ORIGINAL ARTICLE

PATTERN AND TREND OF SEVERE AND COMPLICATED MALARIA AMONG CHILDREN, JIMMA UNIVERSITY SPECIALIZED HOSPITAL, SOUTHWEST ETHIOPIA

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ABSTRACT

BACKGROUND: *Malaria is the most important parasitic disease of humans affecting more than half of the world population, majority of them in Sub-Saharan Africa. Most malarial morbidity and mortality occur in children and pregnant woman. In past few years, Ethiopia introduced different strategies to control and prevent malaria. But hospital admission due to severe and complicated cases was not assessed in the study area. Therefore, the objective of this study was to describe patterns and trend of severe and complicated malaria cases, which could partly measure impact of interventions, admitted to pediatric ward of Jimma University Specialized Hospital.*

METHODS: *Record review of severe and complicated malaria cases admitted to pediatric ward from May 2004 to April 2009 was conducted. Data on age, sex, month and year of admission, severity sign, hospital stay and outcome were collected from April-May, 2009 using structured format. The data were cleaned, coded and entered into computer and analyzed using SPSS for Windows version 13.5.*

RESULT: *Of the total 8768 admission in the stated five years, severe malaria accounted for 660 (7.5%). Majority of the malaria admissions 294(44.5%) were in the age group of 12-59 months and 13(2.0%) less than one month of age. Males accounted for 395(59.9%) of admission. A declining trend in malaria admission both in absolute number and proportion was observed with a nadir in 2007/08. The total pediatrics admission for each year from 2004/5 to 2008/9 was 1678, 1798, 1860, 1683 and 1749 while malaria cases being 240, 220, 89, 30and 81, accounting for 14.3%, 12.2%, 4.8%, 1.9% and 4.6% the respective year admission. There was a bimodal clustering of admitted cases (in months) of each year except for 2007/08. The first peak was in June for 2004/5, 2005/6 and 2006/7 but pushed to July for 2008/9. While the second peak being observed in October for 2004/5 and 2005/6 pushed to November for 2006/7 and 2008/9. Only cards of 413(68.8%) cases were found for review on severity signs and blood film results. Prostration was the commonest severity sign on admission seen on 125 (30.3%) children followed by convulsion 123 (29.8%) and severe anemia 113 (27.4%). Out of the reviewed cards, 335 (81.1%) children had positive blood film for plasmodium species, of whom 281 (83.9%) were positive for p. falciparum. Three hundred thirty four arrived within 72 hours of the onset of the illness. Majority, 513 (77.8%) stayed in the hospital for less than seven days; 15 children died in hospital giving a case fatality rate of 2.3%.*

CONCLUSION: *There was a dramatic declining trend of severe and complicated malaria admission with resurge in 2008/09 calling for further investigation who for the possible causes at community level. The low case fatality rate as compared with previous reports is rewarding for the ward team.*

KEYWORDS: *Severe and complicated malaria, pattern, Trend, Southwest Ethiopia.*

INTRODUCTION

Malaria is the most important parasitic disease of humans affecting more than half of the world population in 109 countries. It has been a major challenge to both public health and socio-economic development to developing countries in general and sub-Saharan Africa in particular. In 2006, Africa harbored 86% of malaria cases, 80% of which occurred in 13 countries including Ethiopia (1). Malaria remains to be a public health concern and of considerable socio-economic burden in Ethiopia where three-fourth of the total population is at risk of infection (2). In the same year, there was an estimated one million death from 250 million cases of malaria, most of them being in under five African children (2). In addition to the fact that most Asian and African countries are malarious, drug resistance and population movement contributes to a further increase in malaria morbidity and mortality (3,4).

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Since 2006, most African countries adopted the World Health Organization (WHO) recommendation of providing insecticide treated bed-nets (ITNs) free of charge to children and pregnant woman (1). In line with this, the Ministry of Health (MOH) of Ethiopia introduced different malaria control and prevention strategies including case management by community level health workers, indoor residual spraying (IRS), distribution of long lasting insecticide nets (LLINs) and information, education and communication and community mobilization through country wide implementation of community conversation (1).

The national Malaria Control Program (NMCP) distributed 20 million LLINs that raised the percentage of households with one insecticide-treated bed nets (ITNs) from 3% nationwide in 2005 to 53% in 2007. In 2006 alone, nearly 7 million courses of artemisinin-based combination therapies (ACT) were delivered (1). Almost all severe forms and deaths from malaria are caused by P. falciparum. Rarely, P. vivax produces serious complications, debilitating relapses and even death (5). Most countries use the 2000 revised WHO criteria for diagnoses of severe malaria (Table 1) (6, 7).

Table 1. WHO Indicators of severe malaria and poor prognosis

Manifestation Features	Description
Initial World Health Organization criteria from 1990 (8)	
Cerebral malaria	Unarousable coma not attributable to any other cause, with a Glasgow Coma Scale score ≤9. Coma should persist for at least 30 min after a generalized convulsion
Severe anemia	Hematocrit <15% or hemoglobin < 5 g/dl in the presence of the parasite
Renal failure	Urine output <400 ml/24 hours in adults (<12 ml/kg/24 hours in children) and a serum creatinine > 3.0 mg/dl despite adequate volume repletion
Pulmonary edema and acute respiratory distress syndrome	The acute lung injury score is calculated on the basis of radiographic densities, severity of hypoxemia and positive end-expiratory pressure
Hypoglycemia	Whole blood glucose concentration <40 mg/dl
Circulatory collapse (algid malaria)	Systolic blood pressure <70 mmHg in patients > 5 years of age (< 50 mmHg in children aged 1–5 years), with cold clammy skin or a core-skin temperature difference >10°C
Abnormal bleeding and/or disseminated intravascular coagulation	Spontaneous bleeding from gums, nose, gastrointestinal tract, or laboratory evidence of disseminated intravascular coagulation
Repeated generalized convulsions	>3 convulsions observed within 24 hours
Acidemia/acidosis	Arterial pH <7.25 or acidosis (plasma bicarbonate <15 mmol/l)
Macroscopic hemoglobinuria	Hemolysis not secondary to glucose-6-phosphate dehydrogenase deficiency
Added World Health Organization criteria from 2000.(9)	
Impaired consciousness	Arousable mental condition
Prostration	Extreme weakness
Hyperparasitemia	>5% parasitized erythrocytes or > 250 000 parasites/µl (in nonimmune individuals)
Hyperpyrexia	Core body temperature >40°C
Hyperbilirubinemia	Total bilirubin >43 µmol/l (> 2.5 mg/dl)

Severe anemia, cerebral malaria and metabolic acidosis are common presentations of severe and complicated malaria in children. However, the clinical features and patterns of severe and complicated malaria differ with age of the patient and geographic location (8). In many patients, several of these complications exist together or evolve in rapid succession within a few hours. In various studies risk factors for severe malaria and death include nonimmune status, coexisting medical conditions, delay in treatment, and severity of the illness at admission (coma, acute renal failure, shock, pulmonary edema, coagulation disorders) (9–11).

Between 1995 and 2000, there were 427 (7% of all admission) children admitted to pediatric ward of Gondar Hospital with a primary diagnosis of severe and complicated malaria (12). Since 2005, the trend of malaria in Ethiopia has shown a decline, the lowest number of cases being recorded in 2007 (1). In 2007, death from malaria among under five year old children decreased by 51% in Ethiopia (13). Monitoring such intervention strategies in a population is a challenge in most developing countries (14,15). In the absence of such data, routine hospital data, provide proxy information for describing the trends and patterns severe and complicated malaria to monitor and plan resource needs in a health system (16). Therefore, this study was conducted to assess the trend and patterns of severe and complicated malaria admission to pediatric ward of Jimma University Specialized Hospital (JUSH).

METHODS AND MATERIALS

This retrospective study was conducted from April to May, 2009 in JUSH, located 352 Km Southwest of Addis Ababa. The hospital gives service for people living in Jimma City, Jimma Zone and the whole Southwest Ethiopia. The Pediatrics ward of the hospital had 100 beds capacity and staffed by pediatricians, residents, medical interns and nurses. Yearly, about 1600 - 2000 children with severe diseases get inpatient care in the ward (17).

The clinical records of all children admitted with the diagnosis of severe and complicated malaria from May 2004 to April 2009 were used to retrieve data. Data on demographic characteristics, month and year of admissions, the severity signs, duration of illness before arrival and outcome were collected from ward logbook and individual clinical records of patients on a structured format. Senior medical students collected the data.

The data were cleaned, entered in to computer and analyzed Using SPSS for windows version 13.5.

The proposal was approved by Medical Sciences Faculty of Jimma University and permission was obtained from hospital authorities to conduct the study. All cases received intravenous quinine based the WHO recommendation. Blood transfusions, intravenous 10% glucose, antipyretics, oxygen by nasal catheter, antibiotics for suspected bacterial co-infection infection, anticonvulsants and other supportive therapy were given when required.

The pediatrics ward of JUSH follows the 2000 WHO criteria with some modifications. Therefore, the study used the following ward modified criteria severe and complicated malaria.

Severe anemia: packed cell volume < 15.0%.

Prostration: Extreme weakness, inability to sit without assistance, lethargy.

Loss of consciousness (cerebral malaria): Any altered state of mentation including unarousable coma, irrespective of blood film result but other causes excluded. **Convulsions**: Repeated or prolonged seizures without signs of meningitis by CSF examination

Respiratory distress: Tachypnea and deep breathing with use of accessory muscles of respiration and chest indrawing

Hypoglycemia: Blood glucose level of < 40 mg/dL or clinically considered and treated in the absence of blood glucose determination.

Jaundice: yellowish discoloration of the sclera and mucous membranes irrespective of serum bilirubin determination.

Renal failure: Urine output of < 0.5 mL/kg per hour or deranged serum creatinine and/or BUN value for age.

Shock: blood pressure of below 5th percentile for age or cold clammy skin in the presence of rapid and weak peripheral pulse.

Hyperparasitemia: if the degree of parasitemia is +3 or more.

Persistent Vomiting: presence of recurrent vomiting affecting oral drug therapy.

RESULTS

A total of 8768 sick children were admitted to the Pediatric wards of JUSH during May 2004 to April 2009. Six hundred sixty (7.5%) of them were with a primary diagnosis of severe and complicated malaria. Males accounted for 395 (59.9%) of the severe malaria admissions. Infants, children age 13-59 month and those beyond five year of age were 136 (20.6), 294 (44.5%) and 230 (34.9%), respectively (Table 2).

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The total pediatrics admission for each year from 2004/5 to 2008/9 was 1678, 1798, 1860, 1683 and 1749 while malaria cases were 240, 220, 89, 30 and 81, accounting for 14.3%, 12.2%, 4.8%, 1.9% and 4.6% of the respective year admission. The highest admission due to malaria was in 2004/5 with a marked decline thereafter until the nadir in 2007/8 when only 30 cases were admitted. There was resurge in 2008/9 (Fig 1).

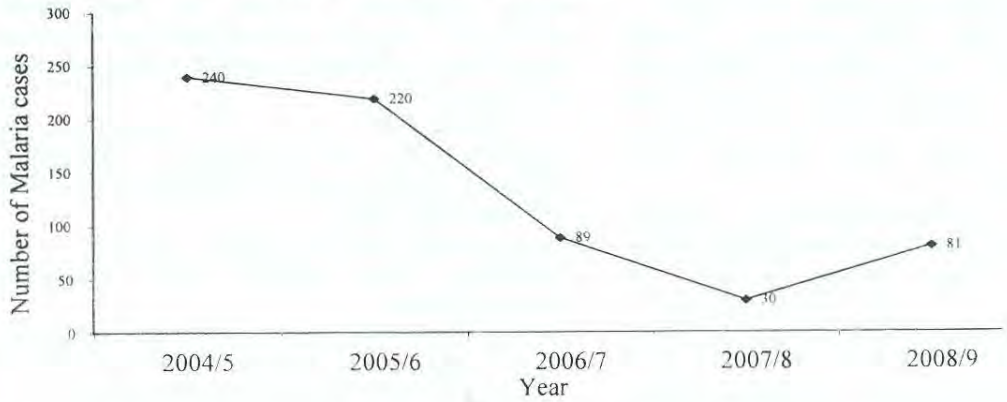

Figure 1. Trend of malaria admission over five years, pediatrics ward, JUSH, 2009

Distribution of cases over months showed bimodal pattern which was true for all the years except for 2007/8. The two humps were during May-July and during September-November. The first peak was in June for 2004/5, 2005/6 and 2006/7 but pushed to July for 2008/9. While the second peak being observed in October for 2004/5 and 2005/6 pushed to November for 2006/7 and 2008/9. The lowest record of severe malaria admission for each year was during months of December to March (Fig 2).

Of the 660 admissions, the charts of 413(68.8%) were recovered and data on severity signs retrieved. Many patients presented with multiple severity signs. Prostration, convulsion, severe anemia, hyperparasitemia and loss of consciousness (define) were seen on 125 (30.3), 123 (39.8%), 113 (27.4%), 103 (24.9%) and 91 (22.0%) children, respectively (Fig 3).

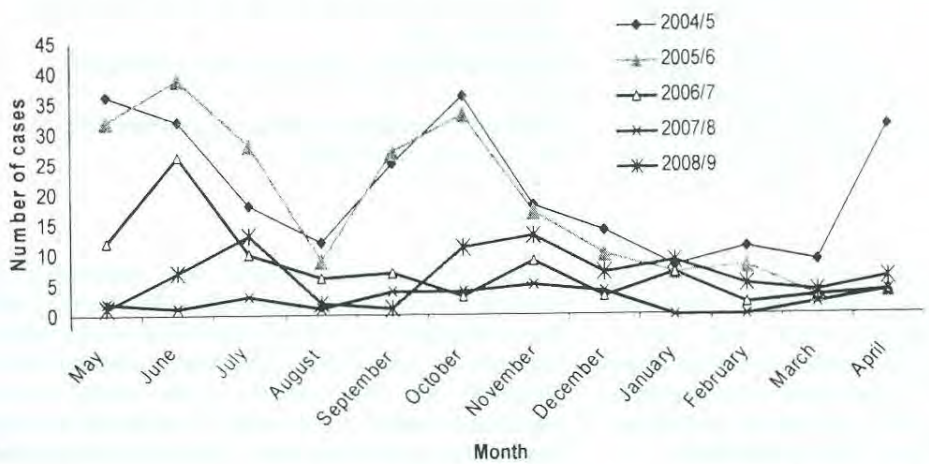

Figure 2. The pattern of malaria admission to the pediatric ward by month over the studied five years, JUSH 2009

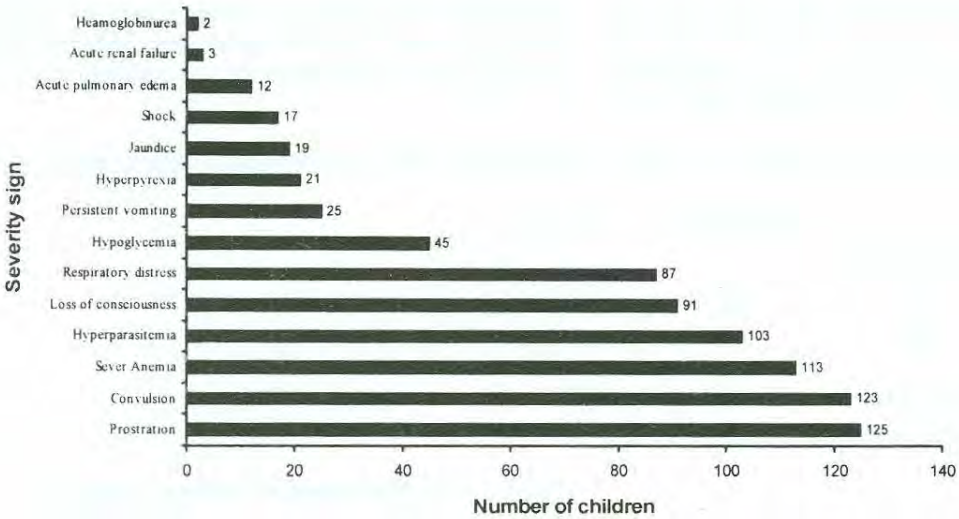

Figure 3. Signs of severity of severe and complicated malaria in children (n=413) admitted to JUSH, 2009.

Of the 413 patients whose card was found, blood film result was not documented for the 15 (3.6%) cases. Plasmodium species were identified in 335 (66.5%) cases but for the remaining, either the result was negative or not documented. *P. falciparum* occurred in 281 (83.9%), mixed infection (*falciparum* and *vivax*) in 30 (8.9%) and *P. vivax* in 24 (7.2%) of the blood film positive cases (Table 2).

Table 2. Characters and blood film results of patients admitted with sever and complicated malaria to JUSH 2009

Socio-demographic variables		Frequently	Percent
Age (n=660)	<1month	13	2.0
	1-11 months	123	18.6
	12-59 months	294	44.5
	≥ 60 months	230	34.9
Sex (n=660)	Male	395	59.9
	Female	265	40.1
Blood film (n=413)	Positive	335	81.1
	Negative	63	15.3
	Not documented	15	3.6
Identified parasite (n=335)	P. falciparum	281	83.9
	P. Vivax	24	7.2
	Mixed	30	8.9

Of the 660 admitted children, only 161 (24.4%) arrived with in 24 hours, 299(45.3%) with in 24-72 hours and the rest 199 (30.2%) after 72 hours of the onset of illness (Fig 4).

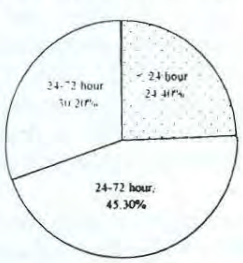

Figure 4. Duration of illness before arrival of patients admitted with severe and complicated malaria, JUSH, 2009.

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The shortest span of hospital stay was a day whiles the longest 31 days. Five hundred thirteen (77.8%) of patients were discharged within seven days of admission. Fifteen (2.3%) of the 660 children admitted with severe malaria have died (Table 4). Mortality was not different by age, sex and, most of the severity signs (P >005) except for loss of consciousness and respiratory distress ($p < 0.05$).

Table 3. Duration of Hospital stay and outcome of patients admitted with sever and complicated malaria, JUSH, 2009

Variables		Frequency	Percent
Duration of Hospital stay (n=660)			
	<3 days	246	37.3
	3-7 days	267	40.5
	>7 days	147	22.2
Outcome (n=660)			
	Improved	645	97.7
	Died	15	2.3

DISCUSSION

This study revealed that malaria accounted for less than a tenth of pediatric admission during the studied five years. It is lower than what was reported (15.7%) from Oromia Region (1995-2000) hospital and health centers pediatric admissions (18) and five times lesser than a report from Zaire/ DRC (19). The low proportion of malaria admission in the current study could be attributed to the difference in the timing of the study where several intervention activities were performed in the past few years. The other reason could be the fact that JUSH is a tertiary hospital; most cases may get managed in near by health centers.

Majority of the admitted cases with the diagnosis of severe malaria were males similar with a study in Gondar where males accounted for 55.1% of malaria admissions (12). Several possible reasons could be considered to explain the larger proportion of male malaria admission including evening/overnight outdoor stay and cultural preference of seeking health care for the male. Twenty percent of admissions were under 1 year of age similar with the finding from Metema district hospital (8). But, in Malawian study, infants accounted for nearly 30% of the admitted children (20).

The magnitude of malaria admission showed a decline from 2004/5 to 2007/8 but begun to rise in 2008/9. This trend could most likely be explained by the multifaceted effort made in malaria control and prevention by MOH and Regions. In 2007, as part of the Ethiopian Millennium commemoration, the FMOH distributed 20 million LLINs and conducted mass drug administration with the ACT drug artemether-lumefantrine (21). But the fact that the number of cases in 2008/9 was more than twice the cases in 2007/8 appeared contrary to the effort several factors could be attributed for the observed resurge including waning of insecticidal effect of the bed nets, decreasing advocacy on proper utilization of ITNs or emergence of drug resistance. The mass drug administration delivered through the health extension workers, simply just for patients with fever and /or entire communities without any malaria diagnosis (21) may be a risk for development of drug resistance.

In most parts of Ethiopia, malaria transmission occurs during September-December following the main rainy season. However, certain areas, largely in the western, southern and eastern part of the country experience a second minor transmission period from April to May, following a short rainy season from February to March (21). As it rains during both seasons in Jimma area, bimodal transmission was observed which was evidenced by a cluster of cases admitted during September-November and May-July the studied years. A study done at Akaki showed only one surge (September-November) following the main rainy season as the second rainy season (spring fall) is not usual in this area (15).

Prostration, convulsion, severe anemia, hyperparesitemia and loss of consciousness, in order of decreasing frequency, were the most frequently seen severity signs in the current study similar with other local reports from Metema, Gambella and Gondar (8,22,12). Other African and Asian studies revealed similar findings with slight difference in order of frequency. In Ghana severe anemia, prostration, respiratory distress, convulsions and impaired consciousness were major severity symptoms (23) and in Zambian children, severe anemia was more common than cerebral malaria (24). The Indian study reported that repeated seizures, unarousable coma, hepatopathy and severe anemia as the commonest complications (25). The observed minor differences in order of frequency of severity signs could arise from the differences in distance from facilities, clinical case definitions used and malaria endemicity of the area.

The rate of positive blood film was higher than the study at Gondar (55%) (12). As expected, majority had P. falciparum infection. The 24 children who were treated as severe malaria while blood film was positives only for

P. vivax might had recurrent vomiting affecting oral therapy or extreme weakness. Even though, Jimma and Gondar are tertiary hospitals, significant proportion of patients were treated without confirmation of malaria. This could be explained by the use of thin blood film in looking for plasmodia.

The malaria case fatality rate in this study was very low as compared with local (12,22) and other developing country reports (19,20,23). Early presentation to the hospital could contribute to the observed low case fatality, more than half of the cases were brought to hospital within 72 hours of the illness. The fact that JUSH used less stringent could have contributed for the better outcome. The short hospital stay (< 7 days) for majority of the cases could also indicate the early stage of the disease at admission that leads to better outcome. Quality of care given might have made a difference.
Of the severity indicators at presentation, respiratory distress and loss of consciousness were significantly associated with mortality ($p < 0.05$) in agreement with the finding in a study from Gambella Hospital (22).

In conclusion, this study revealed a declining trend of severe malaria cases over the studied five years with the nadir in 2007/8 and resurgence 2008/9, two transmission seasons and a very low case fatality rate. Most of the cases were males and under five year old children. Significant proportion of children were managed without blood film confirmation. The severity signs were similar with other studies with minor differences in order of frequency. Even if this study was hospital based, retrospective with incomplete card retrieval, the findings could alert laboratory professionals to consider using thick and thin film to detect hemoparasite, the hospital managers to improve patient record keeping and policy makers to investigate and manage the possible cause of resurge of malaria admission.

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