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Causes and Prognoses of Acute Fever in Children Aged 0 - 15 Who Are Hospitalized in the Department of Pediatrics at the University Hospital (UH) Gabriel Touré, Bamako-Mali

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Abstract

Fever is the primary reason for consultation and admission to pediatric emergency departments. The aim of this study was to describe the clinical, etiological and prognostic aspects of acute fever in children aged 0 - 15 years. **Patients and Methods:** This was a prospective cross-sectional study from April 1, 2021 to March 31, 2022 and affected all children aged 0 to 15 years old with a temperature of 39˚C or higher (≥), having less than five days and hospitalized in the pediatric department of the Gabriel Touré University Hospital. **Results:** During the study period, 150 children were included, the sex-ratio was 0.85. Children aged 0 - 5 years represented 71.4% of the sample. References represented more than half of the sample, or 58% of cases. Body temperature was above 40˚C in 18.7% of cases. Functional signs were dominated by respiratory signs in 28% and digestive signs in 18%. Clinical pallor was found in 55.3% of children associated with signs of respiratory struggle in 70% of cases and tachycardia in 40% of patients. Anemia was present in 65.3% of patients. Hyperleucocytosis and leukopenia were found in 45.3% and 43.3% of patients respectively. The C-reactive protein was positive in 44.7% of patients and Cytobacteriological Examination and Chemistry of Cerebrospinal Fluid was positive in 8.7% of cases. The thick drop was positive in 44.7% of patients and

blood cultures grew in 6 patients. Etiology was dominated by severe malaria 54 cases (36%), pneumonia (19.3%), meningitis (12.6%), and in those under one month it was bacterial neonatal infection (8.6%). In our study, slightly more than one patient out of three died during hospitalization, 36% (54 cases/150) and among these 70% (38 cases/54) were under 5 years old. The most lethal pathologies were severe malaria (36%), bacterial pneumonia (19.3%), meningitis (12.6%), bacterial neonatal infections (8.6%) and measles complicated by pneumonia (5.3%). Mortality during hospitalization was 36% of deaths (54 out of 150 patients) and 70.3% (38/54) of the deceased patients were under 5 years old. **Conclusion:** This study shows that fever is a frequent symptom and a sign of serious and very lethal pathologies. The cause of fever can be a diagnostic challenge for health workers. However, early identification of children at risk for serious illness could allow for prompt and appropriate management in appropriate settings.

Keywords

Acute Fever, Aspects, Clinical, Etiological and Prognostic, Children, Mali

1. Introduction

Fever is a major reason for pediatric emergency room visits. This is a non-specific body defense reaction in response to the action of various triggers called exogenous pyrogens. It is defined as a rise in body temperature above 38˚C [1]. It is acute when it occurs for less than five days in infants under 24 months and less than seven days in children between 24 months and 15 years old [2]-[4]. Febrile syndromes account for 15% to 20% of reasons for urgent consultation in high-standard countries and probably more in tropical areas. The incidence of fever in African regions is about 22%, but varies from country to country, it was in Burundi (39%), Uganda (38.8%), Liberia (32.8%), Mali (16.6%), Guinea (16.1%) [5]. Infectious fevers are the most common, 40% of causes in Europe and 90% in Africa, they are responsible for serious complications and fatal in the absence of early and appropriate treatment [2] [6]-[9]. Fever is a common symptom in sub-Saharan Africa [6] and febrile disease is a major cause of morbidity and mortality [7]. Because it can be indicative of very serious diseases such as severe malaria, pneumonia, meningitis, gastroenteritis, urinary tract infections and infections of unknown or undetermined causes due to the lack or inadequacy of laboratory equipment and reagents in health facilities in our context and where the simultaneous presence of several micro-organisms called co-infections [10]-[12]. In Mali, the first diagnosis mentioned before a febrile child is malaria [13] [14]. Thus, a study carried out at the pediatric emergency room of the Gabriel Touré hospital in Bamako on the etiology of acute fever found that the main causes were urinary infection (16.82%), malaria (7.7%), occult bacteraemia (7.3%) and pneumonia (3.3%) [15]. When are the causes and prognoses of newborns and children

hospitalized in a context of very high fever (>39˚C)? Hence this study with the aim of establishing a relationship between age, clinical description and etiology of acute fever in the pediatric department of Gabriel Touré University Hospital.

2. Patients and Methods

The neonatal and pediatric emergency departments at the department of paediatrics of the University Hospital Center (HUC) Gabriel Touré in Bamako served as a framework for our study. This was a prospective cross-sectional study from April 1, 2021 to March 31, 2022. All children aged 0 - 15 years old hospitalized in the department of pediatrics at HUC Gabriel Touré for high acute fever during the study period were considered by this study. We included all children aged 0 to 15 years old with a temperature of 39˚C or higher (≥) and less than five days. The parameters studied were: sociodemographic (sex, ethnicity, residence, age and profession of parents), clinical (patient's age, mode of admission, onset of disease, functional signs, signs of infection otorhinolaryngological, pulmonary, meningeal, urinary and other infections), paraclinical examinations (Rapid Diagnostic Test (RDT) for malaria, Thick Drop (TD), Urine Dipstick Test (UDT), blood cultures and others according to the context Cytobacteriological examination (CBE) of urine, Cytobacteriological examination and chemistry (CBCE) Cerebrospinal fluid (CSF) and Chest X-ray standing in front), on the evolutionary and prognostic plane (evolution of fever, immediate becoming and becoming according to etiology).

The study was conducted as a follow-up, we were based in the neonatal emergency rooms and pediatric emergency rooms that are the two gateways to patients of the department. The recruitment was done between 08:00 and 16:00 hours from Monday to Friday. All patients had received at admission: a Rapid Diagnostic Test for malaria, a Thick Drop, Blood Cultures and a Blood Count (BC), the C-Reactive Protein (CRP). The Cytobacteriological Examination of urine was done for cases of positive Urinary Strips, the Cytobacteriological and Chemical Examination of Cerebrospinal fluid for all those who had presented clinical signs in favor of meningitis and a radiography of the lung for cases of pneumonia. We established a temperature monitoring sheet, the temperature was taken every 3 hours during the first two days of hospitalization and then the following days a take every 6 hours.

Data were collected on a survey sheet. A two-week pilot study was conducted to determine the reliability of this questionnaire. The purpose of the pilot study was to assess the relevance of the questionnaire and the adequacy of the questioning elements. Data analysis was done with the Statistical Package for Social Sciences (SPSS) version 25.0. A descriptive analysis was performed to determine the frequency of categorical variables. Univariate analysis was performed to determine the factors determining severity, link age and or type of fever with their causes. We obtained individual informed consent, both verbal and written, from parents or caregivers before each patient was included in our study from the vaccine development centre (VDC) department. Confidentiality of data has been respected.

3. Results

During this period, we included 150 children with a sex ratio of 0.85. The under-five were the most represented, 71.4%, of which 12.7% were newborns with an average age of 45.84 ± 34.68 months. The majority of patients lived in Bamako (71.3%) and the reference was the admission mode for more than half of the sample, or 58%. More than one in three patients (34.7%) had received paracetamol-based self-medication at home (Table 1).

Table 1. Characteristics of patients.

Characteristics of patients	Effective n = 150	%
Age in months		
<1	19	12.7
1 - 59	88	58.7
60 - 120	34	22.6
121 - 180	9	6
Sex		
Female	81	46
Male	69	54
Residence		
Bamako	107	71.3
Outside Bamako	43	28.7
Mode of admission		
References	87	58
Brought by parents	60	40
Transfer	3	2
Home-based gestures and treatment		
No treatment	72	48
Paracetamol	52	34.7
Herbal decoction	24	16.0
Wetpack	6	4
Ibuprofen	2	1.3

At the clinical level, 18.7% of patients had hyperthermia (>40˚C) on admission. Respiratory and digestive functional signs were found in 28% and 18% of cases respectively. Fever was considered severe in the vast majority of patients (87.3%).

Pallor was found in 55.3% of children associated with signs of respiratory struggle in 70% of cases, tachycardia in 40% of patients. Hepatosplenomegaly was found in 20.6% of patients. More than half (57.3%) had neuromeninged signs and purulent conjunctivitis in 9.3% (Table 2).

At the paraclinical examination, anemia was present in 65.3% of patients. Hyperleucocytosis and leukopenia were found in 45.3% and 43.3% of patients respectively. C-reactive protein was positive in 58% of patients. The result of the Urine Dipstick Test was positive in 4 patients (2.6%). The Cytobacteriological and Chemical Examination of Cerebrospinal fluid was positive in 13/47 (27.65%). The

thick drop was positive in 44.7% of patients. The germs found were *Staphylococcus aureus* in three patients, Haemophilus influenzae type b in two patients and a case of Cocci Gram-positive infection (HBV). The chest radiography of the face had revealed parenchymal lesions with type of pulmonary condensation lesions in 45/65 (69.23%) (Table 3).

Table 2. Distribution of patients by clinical characteristics.

Clinical features at admission	Effective n = 150	%
Body temperature (˚C)		
39	56	37.3
39.1 - 40	66	44
>40	28	18.7
Functional signs (FS)		
Fever + FS respiratory	42	28
Fever + FS digestives	32	21.3
Severity of the fever		
Yes	131	87.3
No	19	12.7
Skin and skins		
Pallor	83	55.3
Eruption + Ulcerations	25	16.6
Cyanosis	11	7.3
Dehydration folds	10	6.6
Jaundice	8	5.3
Puffiness	2	1.3
Respiratory signs		
Signs of struggle	105	70
Abnormal lung exam	4	2.6
Cardiovascular signs		
Skin Recolour time > 3 seconds	7	4.6
Tachycardia	60	40
Signs digestives		
Hepatosplenomegaly	31	20.6
Neuromeninged signs		
Neuromeninged signs present	86	57.3
Eye signs		
Purulent conjunctivitis	14	9.3

Table 3. Distribution of patients according to paraclinic characteristics.

Caractéristiques des examens paracliniques	Effective	%
Complete Blood Count		
Anemia	98/150	65.3
Hyperleukocytosis	68/150	45.3
Leukopenia	65/150	43.3
Neutropenia	67/150	44.7
C-reactive protein (CRP)		
Positive	87/150	58

Continued

Urine Dipstick Test (UDT)		
Positive	4/150	2.6
Negative	146/150	97.4
Cytobacteriological and Chemical Examination of Cerebrospinal fluid		
Positive	13/47	27.65
Negative	34/47	72.34
Thick drop		
Positive	67/150	44.7
Negative	83/150	55.3
Blood cultures		
Positive	6/150	4
Negative	144/150	96
Chest X-ray of the face		
Parenchymal lesions n = 65	45/65	69.23
Not made	85/150	56.66

The five main causes of fever found were severe malaria 54 cases (36%), pneumonia 29 cases (19.3%), meningitis 19 cases (12.6%), bacterial neonatal infections (BNNI) 13 cases (8.6%) and complicated measles with pneumonia 8 cases (5.3%).

In terms of treatment, all patients were 100% antipyretic (Paracetamol), two out of three patients (70.7%) had received a bi or mono antibiotic therapy (Ceftriaxone, Gentamycin). Antimalarial was prescribed in 44.67% of patients (Artesunate). Seizures were stopped by anticonvulsants (diazepam) in 16 patients.

On the evolutionary and prognostic level, apyrexia was obtained in less than 24 hours in 52.7% and fever persisted beyond 72 hours in 11.3%. In the vast majority of cases, 86% of patients had a length of stay of less than 7 days with an average length of stay of 6 ± 4.2 days. Mortality during hospitalization was 36% of deaths (54 out of 150 patients) and 70.3% (38/54) of the deceased patients were under 5 years old. The most fatal pathologies were meningitis/malaria (100%), meningitis 11/19 (58%), cases of complicated gastroenteritis of severe dehydration 3/6 (50%) and one in three patients suffering from malaria or pneumonia died (31% to 33%) (Table 4 and Table 5).

Table 4. Distribution according to diagnosis selected according to age group of patients.

Diagnosis selected according to age group in months					
Diagnosis retained	**<1**	**1 - 59**	**60 - 120**	**121 - 180**	**Total**
Severe malaria	0	32	18	4	54
Pneumonia	1	25	3	0	29
Meningitis	3	13	3	0	19
Neonatal bacterial infections	13	0	0	0	13
Measles pneumonia	0	4	2	2	8
Severe dehydration	2	3	1	0	6
Sepsis	0	3	0	2	5
Pneumonia + Severe Malaria	0	3	1	0	4

Continued

Severe Meningitis + Malaria	0	2	2	0	4
Severe malaria + measles	0	2	2	0	4
Urinary infection	0	0	2	0	2
Gastroenteritis	0	1	0	0	1
Sepsis + severe malaria	0	0	0	1	1
Total	**19**	**88**	**34**	**9**	**150**

Table 5. Distribution of patients according to evolutionary and prognostic characteristics.

Evolutionary and prognostic characteristics	Effective n = 150	%
Treatment received		
Antipyretic	150	100
Antibiotic	106	70.7
Antimalarial	67	44.6
Anticonvulsants	16	10.6
Corticotherapy	16	10.6
Apyrexy delay (hour)		
<24	79	52.7
24 - 47	39	26
48 - 72	15	10
>72	17	11.3
Length of hospitalization (day)		
<7	129	86
7 - 15	17	11.3
>15	4	2.7
Become		
Healed	94	62.7
Deceased	54	36
Escaped	2	1.3

4. Comments and Discussion

As in all studies, we have encountered some difficulties among others the non-realization of certain additional examinations (lack of financial means of parents or high costs of examinations), the collection of urine in newborns often difficult (urinary catheters often not suitable for the patient's age). Although this study was conducted without partners, we obtained the following results.

In our population, the sex ratio was 0.85 in favor of the female, whereas Belco *et al.*, 2020 found 1.2 [15]. The vast majority of patients (71.3%) were resident in Bamako, results similar to those reported by Belco *et al.* [15]. Depending on the mode of admission, referrals represented more than half of the sample, or 58%, while Penda *et al.* in 2023 [16] found that 62.5% of patients came from another health structure.

As in the literature [15] [17], children under five years of age represented 71.4% of the sample with 12.7% of newborns and an average age of 45.84 ± 34.68 months.

In the presence of a febrile child, clinical signs should be used to determine the level of life-threatening distress and to distinguish between a child with fever and a high risk of serious illness requiring specific treatment, hospitalization or

specialized care and low-risk. Thus, the main reason for consultation was fever (100%), it was considered severe in the vast majority of patients (87.3%) with 18.7% of hyperthermia cases (>40˚C). This fever was associated with respiratory (28%) and digestive (18%) functional signs.

Similar symptomatologies of coughs (48%), vomiting (15.9%) and diarrhea (10.5%) were found in a Cameroonian study in 2023 [16], the same trios are also found in other African studies such as that of Kenya in 2015, of Senegal in 2016 and Burkina Faso in 2018 [18]-[20]. Patients presented as main physical signs pallor in 55.3% of cases, signs of respiratory struggle in 70% of cases, tachycardia in 40% of cases, neuromeninned signs in 57.3% and hepatosplenomegalia in 20.6%. A similar clinical picture consisting of conjunctival paleness (40.5%), hepatosplenomegaly (26%), signs of respiratory distress (9%) and crackles (8.5%) was found in Cameroon [16].

Laboratory examination found anemia (65.3%), leukocytosis (45.3%), leukopenia (43.3%) and C-reactive protein positive in 58% of cases. For the etiological search, the thick drop was positive in 44.7% of patients, The Cytobacteriological and Chemical Examination of Cerebrospinal fluid was positive in 8.7% of cases, blood cultures had grown in 4% of cases and the result of the Urine Dipstick Test was positive in 4 patients (2.6%). All these results support the argument that fever is most often due to an infectious pathology in African regions [18] [19]. In the literature, it is shown that the risk of bacteriemia increases with the degree of temperature, it is very low when the child's body temperature is below 39˚C and increases with the rise in temperature [20] [21]. Thus the five infectious diseases responsible for fever in our context were severe malaria 54 cases (36%), pneumonia 29 cases (19.3%), meningitis 19 cases (12.6%), bacterial neonatal infections (BNNI) 13 cases (8.6%) and complicated measles of pneumonia 8 (5.3%). Penda CI *et al.* in 2023 had found similar pathologies malaria (53%), pneumonia (19.5%), meningitis (11.5%) and urinary tract infection (10%) [16]. Different from those found by Maiga B *et al.* in 2020 urinary infections (16.82%), malaria (7.71%), occult bacteremia (7.3%) [15]. Even if in our resource-limited countries, Identification of the pathogen responsible for fever in several patients remained very difficult due to insufficient or no laboratory and reagent equipment in our health facilities or the presence of several microorganisms [16] [22]-[24].

Infectious diseases are the leading cause of death worldwide, especially in African regions. In our study, slightly more than one patient out of three died during hospitalization, 36% (54 cases/150) and among these 70% (38 cases/54) were under 5 years old. This high mortality rate could be explained by the following reasons, the department of paediatrics is the tertiary level of care for children in Mali where more than half of our admissions are referrals, indicating that seriously ill patients.

Regarding the causes of death, one in three patients hospitalized for either malaria or pneumonia died (31 to 33%). The most fatal pathologies were meningitis and malaria (100% of deaths), meningitis 11 deaths/19 (58%) and cases of

Gastroenteritis complicated from severe dehydration 3 deaths/6 (50%). These pathologies alone or in combination remain the main causes of death for children (especially those under 5 years) worldwide and many more in Africa [25]-[27].

5. Conclusion

This study shows that fever is a common symptom and a marker of serious diseases such as severe malaria (36%), bacterial pneumonia (19.3%), meningitis (12.6%), bacterial neonatal infections (8.6%) and complicated measles pneumonia (5.3%). These pathologies are very important causes of death, one in three patients hospitalized for malaria and or pneumonia died (31 and 33%). All patients hospitalized for malaria associated with meningitis had died (100% of deaths). Thus, the etiological research of fever can present a challenge for health workers especially in our context. At the level of the health system, we must quickly identify children with severe fever for those referred to appropriate health structures ensuring the diagnosis and proper management of these serious pathologies.

Conflicts of Interest

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

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