemia if MCV > 100 fl;
- Normocytic anemia if 80 fl ≤ VGM ≤ 100 fl;
- And Microcytic anemia if VGM < 80 fl.
  It is considered:
- Severe if Hb < 7 g/dL;
- Moderate if 7 g/dL ≤ Hb < 9 g/dL;
- And mild if 9 g/dL ≤ Hb < 11.5 g/dL.

According to the mean corpuscular hemoglobin content (MCHC), whose value varies from 27 to 31 pg, a distinction is made between:
- Hypochromic anemias if MCHR < 27 pg;
- Normochromic anemias if 27 < MCHT < 32 pg.
  Acute anemias are normocytic and normochromic.
  Chronic anemias are microcytic and hypochromic.

- Normal platelet count between 150,000 and 450,000/mm^3.
- Normal white blood cell count 4000 to 10,000/mm^3.

3. Results

3.1. Socio-Administrative Characteristics

We collected 512 children's records out of 1030 admissions during the study period, giving a CBC rate of 50%. Children under 5 years of age were the most represented, accounting for 58% of cases. The average age was 56 months, with extremes of 1 month and 15 years. Males predominated (57%), with a sex ratio of 1.3. Fathers had no education in 56% of cases, and were farmers/workers in 61%. Mothers had no education in 64% and were housewives in 88% of cases (Figure 1 and Table 1).

3.2. Clinical Features

Pallor was the most frequent reason for consultation (29%), followed by convulsion (21%). The majority of patients (67%) had consulted before 7 days of disease progression. Our patients were acutely malnourished in 20% of cases, 15% of which were severe. Physical signs on admission were mainly pallor (60%), respiratory distress (34%) and coma (29%). Malaria accounted for 71% of patients' discharge diagnoses, 53% of which were severe (28% neurological, 20% anemic and 5% mixed). Patients had received anti-malarial treatment in 63% of cases, and 39.4% had benefited from a transfusion of labile blood products (LBC). Erythrocyte concentrates accounted for 91% of all LBC transfusions. The death rate was 1% (Figures 2-4).
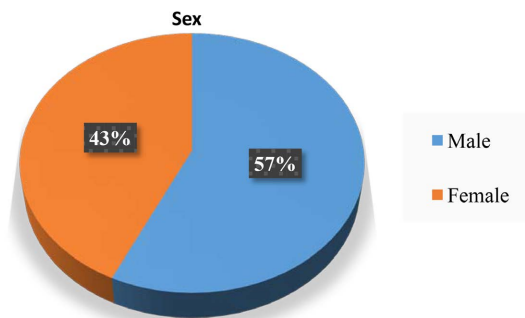

Figure 1. Patients distribution by sex. Males predominated with 57% of patients.

Table 1. Patient distribution by age group.

Age groups	Number	Percentage (%)
1 month - 4 years	295	58
5 - 9 years	154	30
10 - 15 years	63	12
Total	**512**	**100**

Children under 5 years of age were the most represented, accounting for 58% of cases. The average age was 56 months, with extremes of 1 month and 15 years.
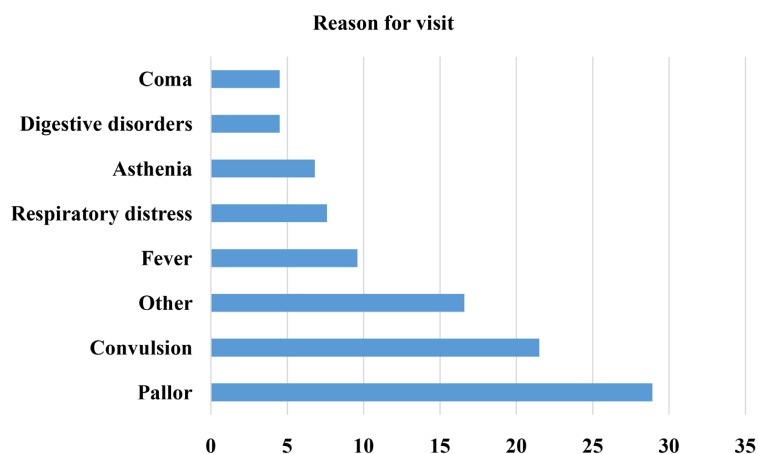
Reason for visit

Figure 2. Distribution of patients by reason for visit. Pallor was present in 29% of patients observed.
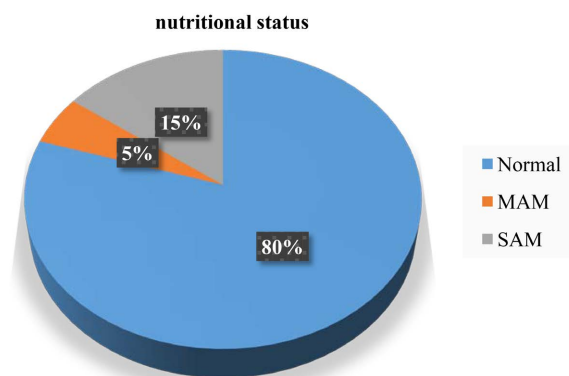
nutritional status

Figure 3. Distribution of patients according to nutritional status. Our patients were acutely malnourished in 15% of cases.
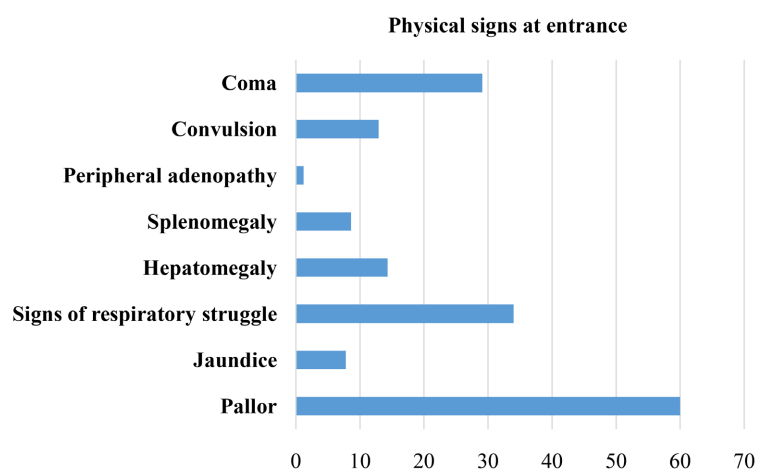
Physical signs at entrance

Figure 4. Distribution of patients according to entry physical signs. Pallor was present in 60% of our patients.

3.3. Blood Count Characteristics

In the majority of cases (60%), the CBC was performed in a private laboratory.

The majority of patients had low RBCs (69%), with a mean of 3088675.15/mm³. The mean hemoglobin level was 7.4 g/dL, with extremes of 1.4 and 17.3 g/dL. The majority of patients (91.8%) had anemia, half of whom (50%) had severe anemia with hemoglobin levels below 7 g/dL. Anemia was microcytic in 72% and hypochromic in 66% of cases. The majority of patients (95.1%) had a hematocrit level < 37%, the mean hematocrit level was 22.3% with extremes of 3.3% and 54%. The majority (69%) had microcytosis, mean GMV was 75.7 fl with extremes of 45 and 117 fl. Macrocytosis was observed in 2% of patients. Mean MCHF was 33.6 g/dL with extremes of 22.9 and 47.8 g/dL; 26% had MCHF < 32 g/dL. Mean MCHT was 25.5 pg with extremes of 12.3 and 41.5 pg. The majority (65%) had MCHT < 27 pg. The mean WBC count was 15089.26/mm³, 62% had hyperleukocytosis and 3% leukopenia. The mean lymphocyte count was 5281/mm³ with extremes of 72 and 71,170/mm³, 38% had lymphopenia and 17% had lymphocytosis. Mean granulocyte count was 8046.97/mm³ with extremes of 900 and 34,300/mm³. Granulocyte counts could only be performed in 41% of patients, and showed normal Neutrophil Polynuclear Nuclei (PNN) in 65%, basophilia in 58% and eosinophilia in 68%. The mean monocyte count was 1667.2 with extremes of 0 and 129,000/mm³, 44% had monocytosis. The mean platelet count was 244482.2/mm³ with extremes of 900 and 907,000/mm³, 40% had thrombocytopenia. The reticulocyte count in almost 14% of patients was predominantly low (73%), with an average of 68867.33/L

4. Discussion

Like all studies based on medical records, our study had certain limitations, including the incompleteness of CBC data in patient records and the use of several types of automatons, partly due to the performance of CBC in private facilities, posing the problem of standard parameter values. Nevertheless, our study provides important pediatric data on the hematological characteristics of sick children in Mali.

4.1. General Patient Profile

Fathers and mothers were predominantly peasants (61.3%) and housewives (87.9%), with no education in 56.1% and 63.7% of cases respectively. In Mali, according to the EDS-M VI, the rates of non-education varied, according to age groups from 15 to 49, from 53% among men and 66% among women. Agriculture, fishing and livestock breeding were practiced by 52% of men and 42% of women. Parents' purchasing power has a positive impact on the care of sick children, which could partly explain the low rate of CBC in our study. For optimal care in a university hospital, every hospitalized child should benefit from at least a CBC, and only half of our patients had achieved this.

4.2. Clinical Features

4.2.1. Reason for Consultation

Pallor (28.9) was the most frequent reason for consultation followed by convul-

sions (21.5).

Danièle KK *et al.* [6], in their study of pediatric anemia in a hospital in Cameroon in 2013, had found that fever was the primary reason for consultation with 55.7% of cases. The same observation was made by Okoko AR *et al.* in the CHU of Brazzaville in 2015: of 4762 children hospitalized, 34.6% were due to convulsions and 24% to anemia [7]. This difference could be explained by the fact that most of our patients were referred by a health facility with a reason for pallor.

4.2.2. Nutritional Status
Malnutrition affected 20% of patients, 15% of whom had the severe form. This rate is higher than the national rate of 9%, of which 3% had the severe form.

4.2.3. Physical Signs of Onset and Diagnosis on Discharge
Pallor (60%), signs of respiratory struggle (34%) and coma (29.1%) were the main physical signs detected on physical examination. The high frequency of pallor is explained by the predominance of the diagnosis of malaria, with its corollary of anemia that is often poorly tolerated, leading to respiratory distress. Coma was essentially associated with the neurological form of malaria. Malaria in all its forms was the most frequent discharge diagnosis, accounting for almost 72% of cases. Mali, like most countries in sub-Saharan Africa, records malaria as the leading cause of mortality and morbidity. In 2018, according to the health information system, 2,614,104 cases of malaria were confirmed and 1001 deaths were recorded.

4.3. Characteristics of the Blood Count

4.3.1. Anemia
Anemia was present in 89.4% of patients, of which 50.2% were severe, 22.7% moderate and 22.6% mild. In its characteristics, this anemia was microcytic (71.5%) and hypochromic (66.4%). In Mali, more than 8 out of 10 children aged 6 to 59 months (82%) suffer from anemia: 25% mild, 51% moderate and 6% severe. The reversal in the types of anemia could be explained by the fact that our study was carried out on severely ill subjects, especially those suffering from malaria. Malaria had been clearly incriminated in the occurrence of anemia in Togolese and Cameroonian children [8] [9]. In the Democratic Republic of Congo, in a study by Kabemba Bukassa Héman *et al.* on the contribution of malaria to the genesis of severe anemia in preschool children in rural areas, the etiological analysis showed that malaria (80.5%) was the leading cause of anemia [10]. On the other hand, microcytosis and hypochromia cannot be explained by malaria, in which the anemia is hemolytic and therefore usually normochromic-normocytic. But this situation could be explained by the high incidence of malnutrition. Anemias observed in French-speaking Africa are most often microcytic hypochromic anemias [11]. In his study of haematological disturbances in children suffering from malaria in Ouagadougou, Burkina Faso, Rande R. found that microcytic hypochromic anaemia accounted for 53.12% of cases [12]. Di-

agne *et al.* also found a predominantly microcytic hypochromic anemia in a 2010 study of children in Dakar, Senegal [13].

4.3.2. Thrombocytopenia

Thrombocytopenia was noted in 39.6% of patients. This could also be explained by the high frequency of malaria in our sample. Several series on haematological disturbances in malaria have observed thrombocytopenia in up to 50% of cases [14] [15] [16].

4.3.3. Disturbances in Leukocyte Count

We observed hyperleukocytosis in almost 62% of patients. WBC counts showed lymphopenia in 38% and monocytosis in 44%. Granulocytes were normal in 52% of cases; granulocyte counts were possible in only 41% of cases, and mainly showed eosinophilia in 68%. PNN was normal in the majority of cases (65%), and basophilia was noted in 58%. Hyperleukocytosis and monocytosis can be explained by both bacterial and parasitic infections, notably malaria, meningitis and pneumopathy, which were the first, third and fourth most frequent diagnoses. Several studies have shown that leukocytes can become elevated in cases of severe malaria [17] [18].

The first diagnosis suggested by hypereosinophilia, especially if it is elevated, is parasitosis [19]. This result corroborates the high positivity of GE testifying to parasitic infection

5. Conclusion

At the end of our study we found that the blood count is not systematically performed in hospitalized children, anemia and hyperleukocytosis were the most observed disturbances. Anemia was more common in children under 5 years of age, its predominantly microcytic and hypochromic character requires additional study with serum iron and ferritinemia.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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