ORIGINAL ARTICLE

Common Hematological Abnormalities in patients with Malaria presenting at Saidu Teaching Hospital, Swat Pakistan

ABDUL AHAD[1], SAIMA QADIR[2], ALEEM UR RASHID[3], AMIR ZEB SWATI[4]
[1]Associate Professor, Department of Medicine, Saidu Teaching Hospital/ Saidu Medical College, Saidu Sharif Swat
[2]Women Medical Officer, Department of Medicine, Saidu Teaching Hospital, Saidu Sharif, Swat
[3]Senior Registrar, Department of Medicine, Saidu Teaching Hospital/ Saidu Medical College, Saidu Sharif Swat
[4]Assistant Professor, Department of Medicine, Saidu Teaching Hospital/Saidu Medical College, Saidu Sharif Swat
Correspondence to: Abdul Ahad, Email: dr.aahad@yahoo.com

ABSTRACT

Objectives: To determine the frequency of common hematological abnormalities in patients with malaria.
Study Design: A cross-sectional study.
Place and Duration of the Study: Department of Medicine, Saidu Teaching Hospital, Swat Pakistan from November 2019 to May 2020.
Material and Methods: A total of 137 patients of both genders aged between 18-60 years and who presented with malaria in emergency or outpatient department were analyzed. Ten cc blood was taken from all enrolled patients and sent to institutional laboratory for the detection of anemia, thrombocytopenia, leucopenia and disseminated intravascular coagulation (DIC). Frequency of common hematological abnormalities among patients of malaria was noted. For data analysis, SPSS version 26.0 was used.
Results: In a total of 137 patients, 95 (69.3%) were male and 42 (30.7%) female. Overall, mean age was 29.2±13.18 while 84 (61.3%) patients were aged between 18 to 30 years. Mean duration of disease was 1.2±1.09 weeks while 89 (65.0%) patients had duration of disease <1 week. Table-1 is showing baseline characteristics of all patients. Anemia was found in 121(88.3%) patients, thrombocytopenia in 67(48.9%), leucopenia in 20 (14.6%) and 35 (25.5%) had DIC.
Conclusion: The frequency of hematological abnormalities in patients with malaria was high. Anemia was found in 88.3% malaria cases, thrombocytopenia 48.9%, leukopenia 14.6% and DIC 25.5%.
Keywords: Anemia, Leukopenia, malaria, thrombocytopenia.

INTRODUCTION

Epidemiological data during the recent years estimated number of malaria endemic countries to be 91 in 2016 while in 2000, this number was estimated to be 108 countries. Globally, last decade witnessed a decrease of 21% in total number of malaria cases. Implementation of wide-spread malaria control programs predominantly in the malaria endemic countries has been the main reason for global decline in number of malaria cases. Europe was announced to be malaria free in the middle of the last decade but regions like South-East Asia and Africa still contribute around 90% of all global malaria cases.[1,2] Malaria is also known to be the cause of major financial burden as the estimated cost of these programs in the malaria endemic countries was calculated to be rising from 960 US$ in 2009 to 2.5 billion US$ in 2014.[3] In Pakistan, malaria affects around 1.6 million cases annually and is 2nd most frequent cause of illness after respiratory tract infections.[4,5]

Hematological and biochemical alterations in the blood of the malaria infected cases are thought to be a concern for potential complications like anemia, thrombocytopenia and disseminated intravascular coagulation (DIC).[6-8] A study from Yemen by Al-Salahy M et al among malaria cases revealed mean hemoglobin (Hb) levels to be 9.4±0.8 g/dl, mean packed cell volume 29.5±0.8%, mean total white blood count 5.9±0.4x10³/ul, mean lymphocyte count 24.6±1.6%, mean neutrophil count 71.3±1.6% and mean platelet count 116.6±7.0x10³/ul.[9] Another study found anemia to be present in 80%, thrombocytopenia in 15%, DIC in 30% of malaria patients.[10] Not much local work is seen enquiring about the presence of hematological abnormalities among newly diagnosed adult cases of malaria so the present study was aimed to find out the frequency of common hematological abnormalities among patients with newly diagnosed malaria.

MATERIAL AND METHODS

This cross sectional study was conducted at the department of medicine, Saidu Teaching Hospital, Swat from November 2019 to May 2020. Approval from the Institutional Ethical Committee was acquired. Informed consents were sought from all study participants. The sample of 137 patients was calculated considering 95% confidence level, 6% margin of error and expected proportion of thrombocytopenia to be 15%[10] in malaria cases.

Inclusion criteria was patients of both genders aged between 18-60 years and who presented with malaria in emergency or outpatient department. Exclusion criteria was cases with past or present history of hepatitis B or C virus infection or any liver dysfunction as described in medical history of medical record. Patients with history of alcohol use were also not included. Anyone using any kinds of anti-malaria drugs in the past 2 weeks was not included. Patients with known history of anemia, thrombocytopenia, leukopenia or DIC were also excluded.

Malaria was diagnosed as history of fever in the past 2-3 days and documented axillary temperature of > 37.5 °C with demonstration of malarial parasite (vivax or falciparum) slides positivity on peripheral smear.

In patients fulfilling inclusion/exclusion criteria, clinical examination was performed and detailed medical history was noted. Ten cc blood was taken from all enrolled patients and sent to institutional laboratory for the detection of anemia, thrombocytopenia, leucopenia and DIC. Anemia was labeled as Hb < 10g/dl. Platelet count < 150,000 IU/L was labeled as thrombocytopenia. Leucopenia was defined as leucocyte count < 4000 IU/L. The DIC was named if plasma D dimer level > 200ng/ml. A special proforma was designed to record all study data.

For data analysis, SPSS version 26.0 was used. Quantitative data was expressed as mean and standard deviation (SD) while qualitative variables were shown as frequency and percentages. Effect modifiers were controlled by stratification while post-stratification, chi-square test was used to compare study date considering p≤0.05 as statistically significant.

RESULTS

In a total of 137 patients, 95 (69.3%) were male and 42 (30.7%) female. Overall, mean age was 29.2±13.18 while 84 (61.3%) patients were aged between 18 to 30 years. Mean duration of disease was 1.2±1.09 weeks while 89 (65.0%) patients had duration of disease <1 week. Table-1 is showing baseline characteristics of all patients.

| Leukopenia | 13 (14.6%) | 7 (14.6%) | 0.9970 |
| DIC | 22 (24.7%) | 13 (27.1%) | 0.7621 |

Table-5: Stratification of Common Hematological Abnormalities With Respect to Residence

Hematological Abnormalities		Rural (n=47)	Urban (n=90)	P value
Anemia	Yes	41 (87.2%)	80 (88.9%)	0.7746
Thrombocytopenia	Yes	22 (46.8%)	45 (50.0%)	0.7227
Leukopenia	Yes	7 (14.9%)	13 (14.4%)	0.9436
DIC	Yes	12 (25.5%)	23 (25.6%)	0.9975

Table-6: Stratification of Common Hematological Abnormalities With Respect To Socioeconomic Status

Hematological Abnormalities		Poor (n=71)	Middle Class (n=55)	Rich (n=11)	P value
Anemia	Yes	62 (87.3%)	48 (87.3%)	11 (100%)	0.4535
Thrombocytopenia	Yes	34 (47.9%)	27 (49.1%)	6 (54.5%)	0.9184
Leukopenia	Yes	10 (14.1%)	8 (14.5%)	2 (18.2%)	0.9378
DIC	Yes	18 (25.4%)	14 (25.4%)	3 (27.3%)	0.9906

Table-1: Characteristics of Patients (n=137)

Characteristics		Number (%)
Gender	Male	95 (69.3%)
	Female	42 (30.7%)
Age Groups (years)	18-30 years	84 (61.3%)
	31-60 years	53 (38.7%)
Area of Residence	Rural	47 (34.3%)
	Urban	90 (65.7%)
Duration of Disease	< 1 week	89 (65.0%)
	≥ 1 week	48 (35.0%)
Socio-economic Status	Poor	71 (51.8%)
	Middle Class	55 (40.1%)
	Rich	11 (8.0%)

Mean platelets count was 138,000±100/l. The mean Hb was 9.4±0.8gm/dl, mean packed cell volume 30.0±1.0, mean total WBC count 7.7 ±1.2x10³/ul, mean lymphocyte count 29.3±2.8, mean neutrophil count 73.8±1.0 and mean platelet count 121.0 ±5.1 x 10³/ul. Anemia was found in 121(88.3%) patients, thrombocytopenia in 67(48.9%), leucopenia in 20 (14.6%) and 35 (25.5%) had DIC (figure-1).

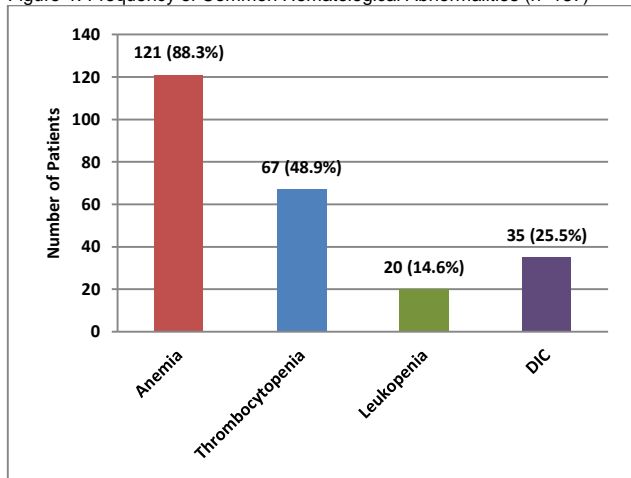Figure-1: Frequency of Common Hematological Abnormalities (n=137)

Table number 2 to 6 are showing stratification of various hematological abnormalities noted in the present study with respect to gender, age, duration of disease, area of residence and socio-economic status and no statistically significant associations were noted (p>0.05)

Table-2: Stratification of Common Hematological Abnormalities with Respect To Characteristics of Patients

Hematological Abnormalities	Male (n=95)	Female (n=42)	P value
Anemia	83 (87.4%)	38 (90.5%)	0.6015
Thrombocytopenia	46 (48.4%)	21 (50.0%)	0.8646
Leukopenia	14 (14.7%)	6 (14.3%)	0.9450
DIC	24 (25.3%)	11 (26.2%)	0.9086

Table-3: Stratification of Common Hematological Abnormalities with Respect to Age (n=137)

Hematological Abnormalities	18-30 years (n=84)	31-60 years (n=53)	P value
Anemia	74 (88.1%)	47 (88.7%)	0.9174
Thrombocytopenia	40 (47.6%)	27 (50.9%)	0.7046
Leukopenia	12 (14.3%)	8 (15.1%)	0.8961
DIC	21 (25.0%)	14 (26.4%)	0.8532

Table-4: Stratification of Common Hematological Abnormalities With Respect to Duration of Disease

Hematological Abnormalities	< 1 week (n=89)	≥ 1 week (n=48)	P value
Anemia	78 (87.6%)	43 (89.6%)	0.7355
Thrombocytopenia	43 (48.3%)	24 (50.0%)	0.8506

DISCUSSION

In this study, 61.3% of study participants had age between 18-30 years while 69.3% patients were male. Farogh A et al revealed majority of adult malaria patients to be between 21 to 35 years while the authors found 56% of study participants to be females.[10]

In the present study, anemia was found in 88.3% patients, thrombocytopenia in 48.9%, 14.6% leucopenia and 25.5% had DIC. Farogh A et al found anemia, jaundice, splenomegaly, thrombocytopenia, leucopenia, hemoglobinuria and DIC to be present among 84%, 14%, 72%, 52%, 18%, 6% and 2% malaria cases respectively.[10] Ullah I from Khayber Pakhtunkhwa district of Pakistan revealed anemia to be the observed 77.2%, thrombocytopenia 54.4% and leukopenia in 8.8% malaria cases.[11] Abro AH et al from UAE analyzing 133 confirmed patients of acute malaria recorded the presence of thrombocytopenia to be 83%, anemia 64%, lymphopenia 24% and mococytosis 10% which correlates well with our findings.[12] Ullah Z et al evaluating hematological outcomes in patients with malaria described thrombocytopenia to be the most common finding observed in 79% malaria cases while anemia and leucopenia were found in 37% and 15% cases respectively.[13] Some of the main mechanisms behind the development of thrombocytopenia in malaria patients are thought to be coagulation disruption, splenic sequestration, high rates of platelets removal by macrophages, bone marrow alterations, antibody-mediated platelet destruction, oxidative stress and aggregation of platelets.[14] Leucopenia was the least common hematological abnormality observed in this study (14.6%) while our findings are consisted with what has been found by other researchers describing leucopenia to be less prevalent finding among malaria infected patients.[15,16]

Malaria is a potential life-threatening illness especially in our parts of the world. Malaria is frequently manifested in the form of hematological abnormalities as shown in the present study. Timely identification and treatment of hematological abnormalities among malaria cases is thought to reduce the total burden of malaria related morbidity and mortality.[17,18]

Our study had some limitations as well. As this was a single center study conducted on a relatively small sample size, our findings cannot be generalized. We were unable to note correlation of hematological abnormalities with certain types of malarial parasite like vivax or falciparum. We could not evaluate outcomes in the present set of patients.

CONCLUSION

The frequency of hematological abnormalities in patients with malaria was high. Anemia was found in 88.3% malaria cases, thrombocytopenia 48.9%, leukopenia 14.6% and DIC 25.5%.

REFERENCES

1. Singh P, Mehta N, Tada NG. Comparison of clinical profile and severity of P. falciparum and P. vivax malaria in a tertiary care hospital of Surat, India. Int J Contemp Peds. 2016;3(4):1288-92

2. Khatib Y, Patel R, Sequeira K, Agrawal G, Chikhale N. Hematological and biochemical alterations in malaria and their correlation with Parasitic Index. IOSR J Pharm. 2015;5(9):53-56.

3. Streatfield PK, Khan WA, Bhuiya A, Hanifi SM, Alam N, Diboulo E, et al. Malaria mortality in Africa and Asia: evidence from INDEPTH health and demographic surveillance system sites. Global health action. 2014;7(1):25369

4. Tareen AM, Rafique M, Wadood A, Qasim M, Rahman H, Shah SH. Malaria burden in human population of Quetta, Pakistan. Eur J Microbiol Immunol 2012;2(3):201-4.

5. Battle KE, Cameron E, Guerra CA, Golding N, Duda KA, Howes RE, et al. Defining the relationship between Plasmodium vivax parasite rate and clinical disease. Malaria J. 2015;14(1):191.

6. Chandra S, Chandra H. Role of haematological parameters as an indicator of acute malarial infection in Uttarakhand state of India. Mediterr J Hematol Inf Di. 2013;5(1):e2013009.

7. Bakhubaira S. Hematological parameters in severe complicated Plasmodium falciparum malaria among adults in Aden. Turk J Hematol 2013;30(4):394–9.

8. Onyesom I. Activities of some liver enzymes in serum of P. falciparum malarial infected humans receiving artemisinin and non-artemisinin-based combination therapy. Annals Biolog Res 2012;3(7):3097–100.

9. Al-Salahy M, Shnawa B, Abed G, Mandour A, Al-Ezzi A. Parasitaemia and Its Relation to Hematological Parameters and Liver Function among Patients Malaria in Abs, Hajjah, Northwest Yemen. Interdiscip Perspect Infect Dis. 2016;2016:5954394.

10. Misra DP, Das S, Pattnaik M, Singh SC, Jena RK. Relationship of Hepatic and Renal Dysfunction with Haemorrheological Parameters in Plasmodiumfalciparum Malaria. JAPI 2011;99:552-56.

11. Ullah I, Ali MU, Ali S, Rafiq A, Sattar Z, Hussain S. Hematological Profile of Patients Having Malaria-positive Peripheral Blood Smears: A Cross-sectional Study at a Diagnostic Research Center in Khyber Pakhtunkhwa, Pakistan. Cureus. 2018;10(9):e3376.

12. Abro AH, Ustadi AM, Younis NJ, Abdou AS, Hamed D, Saleh AA. Malaria and hematological changes. Pak J Med Sci. 2008;24(2):287.

13. Ullah Z, Khattak AA, Aziz N, Khan H, Bano R, Awan UA. Haematological outcomes in progression of malaria: A cohort study from district Dera Ismail Khan, Pakistan. J Pak Med Assoc. 2020;70(10):1830-1833.

14. Autino B, Corbett Y, Castelli F, Taramelli D. Pathogenesis of malaria in tissues and blood. Mediterr J Hematol Infect Dis. 2012;4:e2012061.

15. Igbeneghu C, Odaibo AB. Impact of acute malaria on some haematological parameters in a semi-urban community in southwestern Nigeria. Acta Parasitologica Globalis. 2013; 4:01-5.

16. Bhawna S, Bharti A, Yogesh K, Reena A. Parasitemia and hematological alterations in malaria: A study from the highly affected zones. Iranian J Pathol. 2013;8:1-8.

17. Jairajpuri ZS, Rana S, Hassan MJ, Nabi F, Jetley S. An Analysis of Hematological Parameters as a Diagnostic test for Malaria in Patients with Acute Febrile Illness: An Institutional Experience. Oman Med J. 2014;29(1):12-17.

18. Maltha J, Jacobs J. Clinical practice: the diagnosis of imported malaria in children. Eur J Pediatr. 2011;170(7):821-9.