ISSN- O: 2458 - 868X, ISSN –P: 2458 - 8687

International Journal of Medical Science and Innovative Research (IJMSIR)

IJMSIR : A Medical Publication Hub

Available Online at: www.ijmsir.com

Volume – 2, Issue –6, November – December - 2017, Page No. : 271 - 277

Manifestations of patients infected with malaria: a cross sectional study highlighting the comparison of Plasmodium Vivax and Plasmodium Falciparum on hematological and clinical basis.

Sumayya Anas[1], Nazia Qamar[2], Adnan Anwar[3], Summaiya Iqbal[4], Zarghoona Wajid[5], Madiha Ariff[6]

[1]M.Phil Hematology, Assistant Professor, Department of Pathology, Altibri Medical College.

[2]MBBS, M. Phil, Assistant Professor, Department of Pathology, Altibri Medical College.

[3]MBBS, Senior Lecturer, Department of Physiology, Altibri Medical College Karachi.

[4]MBBS, Hamdard College of Medicine and Dentistry, Hamdard University Hospital.

[5]MBBS, M. Assistant, Musavvir Stem cell clinic and pathology laboratory.

[6]MBBS, Dow University of Health Sciences.

Correspondence Author: Madiha Ariff, MBBS, Dow University of Health Sciences, Karachi, Pakistan

Address: Address: Cantt Station, Karachi, Pakistan - 75510.

Conflicts of Interest: Nil.

Abstract

Objectives: The objective of this study was to find out the frequency of clinical features in Plasmodium falciparum and vivax. Furthermore it also assessed the comparison of hematological parameters in patients infected with these species.

Material and Methods: This was a cross sectional observational study with the use of convenient sampling technique performed in Baqai medical university from April 2010 to April 2012. A total of 191 patients were selected who presented with fever and were diagnosed with malaria on Immunochromatographic technique and microscopy. The patients who were positive for P. vivax malaria were categorized as group A and with P. falciparum malaria were categorized as group B. The demographic data like age and gender were noted with clinical features and hematological parameters. Thick and thin films were prepared and stained with Leishman`s stain and examined under the microscope to identify the p. vivax and p. falciparum. SPSS version 20.0 was used for analysis. Chi square test and t test was used to assess the association. P-value of ≤ 0.05 was considered as significant.

Results: Among the total of 191 patients the mean age was 26.3 ±4.6 years with a male to female ratio of 2:1. Fever was the common symptom and found in 100% of the cases in both the groups. The comparison of clinical features of both the groups showed that it was highly significant in jaundice (p-value<0.001), splenomegaly (p-value<0.001), bleeding (p-value=0.001) and hepatomegaly ((p-value=0.03) whereas it was not significant in pallor. They were highly significant in all measured parameters including hemoglobin (p=0.001), red blood cell count (0.001) and total leucocyte count (p=0.005), while was not significant in platelet count (p=0.348).Blood cytopenias are known complication of malarial infection. as Group A showed bicytopenia in 47(43%), pancytopenia in 11(10%) patients while results of 49 (47%) patients were normal. Similarly in group B, it was found in 39 (46%), 15 (17%) and 30 (37%) patients respectively.

Conclusion: The present study revealed that Plasmodium falciparum was an important cause of severe malaria. In

fact, the comparison of malarial cases showed a significant difference in severity of symptoms and hematological parameters in vivax and falciparum. Furthermore, pancytopenias were found to be the complications of malarial infection which were more pronounced in P. falciparum

Keywords: Plasmodium falciparum, Plasmodium vivax, hematological basis

Introduction

Malaria is endemic infectious disease and is highly prevalent in Africa followed by South East Asia.[1] Pakistan being a part of endemic belt has an incidence of one case per thousand of population and severe malaria has been a major cause of mortality.*[2*] Malaria is common throughout the year with the peak incidence found during monsoon season.[3] The most common malarial species are *P. falciparum, P. ovale, P. vivax,* and *P. malariae,* while the *P. falciparum* being the most virulent.[4] *The correct and rapid diagnosis of patients infected with malaria is vital for effective disease treatment to avoid life threatening complications especially in immunocompromised children and adults. The* clinical features that help in diagnosis of malaria include fever, anemia, pallor, juandice, hepatosplenomegaly and bleeding. However these features lack specificity and positive predictive value but are sensitive measures of malaria particularly in regions where malaria is infrequent.[5] *Plasmodium falciparum* induced mlaria may cause fetal complications like confusion, coma, neurologic focal signs, severe anemia and respiratory difficulties are more striking and may increase the index of suspicion for malaria. Diagnosis of malaria is based on symptoms, examination and laboratory findings although patients travel history play an important role in suspected cases of malaria. It is recommended that all suspects of malaria should be diagnosed and confirmed by microscopic detection on thick and thin Giemsa stained blood films under microscope which is wide accepted gold standard [6,7]. immunochromatographic technique (ICT) is found to be another accepted method of detection in settings where microscopic detection is not efficient. Conversely polymerase chain reaction (PCR) is used for the detection of parasitic nucleic acid which is more precise than microscopy[8]. Serological exposure of antibodies for malaria parasite is made with both indirect immunofluorescence (IFA) or enzyme-linked immunosorbent assay (ELISA), known as a useful practice in diagnosis.[9] Before starting the treatment instant parasitological confirmation by microscopy, or by rapid diagnostic tests, is suggested in every suspects of malaria. While in areas where parasitological detection is not available, treatment alone on the clinical basis is acceptable. Quinine, Chloroquine, Pyrimethamine, Proguanil and Sulfonamides are the different choices of drugs being used in treating malaria. Presently, the combination therapy of artemether and lumefantrine is used for the treatment of malaria cases. as it is superior in terms of risk of treatment failure, low risk of developing resistance, expediency, and minimum side-effects. [10,11] The objective of this study was to find out the frequency of clinical features in P. falciparum and P. vivax. Furthermore, it also assessed the comparison of hematological parameters of these two species in malarial patients.

Patients and Methods

This was a cross sectional observational study with the use of convenient sampling technique. The study was performed in Baqai medical university after taking ethical approval. The duration of the study was from April 2010 to April 2012. A total of 191 patients were selected who presented with fever and were diagnosed with malaria on

immunochromatographic technique (ICT) and microscopy at Fatima hospital pathology lab Baqai Medical University, Karachi.

After taking informed consent, the demographic data like age and gender were noted with complete confidentiality of the data. 3 ml venous blood was collected in the EDTA tubes by the standard venipuncture procedure and used for microscopy and complete blood counts. Thick and thin films were prepared and stained with Leishman`s stain and examined under the microscope to identify the P. vivax and P. falciparum. The patients who were positive for p. vivax malaria were categorized as group A and who were infected with P. falciparum malaria were categorized as group B. Blood counts including total leukocyte count, red cell count, platelet count and absolute values were carried out by using hematology analyzer Sysmex KX21. The clinical features like fever, jaundice, pallor, bleeding, spleenomegaly and hepatomegaly were documented. Fever was recorded by using mercury thermomter whereas all the other features were assessed on history and examination.

Data Analysis

SPSS version 20.0 was used for analysis. Comparison of quantitative data in both groups was evaluated by applying t test after calculating mean and standard deviation. The association of qualitative data was assessed through chi square test. P-value of ≤ 0.05 was considered as significant.

Results

Among the total of 191 patients the mean age was 26.3 ±4.6 years with a male to female ratio of 2:1. There were 107 patients in Groups A and 84 patients in Group B. The different clinical features were noted including fever, pallor, jaundice, bleeding, hepatomegaly and splenomegaly. Among these features Fever was the common symptom and found in 100% of the cases in both the groups. Pallor was found in 43(40.1%) patients in group A whereas it was found in 64(76.1%) in group B. The other features observed in group A were jaundice, bleeding, hepatomegaly and splenomegaly in 5(4.6%), 1(0.9%), 2(1.8%) and 6(5.6%) patients respectively. Similarly, in groups B, these were present in 20(23.8%), 3(3.5%), 5(5.9%) and 18(21.4%) patients respectively. The comparison of clinical features of both the groups showed that it was highly significant in jaundice (p-value<0.001), splenomegaly (p-value<0.001), bleeding (p-value=0.001) and hepatomegaly ((p-value=0.03) whereas it was not significant in pallor. (Table:1)

Table 1: Showing the clinical features and complications at the time of diagnosis.

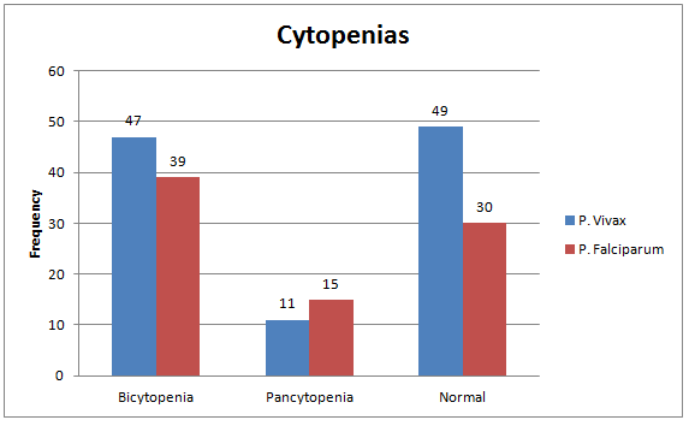
Complication	Plasmodium Vivax (n=107)		Plasmodium Falciparum (n=84)		P-Value
	n	%	n	%	
Fever	107	100	84	100	—
Pallor	43	40.1	64	76.1	0.24
Jaundice	05	4.6	20	23.8	<0.001
Bleeding	01	0.9	03	3.5	0.001
Hepatomegaly	02	1.8	05	5.9	0.03
Splenomegaly	06	5.6	18	21.4	<0.001
Chi-square test was used to assess the significance					

Comparative analysis of hematological parameters of both the groups showed that, Mean hemoglobin, RBC count, TLC and platelet count in all the patients of group A were found as 11.13±2.50 g/dl, 4.12± 0.78 10^6/µl, 5.22±2.67 10^3/µl and 91.41± 74.45 10^3/ µl respectively. Likewise in group B, they were 8.56±3.04 g/dl, 3.24±1.19 10^6/µl, 6.68±4.49 10^3/ul, and 95.79±79.0 10^3/µl respectively. They were highly significant in all measured parameters including hemoglobin (p-value=0.001), Red blood cell count (p-value=0.001) and total leucocyte count (p-value=0.005), while was non significant in platelet count (p-value=0.348).Table(2)

Table 2: Showing the comparison of hematological parameters between two groups.

Parameters	Group A		Group B		P-Value
	Mean	SD	Mean	SD	
Hemoglobin (g/dl)	11.13	2.50	8.56	3.04	0.001
Red Cell Count (x10^6/µl)	4.12	0.78	3.24	1.19	0.001
Total Leucocyte Count (x10^3/µl)	5.22	2.67	6.68	4.49	0.005
Platelet Count (x10^3/µl)	91.41	74.45	95.79	79.07	0.348
Independent t –test is used to assess the significance					

Blood Cytopenias are known complication of malarial infection found as Group A showed bicytopenia in 47(43%), pancytopenia in 11(10%) patients while results of 49 (47%) patients were normal. Similarly in group B, it was found in 39 (46%), 15 (17%) and 30 (37%) patients respectively. (Figure:1)



Discussion

According to WHO report of 2011, among all malarial cases in South East Asia region majority of the cases were infected with vivax.[1] One of the study discovered that, the hospitalization of male children due to malaria are more than twice the number of female children. Likewise, male to female ratio in severe malaria also showed the similar manner in adults. The reason for this male predominance might be related to greater possibility of males having more contact with external environment. However, further investigation are needed to find out genetic association of this male dominance[12]. The findings of the above studies are consistent with our study in which we also observed the dominance of male patients.

In a study by Mobassir et al, fever was found to be the commonest complain in patients infected with malaria.[13] Debojyoti Sarkar et al, found cerebral malaria, jaundice, moderate to severe anemia, bleeding in the form of epistaxis, petechiae, ecchymoses, hematuria, hepatomegaly and splenomegaly as common clinical complications.[14] The causes of jaundice are multifactorial, these include, intravascular haemolysis of red blood cells, haemolysis of non-parasitized red blood cells.[15] In another study done in Nigeria, hyperbilirubinaemia was observed as a common feature. [16] The observations of our study are in accordance with the above studies, in which we observed fever as the most common finding found in all cases followed by pallor, jaundice, bleeding, hepatomegaly and splenomegaly.

In few studies, hematological variations were considered as the characteristic features of the malarial infection which were more prominent in patients infected with P. falciparum as compared to P. vivax [17-20]. One of the study established that thrombocytopenia was found in majority of the case infected with P. falciparum as compared to the patients infected with P. vivax. The probable mechanism for thrombocytopenia in vivax can be accredited to lysis of platelets, immunological response, destruction and oxidative stress[21].

The additional hematological characteristic related with malaria includes severe leukocytopenia which was more pronounced in patients infected with P. Vivax.[22] Pancytopenia was found to be a prominent feature of P. Falciparum. However, Leukocytopenia was a transient finding which resolved with treatment[13]. One of the study documented the alteration in bone marrow reflected by decrease in cellularity with the resultant decrease in the erythropoiesis in both the infections [22]. Nevertheless, in

chronic infections, marrow cellularity tends to be normal or amplified but erythropoiesis is defective. This effect on erythropoiesis was due to the decrease in the availability of the oxygen to the sinusoids of bone marrow because parasitized block the sinusoids [23].There is a wide variation in the hemoglobin level in patients infected with P vivax. [18,24]. Some of the studies discussed hematological result in both infections and documented P. falciparum as more severe and life threating infection than P. vivax as thrombocytopenia and anemia was more profound in P. falciparum.[25-27] The observations of the above studies are in agreement with our study in which we discovered obvious hematological alterations in both groups but more severe anemia, leucopenia and thrombocytopenia found in patients of group B who were infected with plasmodium falciparum

The mixed approach of this study has established that we have assessed the wide variations of the clinical and hematological features of patient infected with P. vivax and P. falciparum. However, the study might not be immune from observer and selection bias. Considering the findings of our study and to what range they are consistent with the other plasmodium species would be revealing to identify more facts about the clinical features that would be helpful for the clinicians to reduce the burden of the disease through precise and early diagnosis.

Conclusion

The present study revealed that P. falciparum was an important cause of severe malaria. In fact, the comparison of malarial cases showed a significant difference in severity of symptoms and hematological parameters in vivax and falciparum. Furthermore, pancytopenias were found to be the complications of malarial infection which were more pronounced in P. falciparum.

References

[1]. World Malaria Report 2011. Geneva: World Health Organization; 2011 [cited 2017 29th November]. Available from: http://www.who.int/malaria/publications/atoz/9789241564403/en/.

[2]. Zafar-Latif A, Strickland GT, Fox E, Khaliq AA, Chowdhry MA. Seasonal fluctuation of malaria in four selected villages of the Punjab. Pakistan Journal of Medical Research. 1985;24:53-61.

[3]. Limaye CS, Londhey VA, Nabar ST. The study of complications of vivax malaria in comparison with falciparum malaria in Mumbai. J Assoc Physicians India. 2012 Oct;60(60):15-8.

[4]. Costa FT, Avril M, Nogueira PA, Gysin J. Cytoadhesion of Plasmodium falciparum-infected erythrocytes and the infected placenta: a two-way pathway. Brazilian journal of medical and biological research. 2006 Dec;39(12):1525-36.

[5]. Erhart LM, Yingyuen K, Chuanak N, Buathong N, Laoboonchai A, Miller RS, Meshnick SR, Gasser Jr RA, Wongsrichanalai C. Hematologic and clinical indices of malaria in a semi-immune population of western Thailand. The American journal of tropical medicine and hygiene. 2004 Jan 1;70(1):8-14.

[6]. Universal access to malaria diagnostic testing: An operational manual. Geneva: World Health Organization; 2011 [cited 2017 29th November]. Available from: http://apps.who.int/iris/bitstream/10665/44657/1/9789241502092_eng.pdf.

[7]. Jain M, Gupta S, Jain J, Grover RK. Usefulness of automated cell counter in detection of malaria in a cancer set up-Our experience. Indian Journal of Pathology and Microbiology. 2012 Oct 1;55(4):467.

[8]. Johnston SP, Pieniazek NJ, Xayavong MV, Slemenda SB, Wilkins PP, da Silva AJ. PCR as a confirmatory

technique for laboratory diagnosis of malaria. Journal of clinical microbiology. 2006 Mar 1;44(3):1087-9.

[9]. Malaria. Centers for Disease Control and Prevention; [cited 2017 29th November]; Available from: https://www.cdc.gov/malaria/.

[10]. Guidelines for the treatment of malaria. Geneva: World Health Organization; 2010 [cited 2017 29th November]. Available from: http://apps.who.int/medicinedocs/documents/s19105en/s19105en.pdf.

[11]. Tjitra E, Anstey NM, Sugiarto P, Warikar N, Kenangalem E, Karyana M, Lampah DA, Price RN. Multidrug-resistant Plasmodium vivax associated with severe and fatal malaria: a prospective study in Papua, Indonesia. PLoS medicine. 2008 Jun 17;5(6):e128.

[12]. Singh R, Kumar S, Rana SK, Thakur B, Singh SP. A comparative study of clinical profiles of vivax and falciparum malaria in children at a tertiary care centre in Uttarakhand. Journal of clinical and diagnostic research: JCDR. 2013 Oct;7(10):2234.

[13]. Hussain MM, Sohail M, Abhishek K, Raziuddin M. Investigation on Plasmodium falciparum and Plasmodium vivax infection influencing host haematological factors in tribal dominant and malaria endemic population of Jharkhand. Saudi journal of biological sciences. 2013 Apr 30;20(2):195-203.

[14]. Sarkar D, Ray S, Saha M, Chakraborty A, Talukdar A. Clinico-laboratory profile of severe Plasmodium vivax malaria in a tertiary care centre in Kolkata. Tropical parasitology. 2013 Jan;3(1):53.

[15]. Mishra SK, Mohapatra S, Mohanty S. Jaundice in falciparum malaria. JIACM. 2003;4(1):12-3.

[16]. Adeosun OG, Oduola T, Akanji BO, Sunday AM, Udoh SJ, Bello IS. Biochemical alteration in Nigerian children with acute falciparum malaria. African Journal of Biotechnology. 2007;6(7).

[17]. Weatherall DJ, Miller LH, Baruch DI, Marsh K, Doumbo OK, Casals-Pascual C, Roberts DJ. Malaria and the red cell. ASH Education Program Book. 2002 Jan 1;2002(1):35-57.

[18]. Kochar DK, Das A, Kochar SK, Saxena V, Sirohi P, Garg S, Kochar A, Khatri MP, Gupta V. Severe Plasmodium vivax malaria: a report on serial cases from Bikaner in northwestern India. The American journal of tropical medicine and hygiene. 2009 Feb 1;80(2):194-8.

[19]. Sharma A, Khanduri U. How benign is benign tertian malaria?. Journal of vector borne diseases. 2009 Jun 1;46(2):141.

[20]. Narang GS, Singla N. Thrombocytopenia and other complications of Plasmodium vivax malaria. Current Pediatrics. 2011;15(2).

[21]. Rodríguez-Morales AJ, Sánchez E, Vargas M, Piccolo C, Colina R, Arria M, Franco-Paredes C. Occurrence of thrombocytopenia in Plasmodium vivax malaria. Clinical infectious diseases. 2005 Jul 1;41(1):130-1.

[22]. Douglas NM, Anstey NM, Buffet PA, Poespoprodjo JR, Yeo TW, White NJ, Price RN. The anaemia of Plasmodium vivax malaria. Malaria journal. 2012 Apr 27;11(1):135.

[23]. Gwamaka M, Fried M, Domingo G, Duffy PE. Early and extensive CD55 loss from red blood cells supports a causal role in malarial anaemia. Malaria journal. 2011 Dec 1;10(1):386.

[24]. Genton B, D'Acremont V, Rare L, Baea K, Reeder JC, Alpers MP, Müller I. Plasmodium vivax and mixed infections are associated with severe malaria in children: a prospective cohort study from Papua New Guinea. PLoS medicine. 2008 Jun 17;5(6):e127.

[25]. Shaikh MA, Ahmed S, Diju IU. Platelet count in malaria patients. Journal of Ayub Medical College Abbottabad. 2011 Mar 1;23(1):143-5.

[26]. Memon AR, Afsar S. Thrombocytopenia in hospitalized malaria patients. Pakistan Journal of Medical Sciences. 2006 Apr;22(2):141.

[27]. Bashawri LA, Mandil AA, Bahnassy AA, Ahmed MA. Malaria: hematological aspects. Ann Saudi Med. 2002 Sep 1;22(5-6):372-6.