ORIGINAL ARTICLE

STUDY OF PLATELET COUNT IN MALARIA PATIENTS AND THE CORRELATION BETWEEN THE PRESENCE AND SEVERITY OF PLATELET COUNT WITH TYPE OF MALARIA

Sudheer Babu Devineni¹, Obulapuram Suneetha², Nannam Harshavardhan³

HOW TO CITE THIS ARTICLE:

Sudheer Babu Devineni, Obulapuram Suneetha, Nannam Harshavardhan. "Study of Platelet Count in Malaria Patients and the Correlation between the Presence and Severity of Platelet Count with Type of Malaria". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 67, August 20; Page: 11734-11746, DOI: 10.14260/jemds/2015/1691

ABSTRACT: BACKGROUND: Malaria remains one of the major health problems in the tropics with increased morbidity & mortality. Thrombocytopenia is a common finding in malaria, but its correlation with the type of malaria and prognostic implications in context with severity of low platelet count has not been evaluated in large studies. In view of paucity of data from Indian studies, we attempt to correlate the low platelet count with type of malaria and outcome. **AIM:** Study of platelet count in malaria patients and correlation between the presence and severity of platelet count with type of malaria. **MATERIAL & METHODS:** A total of 180 patients diagnosed to have Malaria over a period of two years admitted in Guntur Teaching and General Hospital attached to Guntur Medical College, Guntur were studied. All study subjects were identified positive for Malaria parasite on peripheral smear examination with conventional microscopy. Platelet count was done on a fully automated, quantitative analyzer. Daily platelet count was done for all those admitted with malaria. P.falciparum antigen test (PfHrp antigen test- Parascreen) was performed in subjects with P.vivax Malaria on the peripheral smear with a platelet count less than 20,000cells/cmm for more emphatic exclusion of associated P.falciparum infestation. P.falciparum antigen test was also performed in subjects with high index of clinical suspicion or multi organ involvement. **RESULTS:** a total of 180 patients were found to have malaria, 114(63.3%) were P.vivax, 62(34.4%) were P.falciparum and 4(2.7%) were mixed. 146(81.1%) patients had thrombocytopenia. 34(23.3%) developed complicated malaria. Severe thrombocytopenia was noted in 58.8% of complicated malaria with $p < 0.001$. 20 patients persisted to have thrombocytopenia on 6th day even after adequate therapy. 14(70%) patients out of 20 recovered and 6(30%) died in which 2 was P.falciparum and 4 were mixed infection. **CONCLUSION:** Thrombocytopenia is a common association of malaria with incidence of 81.1%. Severe thrombocytopenia is commonly seen in P.falciparum. Platelet count $< 20,000$ was seen in P. falciparum and P.vivax. But more commonly in P. falciparum. Out of 36 severe thrombocytopenia 34 developed complicated malaria with significant p value indicating that patients with severe thrombocytopenia at the time of admission are 8.5 times more prone to develop complications when compared to mild and moderate thrombocytopenia. Patients who persisted to have thrombocytopenia even after 6th day of therapy, their mortality increased by 30%.

KEYWORDS: Malaria; Thrombocytopenia; Complications.

INTRODUCTION: Malaria is probably one of the oldest diseases known to mankind that has had profound impact on our history. For centuries it prevented any economic development in vast regions of the earth. It continues to be a huge social, economical and health problem, particularly in the tropical countries. History of malaria and its terrible effects is as ancient as the history of civilization, therefore history of mankind itself. The term malaria (From the Italian mala "bad" and

ORIGINAL ARTICLE

aria "air") was used by the Italians to describe the cause of intermittent fevers associated with exposure to marsh air or miasma. The word was introduced to English by Horace Walpole, who wrote in 1740 about a "horrid thing called malaria that comes to Rome every summer and kills one." The term malaria, without the apostrophe, evolved into the name of the disease only in the 20th century. Up to that point the various intermittent fevers had been called jungle fever, marsh fever, paludal fever, or swamp fever. Malaria affects more than 2400 million people, over 40% of the world's population, in more than 100 countries in the tropics from South America to the Indian peninsula. The tropics provide ideal breeding and living conditions for the anopheles mosquito, and hence this distribution.⁽¹⁾ Every year 300 million to 500 million people suffer from this disease. WHO forecasts a 16% growth in malaria cases annually.⁽²⁾ About 1.5 million to 3 million people die of malaria every year (85% of these occur in Africa), accounting for about 4-5% of all fatalities in the world. One child dies of malaria somewhere in Africa every 20 sec., and there is one malarial death every 12 sec somewhere in the world. It accounts for 2.6 percent of the total disease burden of the world.

AIMS AND OBJECTIVES:

1. To study the incidence of thrombocytopenia in Malaria.
2. To study the incidence of thrombocytopenia in relation to type of malaria.
3. To study and correlate the severity of thrombocytopenia in vivax and falciparum malaria.
4. To determine whether the initial platelet count is an independent prognostic marker for severity of malaria.

Study Design: Prospective study.

Study Period: From Jan. 2014 to May 2015.

Study Population: A total of 180 patients diagnosed to have Malaria admitted in Government general hospital attached to Guntur Medical College, Guntur included in the study.

MATERIAL AND METHODS: A total of 180 patients diagnosed to have Malaria admitted in Government general hospital attached to Guntur Medical College, Guntur included in the study. All study subjects were identified positive for Malaria parasite on peripheral smear examination with conventional microscopy. Platelet count was done on a fully automated, quantitative analyzer. Platelet count was the number of thrombocytes derived from directly measured platelet pulses, multiplied by a calibration constant and expressed in thousands of thrombocytes per microliter of whole blood. Repeat platelet count was done in subjects with marked thrombocytopenia until normal or near normal values was reached. Patients with thrombocytopenia were divided into 3 categories³ mild-0.5-1.5 lakhs cells/cu mm, moderate-0.2-0.5 lakhs cells/cumm and severe <0.2 lakhs cells/cu mm. P.falciparum antigen test (PfHrp antigen test-Parascreen) was performed in all subjects with malaria parasite positive on peripheral smear. P.vivax Malaria on the peripheral smear with a platelet count less than 20,000cells/cmm for more emphatic exclusion of associated P.falciparum infestation. P.falciparum antigen test was also performed in subjects with high index of clinical suspicion or multi organ involvement. Other investigation includes CBC, LFT, RFT, Chest X- Ray, Ultrasound Abdomen, if necessary Blood Culture, Urine Culture, Dengue serology.

P.falciparum was treated with either chloroquine or artesunate depending upon the clinical severity. P.vivax malaria was treated with chloroquine followed by two week course of primaquine.

Data was expressed on a excel spreadsheet and statistical analysis was performed. P values less than 0.005 were considered significant.

Inclusion Criteria:

- All patients above 14 years of age and either sex whose blood smear was positive for malaria are included in the study.
- Platelet count done before starting treatment.

Exclusion Criteria:

- Clinical diagnosis of malaria without positive blood smears.
- Platelet count done after starting treatment.
- Patients who received partial treatment outside the B.T.G.H and referred later to this hospital.
- Patients with known HIV positive.
- Patients with known case of chronic renal and liver disease.
- Congenital & Hereditary Thrombocytopenia Immune induced thrombocytopenia Drug induced thrombocytopenia.

Statistical Analysis: Chi square test or Fisher Exact test and student 'T' test has been used to find the significant association of study characteristics (Thrombocytopenia) with type of malaria.

RESULTS: A total of 180 subjects who diagnosed to have Malaria over a period of one and half years were studied. The mean age of patients was 40.13 ± 14.10 years. The study included 75.6% males and 24.4% females. Typical paroxysms were observed in 40 patients of P.Vivax and 10 patients of P.Falciparum. Under atypical manifestations like vomiting was seen in 26 patients of P.Falciparum and 10 patients in P.Vivax 4 in mixed infection, headache in 30 patients of P.Falciparum and 16 in P.Vivax, jaundice in 20 patients of P. falciparum, 4 P.vivax and 4 mixed infection. altered sensorium in 16 patients of P.Falciparum and none in P.Vivax, pain abdomen in 12 patients of P.Falciparum and none in P.Vivax, cough and breathlessness in 16 patients of P.Falciparum and none in P.Vivax, joint pain in 6 patients in P.Falciparum 4 in P.Vivax. Commonest atypical symptom being headache and vomiting. Common clinical sign in decreasing order are splenomegaly (86%), pallor (46.6%), Icterus (13.3%), hepatomegaly (10%), altered sensorium (8%), petechiae (6%). A total of 180 subjects who had malaria, 114 were P.vivax and 62 were P.falciparum. Incidence of P.vivax 63.3% and P.falciparum 34.4%. Incidence of Thrombocytopenia was 146(81.1%), with mild Thrombocytopenia 54(30%), moderate Thrombocytopenia 56(31.1%) and 36(20%) with severe Thrombocytopenia. Normal platelet count was observed in 34(18.9%) of patients.

Mean platelet count overall was 0.95 ± 0.80 lakhs. Mean platelet count in mild thrombocytopenia was 1.23 ± 0.11 lakhs. Mean platelet count in moderate thrombocytopenia was 0.37 ± 0.07 and Mean platelet count in severe thrombocytopenia was 0.16 ± 0.04 lakhs, indicating that thrombocytopenia is a common association in malaria. 146 out of 180 who had thrombocytopenia were taken up, to study its prognostic implication. Mild Thrombocytopenia was observed in 36(42.8%) cases of P.Vivax and in 18(31%) cases of P.Falciparum. Moderate Thrombocytopenia was noted in 32(38%) cases of P.Vivax and in 24(41.4%) cases of P.Falciparum. Severe Thrombocytopenia was noted in 16(19.1%) cases of P.Vivax and in 16(27.5%) cases of P.Falciparum and all 4 cases (100%) of mixed malaria. Mean platelet count in Falciparum species overall was 0.62 ± 0.56 lakhs with range from 0.07-2 lakhs when compared to 1.16 ± 0.85 lakhs with range from 0.1-3 lakhs in Vivax species.

ORIGINAL ARTICLE

Mean platelet count in mild thrombocytopenia in Falciparum was 1.12 ± 0.14 lakhs when compared to 1.24 ± 0.11 lakhs in vivax. Mean platelet count in moderate thrombocytopenia in Falciparum was 0.36 ± 0.07 lakhs when compared to 0.39 ± 0.06 lakhs in vivax. Mean platelet count in severe thrombocytopenia in Falciparum was 0.14 ± 0.05 lakhs when compared to 0.17 ± 0.04 lakhs in vivax.

According to the revised WHO guidelines of 2000 patients who had Thrombocytopenia were grouped into complicated and uncomplicated. In our study 34 cases had complicated malaria and 112 cases had uncomplicated malaria. In complicated malaria 24 patients had Hemoglobin $<5\text{gm\%}$ in which 20(83.3%) were P.Falciparum and 4(16.7%) were P.Vivax, 18 patients had s.creatinine $>3\text{mg\%}$ in which 8(44.4%) were P.Falciparum and 6(33.3%) were P.Vivax, 24 patients had T.Bilirubin $>3\text{mg\%}$ in which 20(83.3%) were P.Falciparum and 4(16.7%) were mixed, 22 patients had metabolic acidosis ($\text{ph} < 7.2$), 16(72.7%) were P.Falciparum and 2(9.1%) were P.Vivax, and 4 mixed(18.2%). 12 patients had spontaneous bleeding with DIC in which 10(83.3%) were P.Falciparum and 2(16.7%) in mixed, 6 patients had coma for $>30\text{min}$, in which 2(33.3%) were P.Falciparum and 4(66.7%) were mixed, 8 patients had hyperparasitemia in which 4(50%) in P.Falciparum and 4(50%) in mixed, 2 patients had hypoglycemia which was mixed infection, 24 patients had prostration in which 16(66.7%) were P.Falciparum, 4(16.7%) P.Vivax and 4(16.7%) mixed, 8 patients had ARDS in which 4(50%) were P.Falciparum and 4(50%) were mixed, 12 patients developed shock in which 4(33.3%) were P.Falciparum, 4(33.3%) were P.Vivax and 4(33.3%) were mixed. Complications were commonly seen in P.falciparum and mixed compared to P.vivax of which anemia and hyperbilirubinemia being the most common. Relationship of degree of thrombocytopenia to severity of malaria.

Out of 112 uncomplicated malaria, mild thrombocytopenia was noted in 48(42.9%), moderate thrombocytopenia in 48(42.9%), and severe thrombocytopenia in 16(14.3%). Out of 34 cases of complicated malaria mild thrombocytopenia was noted in 6(17.6%), moderate thrombocytopenia in 8(23.5%) and severe thrombocytopenia in 20(58.8%). P value < 0.005 , was noted in severe thrombocytopenia. Daily platelet count was done for all patients from the day of admission to day of discharge, and underwent specific treatment. On an average 6th day was considered as last day. On day one 146 patients had low platelet count, on day two 122 patients had low platelet count, on day three 116 patients had low platelet count, on day four 90 patients had low platelet counts, on day five 56 patients had low platelet counts, on day six 20 patients persisted to have low platelet count despite of adequate therapy.

Out of 146 cases 6 died with the overall mortality of 4.1%. 20 patients who persisted to have thrombocytopenia at 6th day 14 recovered and 6 died in which 2 was P.falciparum and 4 were mixed infection with an increase in mortality rate of 30%.

DISCUSSION: A total of 180 malaria cases were studied. The mean age of the patients was 40.13 ± 14.10 . This study is comparable with other studies like Gayatri K et al in their study, they found that mean age was 42.13 ± 16.12 .⁴ Another study conducted by by Jadhav UM et al, in their study, they found that mean age was 44.17 ± 13.13 .⁵ Older age groups are more susceptible to infection due to lack of immunity.

This study includes 136 male and 44 female patients. In the present study males are more commonly involved due to the fact that most of the patients had recent history of travel to endemic areas. This findings are comparable to other studies conducted by Gayatri K et al, Trampuz A et al,⁶

ORIGINAL ARTICLE

and Patel U et al,⁷ who found that males were more commonly involved than females since most of the male patients had a recent history of travel to endemic areas. The commonest clinical manifestation was fever with chills and rigors (100%), headache (25.5%), vomiting (22.2%) jaundice (15.5%).⁸ Commonest sign being splenomegaly (86.7%) followed by pallor (46.7%) and icterus (13.3%). These findings are comparable with other studies like Oh MD et al, Song HH et al, Giha HA et al, Grobusch MP et al, Trampuz A et al who found that fever with chills was the most common symptom found followed by headache, vomiting and jaundice. They also found that splenomegaly was the most common sign followed by pallor and icterus. A clinical spectrum of fever, splenomegaly and pallor is most often associated with malaria.

In the present study 146 subjects out of 180 malaria cases had thrombocytopenia. Incidence of thrombocytopenia being 81.1%. Thrombocytopenia is a common feature of acute malaria and occurs in both *P.falciparum* and *P.vivax* infection regardless of severity of infection. Thrombocytopenia in a patient with febrile illness increases the possibility of malarial infection.⁹ Figures of the present study are comparable to studies done by other investigators eg, Jain M et al.¹⁰ In their study, they found that thrombocytopenia was present in 70% of the patients. Another study conducted by Jadhav UM et al, in their study, they found that thrombocytopenia was found in 79.4% of the patients. Another study conducted by Sharma K. et al, in their study, they found that thrombocytopenia was present in as high as 90% of the patients. Sheraz jamal khan et al,¹¹ in their study, they found that significant thrombocytopenia was seen in more than half of the patients. Another study conducted by Lathia et al.¹² In that study they found that thrombocytopenia alone was a predictor for malaria and thrombocytopenia in a patient with acute febrile illness increases the probability of malarial infection.

Out of 180 cases 114 had *P.vivax* malaria, 62 patients had *P.falciparum*, and 4 had mixed infection. Incidence of *P.vivax* malaria is 63.3% and *P.falciparum* 34.4%.^{13,14} Prevalence of *P.vivax* malaria is common in India, because of variation in climatic condition, breeding places of mosquito and genetic resistance of *P.falciparum*. These figures are comparable to studies done by other investigators as Sheraz jamal khan et al, in their study, they observed that thrombocytopenia was seen in malaria patients but more common in vivax type contrary to the belief that thrombocytopenia is very common in falciparum.¹⁵ Another study conducted by Jain M et al, in that study they found that thrombocytopenia [70%] was common in malaria patients in which 67.3% were falciparum which was more common than the vivax type. Another study conducted by Jadhav UM et al, in their study, they found that thrombocytopenia was common in malaria patients in which falciparum was more common than vivax type. Another study conducted by Horstmann et al,¹⁶ in their study, they found thrombocytopenia in 85% of falciparum and 72% of vivax malaria.

In this study, mild and moderate thrombocytopenia was statistically insignificant when compared to severe thrombocytopenia. We noticed that severe thrombocytopenia was commonly associated with *P.falciparum* (27.5%) as compared to *P.vivax* (19%). These figures are comparable to the studies done by other investigators as Abdul Rauf Memom et al, in their study, they found that mild to severe thrombocytopenia was observed in hospitalized malarial patients, in which falciparum was found to be the most common. Another study conducted by Jadhav UM et al, in their study, they found that absence of thrombocytopenia is uncommon in malaria, its presence is not a distinguishing feature between the two types. Severe thrombocytopenia can occur in both but more commonly in falciparum malaria. Another study conducted by Kaur D et al,¹⁷ in their study, they found that severe thrombocytopenia was seen in vivax malaria.

ORIGINAL ARTICLE

The mechanism of thrombocytopenia is uncertain. Immune mediated lysis, sequestration in the spleen and a dyspoietic process in the marrow with diminished platelet production have all been postulated. Abnormalities in platelets structure and function have been described as consequences of malaria, and in rare instances platelets can be invaded by malarial parasite themselves.¹⁸

Thrombopoietin (TPO) is the key factor for platelet production and is elevated in state of platelet depletion. TPO serum levels have been shown to be significantly higher in subjects with severe malaria, normalizing within 14 - 21 days of therapy. Two types of changes in platelet dysfunction are seen in malaria. Initially there is platelet hyperactivity; this is followed by platelet hypoactivity. Platelet hypoactivity results from various aggregating agents like immune complex, surface contact of platelet membrane to malarial red cells damage to the endothelial cells. The injured platelets undergo lysis intravascularly. The release of platelet contents can activate the coagulation cascade and contribute to DIC. Transient hypoactivity is seen following this phase and returns to normal in 1-2 weeks. In many studies undertaken, the significance of haemostatic abnormalities as a consequences of malaria has been difficult to assess as a result of the presence of various associated complications such as liver dysfunction, uremia.^{19,20}

In this study, we found that DIC was the commonest cause for severe thrombocytopenia in 16 cases of *P.falciparum*. 14 recovered with adequate medical therapy within 7 to 10 days, 2 patients died of severe metabolic acidosis and multi organ dysfunction. 16 cases of *P.vivax* malaria had severe thrombocytopenia. All the 16 cases recovered within a week. These findings are comparable to the study done by other investigators as Krishnan et al,²¹ in their study, they found that about 19 patients had thrombocytopenia and DIC, noticed that malaria is an important cause of multi organ failure in India and mortality rate was less when one or few organs were involved as compared to two or more organs involved. Another study conducted by Koulmann P et al,²² in their study, they found that failure of one or more organ systems and development of several metabolic disorders secondary to the presence of falciparum malaria.

146 patients who had thrombocytopenia were categorized into complicated and uncomplicated malaria based on WHO guidelines. Among 146 cases 34(23.3%) had complicated malaria and 112(76.7%) had uncomplicated malaria. Among 34 cases of complicated malaria, 22 were *P.falciparum*, 8 were *P.vivax* and 4 had mixed infection. Complicated malaria is common in *P.falciparum* infection^{23,24} These findings are comparable to the study conducted by other investigators such as Dharmesh Kumar N Patel et al,²⁵ in their study, they found that complicated malaria was more commonly caused by falciparum malaria and was rarely caused by other malarial parasites.

The mechanism for complicated malaria is complex. In *P. falciparum* infection, membrane protuberance appears on the erythrocyte surface towards the end of the first 24hrs of asexual cycle. These "knobs" extend high molecular weight antigenically variant, strain specific, adhesive protein (PfEMP1) that mediate attachment to receptors on venules and capillary endothelium an event termed cytoadherence. Several vascular receptors are identified, of which intracellular adhesion molecule1 is probably the most important in the brain and CD36 in most other organs. Thus, the infected erythrocytes stick inside the small blood vessels. At the same stage, these *P.falciparum* infected RBCs may also adhere to uninfected RBCs to form rosettes. The process of cytoadherence, rosetting and agglutination are central to the pathogenesis of *P.falciparum* malaria.²⁶

Among 34 cases of complicated malaria, 24 patients had severe anemia (Hb<5gm%) with hepatic dysfunction and 22(64.7%) had metabolic acidosis. 16 patients had altered sensorium. CSF

ORIGINAL ARTICLE

analysis was done which was normal. 6 Patients developed coma and were put on mechanical ventilators, who died within 2 weeks of hospitalization, which shows high mortality rate in cerebral malaria.²⁷ These findings are comparable to other studies done by authors such as Trampuz A et al, in their study, they found that complications involve the nervous, respiratory, renal, and/ hematopoietic system. Metabolic acidosis and hypoglycemia were common systemic complications. These complications are commonly caused by falciparum malaria.

Out of 10 complicated P.vivax malaria 4 had severe anemia(Hb<5gm%), 6 developed ARF secondary to severe vomiting and dehydration, Renal impairments is common among adults with severe P.falciparum malaria. Studies also suggested that P.vivax can also cause renal dysfunction.^{28,29} This study is comparable to other studies done by authors such as Prakash et al, in their study, they found that acute renal failure can occur in both vivax and falciparum malaria but more commonly in falciparum. Another study done by Kaur et al found that unusual presentation of vivax malaria with severe thrombocytopenia and acute renal failure. The pathogenesis of renal failure is unclear but may be related to erythrocyte sequestration interfering with renal microcirculatory flow and metabolism. Clinically and pathologically this syndrome manifests as acute tubular necrosis, although cortical necrosis never develops. In survivors, urine flow resumes in a median of four days, and serum creatinine levels return to normal in a mean of 14 days.

In this study all the 6 patients who developed ARF, their serum creatinine returned to normal by 2nd week. 2 patients required dialysis and other 4 were treated conservatively. There were no deaths in complicated vivax malaria. This study is comparable to other study such as Prakash et al, in which he found that vivax malaria can cause acute renal failure but the prognosis of it in vivax malaria is favourable.

When thrombocytopenia is co-related with severity of malaria, severe thrombocytopenia was commonly associated with complicated malaria (58.8%) as compared to uncomplicated malaria (14.3%). Maximum thrombocytopenia occurred on third and fourth day of infection and gradually returned to normal by fifth to sixth day. Those persisted to have severe thrombocytopenia beyond 6th day, their mortality and morbidity increased despite adequate therapy. This study is comparable to other studies done by investigators such as Beale PJ et al,³⁰ in their study, they found that lowest platelet count was found between the day of diagnosis and the fourth day of treatment, thereafter they returned to normal values. Another study conducted by Horstmann RD et al, who found that thrombocytopenia was a common feature in human malaria and in all the patients the platelet count rose to threefold the initial values with the clearance of parasite. Another study conducted by A Kumar et al,³¹ found that platelet count which was decreased, reverted to normal values on treatment.

Patients who had severe thrombocytopenia at the time of admission are 8.5 times more prone to develop complications when compared to mild and moderate thrombocytopenia based on student 'T' test. In this study 20 patients had severe thrombocytopenia beyond 6th day, 14 recovered within 7 to 10 days, 6 died with an increase in mortality rate from 4.1% to 30%³², of which 2 was P.falciparum and 4 were mixed infection.

CONCLUSIONS:

- Thrombocytopenia is a common association of Malaria
- Thrombocytopenia is seen in both P.vivax and P.falciparum.

ORIGINAL ARTICLE

- Severe thrombocytopenia (Platelet count<20,000) is seen in *P.falciparum* & *P.Vivax* malaria but more common in *P.falciparum*.
- Severe thrombocytopenia is a good predictor of poor prognosis than mild and moderate thrombocytopenia.
- Patients who present with severe thrombocytopenia are 8.5 times more prone to develop complications than mild and moderate thrombocytopenia. This indicates that initial platelet count is an independent prognostic marker for severity of malaria.
- In patients with low platelet count, platelet count returned to normal values in more than 80% of patients after starting treatment within 6 days.

If severe thrombocytopenia persists for more than six days despite of adequate therapy, mortality rate increases from 4.1% to 30%.

Early diagnosis and prompt treatment of complications reduces the global burden of malaria. Severity of thrombocytopenia is a better predictor of outcome but it does not help in early diagnosis of complicated malaria. Hence further studies should be conducted on thrombocytopenia in malaria, rate of fall in platelet count which may help in early diagnosis of complications in malaria.

REFERENCES:

1. WHO Expert Committee on malaria; Twentieth report 1998. Geneva, Switzerland 2000.
2. National Anti-Malaria Program. New Delhi: Directorate of NAMP, Ministry of Health and Family welfare 2002.
3. Abdul Rauf Memon, Salahuddin Afsar. Thrombocytopenia in hospitalized malaria patients- Pakistan Journal of Medical Sciences - April-June 2006; Vol-22: Number-2; pages 141-143.
4. Gayathri k et.al. J Indian Med Assoc. "Clinical profile of falciparum malaria in a tertiary care hospital". 2000 Apr; 98(4): 160-169.
5. Jadhav.U.M. Patkar V.S.Kadam N.N. "Thrombocytopenia in Malaria - Correlation with type & severity of malaria"; JAPI 2004; 52: 615 - 618.
6. Trampuz A, Jereb M, Muzlovic I, Prabhu RM. "Clinical review: Severe malaria". Crit Care. 2003 Aug; 7(4): 315-23.
7. Patel. U, Gandhi. G, Friedman. S, Niranjana. S. "Thrombocytopenia in Malaria" Journal of national Medical Association 2004; 96(9): 1212- 4.
8. Giha HA, Elghazali "Clinical pattern of severe Plasmodium falciparum malaria in Sudan in an area characterized by seasonal and unstable malaria transmission". Trans R Soc Trop Med Hyg. 2005 Apr; 99(4): 243-51.
9. Harris VK, Richard VS, Mathai E, et al. A study on clinical profile of falciparum malaria in a tertiary care hospital in south India. Indian J Malariol. 2001 Mar-Jun; 38 (1-2): 19-24.
10. Jain M, Kaur M. "Comparative study of microscopic detection methods and haematological changes in malaria". Indian J Pathol Microbiol. 2005 Oct; 48(4): 464- 7.
11. Sheraz Jamal Khan, Fazal Raheem Khan et al. Malaria can lead to thrombocytopenia-Rawal Medical Journal- July-Dec-2008; vol-33: number-2; pages 183-186.
12. Lathia TB, Joshi R. "Can hematological parameters discriminate malaria from nonmalarious acute febrile illness in the tropics" Indian J Med Sci. 2004 Jun; 58(6): 239-44.
13. Kochar D, Kumawat BL, Karan S. "Severe and complicated malaria in bikaner, western India". Southeast Asian journal tropical medicine. 1997 Jun; 28(2): 259-67.

ORIGINAL ARTICLE

14. Siddarth. N. shah "API Text book of Medicine" 14th edition 104-108.
15. Srichaikul T, Pulket C. Platelet dysfunction in malaria. Southeast Asian J Trop Med Pub Health 1988; 19: 225-33.
16. Horstmann RD, Dietrich M, Bienzle U, Rasche H. Malaria-induced thrombocytopenia. Blut. 1981 Mar; 42(3): 157-164.
17. Kaur D, Wasir V, Gulati S. "Unusual Presentation of Plasmodium vivax Malaria with Severe Thrombocytopenia and Acute Renal Failure". J Trop Pediatr. 2007 Jun; 53(3): 210-2.
18. Mohanty S, Marwaha K, Ghosh S, et al. Functional and ultrastructural changes of platelets in malaria infection. J Clin Invest 1988; 71: 832-6.
19. Yamaguchi S, Kubota T, Yamagishi T, Okamoto K, Izumi T, Takada M, Kanou S, Suzuki M, Tsuchiya J, Naruse T "Severe thrombocytopenia suggesting immunological mechanisms in two cases of vivax malaria". Am J Hematol. 1997 Nov; 56(3): 183-6.
20. Ohtaka M, Ohyashiki K, Iwabuchi H, Iwabuchi A, Lin KY, Toyama K. "A case of vivax malaria with thrombocytopenia suggesting immunological mechanisms". Rinsho Ketsueki.; 34(4): 490-2.
21. Krishnan A, Karnad DR. "Severe falciparum malaria: an important cause of multiple organ failure in Indian intensive care unit patients". Crit Care Med. 2003 Sep; 31(9): 2278-84.
22. Rouvin B, Koulmann P. "Severe malaria in intensive care units" Med Trop (Mars).2003; 63(3): 258-66.
23. Mishra SK, Panigrahi P, Mishra R, Mohanty S. "Prediction of outcome in adults with severe falciparum malaria: a new scoring system". Malaria Journal.2007 Feb 27; 6: 24.
24. Krishnan A, Karnad DR. Severe falciparum malaria: An important cause of multiple organ failure in Indian intensive care unit patients. Crit Care Med 2003; 31: 2278-84.
25. Dharmesh Kumar N Patel, Pradeep P, Surti MM, Agarwal SB. Clinical Manifestations of Complicated Malaria an Overview-Journal, Indian academy of clinical medicine oct-dec-2003; vol-4: Number-4, pages 323-331.
26. Fauci et. al "Harrison's Text book of Internal Medicine" 17th edition. 1280-1293.
27. Dixon R, Rosse W, Ebbert L. Quantitative determination of antibody in idiopathic thrombocytopenic purpura. Correlation of serum and platelet-bound antibody with clinical response. N Engl J Med. 1975 Jan 30; 292(5): 230-236.
28. Prakash J et.al. "Acute renal failure in Plasmodium vivax malaria' J Assoc Physicians India. 2003 Mar; 51: 265-7.
29. Mehta KS, Halankar AR, Makwana PD, Torane PP, Satija PS, Shah VB" Severe acute renal failure in malaria". J Postgrad Med. 2001 Jan-Mar; 47(1): 24-6.
30. Beale PJ, Cormack JD, Oldrey TB. "Thrombocytopenia in malaria with IgM changes". BMJ 1972; 1: 345-9.
31. Kumar A, Shashirekha. "Thrombocytopenia-an indicator of acute vivax malaria" Indian J Pathol Microbiol 2006 Oct; 49 (4): 505-8.
32. Kreil A, Wenisch C, Looareesuwan S. "Thrombopoietin in Plasmodium falciparum malaria. Br J Haematology 2000; 109: 534-6.

ORIGINAL ARTICLE

Age in years	Number of Patients	Percentage
21-30	54	30.0
31-40	48	26.7
41-50	44	24.4
51-60	22	12.2
61-70	12	6.6
Total	180	100.0
Mean $\pm$ SD	40.13 $\pm$ 14.10	

Table 1: Age Distribution

Sex	Number of Cases	Percentage
Male	136	75.6
Female	44	24.4
Total	180	100.0

Table 2: Sex distribution

Symptoms	P.Falciparum	P.Vivax	Mixed Infection
	(n=62)	(n=114)	(n =4)
Typical Paroxysm	10(16.1%)	40(35.1%)	-
Vomiting	26(32.3%)	10(8.8%)	4
Headache	30(48.4%)	16(14.1%)	-
Jaundice	20(32.3%)	4(3.5%)	4
Altered sensorium	12(25.8%)	0	4
Pain abdomen	12(19.4%)	2(1.8%)	-
Cough & Breathlessness	8(12.9%)	0	-
Joint pain	6(9.7%)	4(3.5%)	-

Table 3: Distribution of Symptoms

Signs	Number of Cases	Percentage
	(n=180)	
Splenomegaly	156	86.7
Pallor	88	48.8
Icterus	24	13.3
Hepatomegaly	20	11.1
Altered sensorium	16	8.9
Petechia	6	3.7

Table 4: Distribution of signs

ORIGINAL ARTICLE

Type of Species	Number of Cases	Percentage
	(n=180)	
P.Falciparum	62	34.4
P.Vivax	114	63.3
Mixed	4	2.7

Table 5: Type of species

Incidence of Thrombocytopenia	Number of Cases (n=180)	Percentage
Normal (>1.5 lakh)	34	18.9
Mild (0.5-1.5 lakh)	54	30.0
Moderate (0.20-0.50 lakh)	56	31.1
Severe (<0.2 lakh)	36	20.0

Table 6: Incidence of thrombocytopenia

Thrombocytopenia	Species			Total
	P. Falci	P. Vivax	Mixed	
Mild	18(31%)	36(42.8%)	-	54
Moderate	24(41.3%)	32(38%)	-	56
Severe	16(27.5%)	16(19%)	4(100%)	36
Total	58	84	4	146

Table 7: Association of Thrombocytopenia with Species

Severity of Malaria	Number of Cases	Percentage
	(n=146)	
Uncomplicated Malaria	112	76.7
Complicated Malaria	34	23.3

Table 8: Severity of Malaria

Criteria	Number of Patients	Species		
		P. Falciparum	P.Vivax	Mixed
Hb<5 gm/dl	24	20(83.3%)	4(16.7%)	-
S.Creatinine >3mg%	18	8(44.4%)	6(33.3%)	4(22.2%)
		20(83.3%)	-	4(16.7%)
M. acidosis.ph<7.2	22	16(72.7%)	2(9.1%)	4(18.2%)
Spt bleeding and DIC	12	10(83.3%)	-	2(16.7%)
Coma >30min	6	2(33.3%)	-	4(66.7%)
Hyperparasitemia>5%	8	4(50.0%)	-	4(50.0%)
B.sugar<40mg%	2	-	-	2(100.0%)

ORIGINAL ARTICLE

Prostration	24	16(66.7%)	4(16.7%)	4(16.7%)
ARDS	8	4(50.0%)	-	4(50.0%)
Systolic BP<80mmhg	12	4(33.3%)	4(33.3%)	4(33.3%)

Table 9: WHO guidelines for complicated malaria

Thrombocytopenia	Severity of Malaria		Total
	Uncomplicated	Complicated	
Mild (0.5-1.5 lakh)	48 (42.9%)	6(17.6%)	54
Moderate (0.2-0.5 lakh)	48(42.9%)	8(23.5%)	56
Severe (<0.2 lakh)	16 (14.3%)	20(58.8%)	36
Total	112 (100.0%)	34(100.0%)	146

Table 10: Association of Thrombocytopenia with severity of malaria

Species	Severity of Malaria		Total	P value
	Uncomplicated	Complicated		
P Falciparum	38(33.9%)	20(58.8%)	58	0.066+
P. Vivax	74(66%)	10(29.4%)	84	0.007**
Mixed	-	4(11.7%)	4	0.062+
Total	112(100%)	34(100%)	146	-

Table 11: Association of malaria species with severity of malaria

Platelet Counts	Number of Patients with thrombocytopenia (n=146)	Percentage
1 st day	146	100.0
2 nd day	122	83.6
3 rd day	116	79.5
4 th day	90	61.6
5 th day	56	38.4
6 th day	20	13.7

Table 12: Number of patients had thrombocytopenia

Species	Outcome		Number of Patients
	Died	Recovered	
P. Falciparum	2(3.4%)	56(96.6%)	58
P. Vivax	-	84(100.0%)	84
Mixed	4(100.0%)	-	4
Total	6(4.1%)	140(95.9%)	146

Table 13: Association of Species with outcome

ORIGINAL ARTICLE

AUTHORS:

1. Sudheer Babu Devineni
2. Obulapuram Suneetha
3. Nannam Harshavardhan

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor & I/C Professor,
Department of General Medicine, Govt.
Fever Hospital, Guntur Medical College
Guntur.
2. Assistant Professor, Department of
General Medicine, Govt. Fever Hospital/
Guntur Medical College Guntur.

FINANCIAL OR OTHER

COMPETING INTERESTS: None

3. Assistant Professor, Department of General
Medicine, Govt. Fever Hospital, Guntur
Medical College Guntur.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Sudheer Babu Devineni,
D. No: 4-16-169,
Bharathpeta, 1st Line,
Guntur, Andhra Pradesh.
E-mail: sudheerbabudevineni@gmail.com

Date of Submission: 01/08/2015.
Date of Peer Review: 02/08/2015.
Date of Acceptance: 14/08/2015.
Date of Publishing: 20/08/2015.