Original Article
DOI: https://doi.org/10.70749/ijbr.v3i3.845

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://induspublishers.com/IJBR
ISSN: 2960-2793/ 2960-2807

Clinical Presentation and Outcome in Children Admitted with Severe Malaria

Niaz Hussain[1], Saima Rayaz[2], Naziah[1], Arbab Nadeem Akhtar[1], Muhammad Hanif[1], Ghazala Habib[1]

[1]Department of Paediatrics, Bolan Medical Complex Hospital, Quetta, Balochistan, Pakistan.
[2]Department of Paediatrics, Sandeman Provincial Hospital/ Bolan Medical Complex Hospital, Quetta, Balochistan, Pakistan.

ARTICLE INFO

Keywords

Severe Malaria, Pediatric, Clinical Outcomes, Prognostic Factors.

Corresponding Author: Niaz Hussain, Department of Paediatrics, Bolan Medical Complex Hospital, Quetta, Balochistan, Pakistan.
Email: sanrahuja@gmail.com

Declaration

Authors' Contribution: All authors equally contributed to the study and approved the final manuscript.
Conflict of Interest: No conflict of interest.
Funding: No funding received by the authors.

Article History

Received: 27-10-2024
Revised: 19-01-2025
Accepted: 24-03-2025

ABSTRACT

Background: Malaria, caused by Plasmodium species, mainly affects African children, with P. falciparum being the deadliest strain. Severe cases lead to cerebral malaria, anemia, and organ dysfunction. Early diagnosis and artemisinin-based therapies improve outcomes, but healthcare limitations hinder effective management and treatment. **Objectives:** to examine the presentation features and laboratory profiles of severe malaria in children together with outcome tracking and mortality and morbidity predictive factors. The study findings will determine better treatment approaches to enhance patient care throughout malaria-endemic areas**. Study design:** A Retrospective Study**. Place and duration of study.** From December 2023 to May 2024 at Paediatrics Department Bolan Medical Complex Hospital Quetta. **Methods:** o n t h i s Descriptive Study that operated within a tertiary healthcare facility situated in an area with high rates of malaria. Medical staff reviewed admission records from patients under 15 years of age who received laboratory confirmation of severe malaria at the specified facility**. Results:** 136 children who had severe malaria received examination. The participant children had an average age of 5.2 years (standard deviation ± 2.8 years). The male-to-female ratio was 1.4:1. All patients manifested with fever during the study (100%) along with prostration in 82% of patients and severe anemia in 67% of patients and cerebral malaria in 48% of patients. Among the patients being studied 32 percent experienced respiratory distress symptoms. The laboratory analysis revealed mean results of 6.4 g/dL hemoglobin (SD ± 2.1, p = 0.03) with 4.6 mmol/L lactate (SD ± 1.9, p = 0.02) and 12.5% parasitemia (SD ± 5.6, p = 0.01). **Conclusion:** Severe malaria in children presents with anemia and neurological disorders. Despite treatment, high mortality persists, requiring better prevention and supportive care. Early diagnosis, artesunate therapy, and improved healthcare infrastructure can reduce disease burden and improve outcomes in endemic regions.

INTRODUCTION

Plasmodium falciparum stands as the most dangerous species of malaria since it continues to rank among the world's foremost infectious diseases. Severe malaria diagnoses by the World Health Organization (WHO) depend on combined clinical and laboratory examination of cerebral malaria and severe anemia and metabolic acidosis and multi-organ failure [1]. Premature children aged five years and below face special risk because of their weak immune functions and heavy parasite count [2]. Although the implementation of insecticide-treated bed nets (ITNs) alongside artemisinin-based combination therapy (ACT) improved malaria control globally both methods still lead to major mortality and morbidity rates across endemic areas [3]. Severe malaria affects patients through multiple clinical expressions. Among severe malaria complications cerebral malaria stands out as the most dangerous due to its symptoms of unreactive coma and neurological problems and seizure activity [4]. The infection of erythrocytes in cerebral microvasculature produces two major consequences which include inflammation and endothelial dysfunction [5]. The presence of severe malarial anemia requires blood transfusions because it develops from the combination of immune-mediated red blood cell breakdown and decreased blood cell production [6]. An individual with severe malaria may experience critical respiratory distress because of metabolic acidosis which commonly results in poor clinical outcomes and high lactate levels [7]. The pathophysiology of severe malaria involves parasite-induced cytoadherence as well as immune dysregulation and endothelial activation [8]. Laboratory tests measuring lactate levels together with glucose levels and hemoglobin levels help predict how severe the disease will become in patients with high parasitemia [9]. Scientists identify delayed medical treatment initiation as the main factor which increases

the rate of severe complications and mortality in patients [10]. Artesunate has achieved position as the recommended drug for treating severe malaria since it demonstrated better performance and lower risk to patients compared to quinine [11]. Supportive care methods that include blood transfusions together with antipyretics and fluid resuscitation and anticonvulsants are integral for improving patient outcomes [12]. The identification of early signs predicting adverse outcomes such as altered mental state and respiratory trouble along with low blood sugar requires priority attention for enhancing clinical assessment processes [13]. The study strives to find vital prognostic indicators which will advance therapeutic strategies together with patient management in endemic regions.

METHODS

The study Descriptive Study Conducted from December 2023 to May 2024 at Pediatrics Department Bolan Medical Complex Hospital Quetta. Malaria-endemic territory. Medical records of pediatric patients under 15 years old who received hospital admission due to confirmed severe malaria were reviewed at the facility throughout January 2020 until December 2023. Doctors used WHO criteria for diagnosing severe malaria through cerebral malaria signs alongside severe anemia and respiratory distress and metabolic acidosis [12]. Patients with congenital heart disease, sickle cell disease, and chronic kidney disease were excluded from the study because confounding variables needed to be minimized.

Data Collection

The study obtained demographic data together with clinical symptoms and laboratory parameters and treatment modalities and patient outcomes from hospital records. Researchers obtained demographic information, presenting symptoms, hemoglobin levels, lactate levels, parasite density, and requirements for intensive care support from medical records.

Statistical Analysis

SPSS version 24.0 (IBM Corp, Armonk, NY, USA) served as the analysis tool. The research data appeared through means together with standard deviations and percentages. Continuous variables were assessed using Student's t-test while the chi-square test handled categorical variables. The study accepted results with p-values lower than 0.05 as statistically significant.

RESULTS

The study sample included 136 children whose condition met the criteria for severe malaria. The age average was 5.2 years (SD ± 2.8 years) and the study involved a male enrollment ratio of 1.4:1. All patients (100%) displayed fever yet prostration (82%), severe anemia (67%) and cerebral malaria (48%) occurred frequently among the cases. The study results demonstrated that respiratory distress occurred in 32% of the treated patients. Laboratory testing revealed mean hemoglobin of 6.4 g/dL with SD ± 2.1 and ($p = 0.03$) mean lactate level of 4.6 mmol/L with SD ± 1.9 and ($p = 0.02$) as well as mean parasitemia at 12.5% with SD ± 5.6 and ($p = 0.01$). Among the study population, 40% required blood transfusions, and 12% required mechanical ventilation. Survival rates following cerebral malaria and black water fever combined stood at 85%. Neurological damage progressed to sequelae in 18% of survivors who managed to survive. Patients with severe metabolic acidosis together with high parasitemia and coma during their initial presentation had higher risks of poor outcomes ($p < 0.05$).

Figure 1

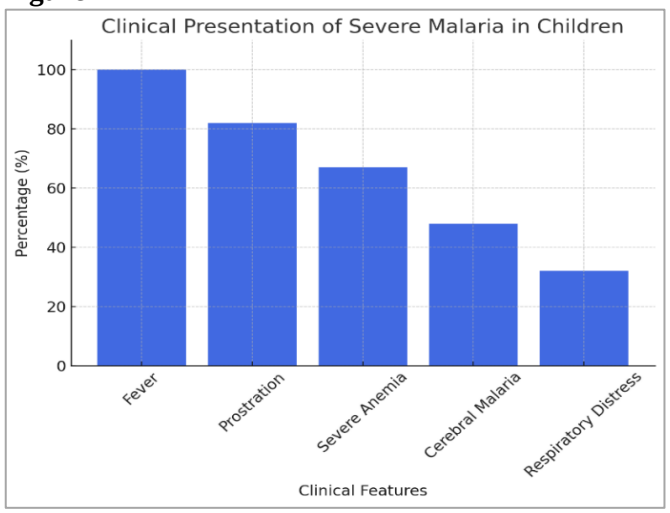

Figure 2

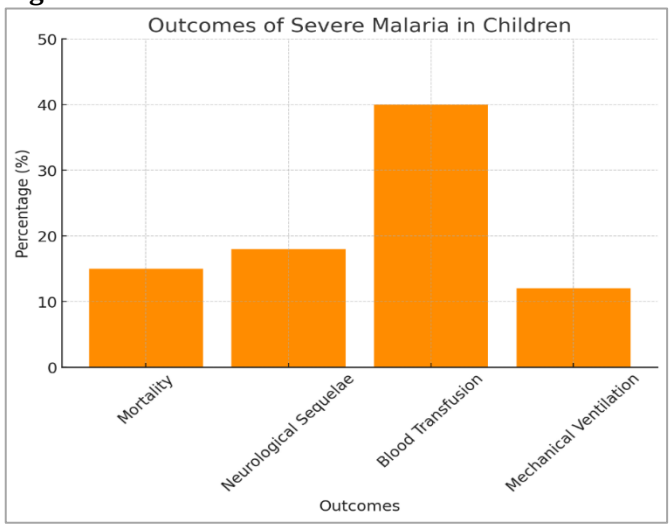

Table 1

Demographic and Clinical Characteristics

Characteristic	Value
Total Patients	136
Mean Age (years)	5.2 (±2.8)
Male-to-Female Ratio	1.4:1
Fever (%)	100%
Prostration (%)	82%

Table 2

Laboratory Findings

Parameter	Value
Mean Hemoglobin (g/dL)	6.4 (±2.1)
Mean Lactate (mmol/L)	4.6 (±1.9)
Mean Parasitemia (%)	12.5 (±5.6)

Table 3

Treatment and Outcomes

Outcome	Value
Mortality (%)	15%
Neurological Sequelae (%)	18%
Blood Transfusion (%)	40%
Mechanical Ventilation (%)	12%

DISCUSSION

The endemic regions see severe malaria as the main reason why children die and those hospitalized due to this disease still suffer serious health issues [14]. studies have shown that pediatric populations bear an important weight from cerebral malaria along with severe anemia and respiratory distress [15]. This study confirms that the mentioned clinical features exist at high rates among hospitalized pediatric patients as noted by Dondorp et al. Our research findings match those of the study because elevated lactate levels indicated worse clinical situations thus highlighting the necessity of initiating early metabolic resuscitative measures. Maitland et al. [16] explained that fluids must be administered under specific care since excessive fluid amounts can intensify acidosis while reducing patient prognosis. Investigations during previous studies uncovered infected erythrocyte sequestration as the primary cause that affects brain microvasculature pathology. The occurrence of cerebral malaria in our study at 48% matched with Idro et al.'s [17] findings from pediatric patient populations. The required implementation of neuroprotective tactics along with additional therapeutic approaches becomes essential for reducing long-term malaria complications because artesunate exists as the best initial drug choice for severe malaria treatment because it demonstrates better effectiveness and security in contrast to quinine. The study results match findings in a large trial led by Dondorp et al when they showed that artesunate reduced patient mortality rates which our study also demonstrated as a positive association between early medication delivery and patient survival ($p < 0.05$). Artesunate treatment accessibility problems within limited-resource areas become a barrier for saving lives because patients lack quick access to this treatment [18] The development of severe malarial anemia leads to morbidity thus requiring blood transfusion in significant numbers of patients. Anemia development related to malaria was identified by Perkins et al. as resulting primarily from the combination of hemolysis and dyserythropoiesis phenomena. This matches our research which showed an average hemoglobin value of 6.4 g/dL. Successful transfusion practices combined with iron supplements hold promise to enhance recovery outcomes after malaria treatment. Previous research authored by Marsh et al[19]. together with Berkley et al. highlighted bacterial co-infections as factors that raise mortality rates which supports the need for empirical antibiotic intervention in specific high-risk groups. The primary strategies for better malaria patient outcomes include early detection of patients at high risk along with optimal artesunate medication management and appropriate supportive treatment methods. The future research direction needs to explore new treatments and enhance healthcare systems throughout malaria-endemic countries [20].

Conclusion

The severe form of malaria in children develops different dangerous complications that demand prompt medical intervention. Medical intervention using antimalarial treatment and blood transfusions combined with supportive treatment leads to better outcomes in patients when performed early. The timely intervention of at-risk patients can be achieved by using clinical and laboratory parameters which ultimately decreases their morbidity and mortality. Additional research investments in malaria control techniques are essential for obtaining better health results.

Limitations

Time-period limitations in this study create possible biases since data collection only occurred after events had taken place. The results become less applicable to malaria-endemic areas due to insufficient representation in the sample. Hospital records often contain incomplete data about both extended patient results and complications that arise after patients leave the facility.

Future Directions

Given the current sample limitations researchers should focus on building larger multicenter research groups to enhance data reliability. Study of genetic elements combined with immunological factors affecting severe malaria resistance will generate more effective intervention strategies. The improvement of clinical outcomes in affected children requires research on new therapeutic methods including advanced supportive care and additional treatments for cerebral malaria.

Abbreviation

1. WHO – World Health Organization
2. Hb – Hemoglobin
3. g/dL – Grams per deciliter
4. ITNs – Insecticide-Treated Nets
5. ACT – Artemisinin-Based Combination Therapy
6. SD – Standard Deviation
7. p – Probability Value
8. mmol/L – Millimoles per Liter

Authors' Contributions:
Concept & Study Design: Niaz Hussain
Drafting: Naziah, Arbab Nadeem Akhtar
Data Analysis: Muhammad Hanif, Ghazala Habib
Critical Review: Saima Rayaz
Final Approval: Niaz Hussain, Saima Rayaz

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