

ORIGINAL ARTICLE

PREVALENCE OF MALARIA IN BLOOD DONORS IN A TERTIARY CARE HOSPITAL IN PESHAWAR

Zahish Safiullah Jan, Nayab Safiullah Jan, Humerah Safdar, Ayesha Rehman, Khizar Abdullah Khan, Sidra Humayun*

Department of Pathology, Hayatabad Medical Complex, *Muhammad College of Medicine, Peshawar, Pakistan

Background: Malaria is a protozoan parasitic infection of humans resulting from one or more of the five species of the genus *Plasmodium*. A transfusion transmitted infection (TTI) is a virus, parasite, or other potential pathogen that can be transmitted in donated blood through transfusion to a recipient. The aim of this study was to find out the frequency of malaria in blood donors at a tertiary care hospital in Peshawar. **Methods:** A total of 218 patients were observed in this descriptive cross-sectional investigation from 16 April to 16 October 2021, at Department of Pathology, Hayatabad Medical Complex, Peshawar. Informed consent was obtained from the blood donors justifying the inclusion criteria. Three ml venous blood of each donor was collected in EDTA containing vacutainer. The complete blood count was done on CELL-DYN Ruby® analyzer. Geimsa stained thick and thin blood films were made from each donor blood sample and was examined under $\times 100$ objective lens (oil immersion) using a light microscope for *Plasmodium*. **Results:** Mean age of the subjects was 32 ± 11.46 years; 88% donors were male and 12% were female. The frequency of malarial parasite was 4% in blood donors. The transmission of malarial parasite was found significant with a history of fever among the blood donors ($p < 0.05$). **Conclusion:** The frequency of malarial parasite was 4% in blood donors presenting at a tertiary care hospital of Peshawar, Pakistan.

Keywords: Blood donors, Malaria, *Plasmodium*, Peshawar, Pakistan

Pak J Physiol 2022;18(3):27-9

INTRODUCTION

A transfusion-transmitted infection (TTI) is a virus, parasite, or other possible pathogen that can be communicated to a recipient through blood transfusion.¹ Malaria is a protozoal infection of humans caused by one or more of the five *Plasmodium* species, i.e., *P. falciparum*, *Plasmodium vivax*, *P. ovale*, *P. malariae* and *P. knowlesi*.² Malaria can spread through transfusion of cellular components of the blood, and it is responsible for majority of transfusion-transmitted infections worldwide.³ Prior screening of donated blood ensures safe blood transfusions. The TTIs such as the HIV-AIDS, hepatitis, syphilis, and malaria are all possible with each unit of blood transfused. TTIs are more likely to be transmitted by commercially compensated blood donors than by voluntary donors, posing a serious infection risk. The morbidity and mortality caused by infected blood transfusions have deleterious effects on both recipients and their families.⁴

There has been scarcity of data on distribution and potential impact of different *Plasmodium* species in transfusion-related malaria cases, particularly among young children and pregnant women who are the most frequent recipients of blood transfusions in Pakistan.⁵ In endemic regions, transfusion malaria is very common. The donor may remain infective for years after a malaria infection, i.e., up to 3 years with '*P. falciparum*', up to 4 years with '*P. vivax*', and up to 50 years with '*P. malariae*'.⁶

Infections are more likely in transfusions of blood retained for fewer than 5 days, while transmission is uncommon in infusion of blood preserved for more than 14 days. Malaria, on the other hand, is not reported to be transmitted by frozen plasma.⁷ Malaria can spread quickly and cause severe morbidity and mortality when spread through blood transfusion to a non-immune recipient, especially if detection is delayed. Pakistan is classified as a country with moderate malaria endemicity, with a National API (Annual Parasite Index) of 1.08 with considerable variation within and between provinces. *P. vivax* and *P. falciparum* are the only parasite species found, with *P. vivax* accounting for more than 80% of reported cases in the country.⁸ The incidence of transfusion-transmitted malaria is about 0.25 cases per million blood units donated by donors.⁹ Three hundred (300) blood donors from Jamila Sultana Foundation Rawalpindi were evaluated and screened for the presence of infectious disease in another study. Four (1.6%) of these donors were infected with malaria.¹⁰ The aim of the current study was to find the frequency of malarial parasite in donated blood in a tertiary care hospital.

MATERIAL AND METHODS

This was a single centred, simple cohort study constructed and conducted after the approval of Institutional Review Board of the Hospital and by the College of Physicians and Surgeons Pakistan. The study

was conducted from 16th April to 16th October 2021 at Department of Pathology, Hayatabad Medical Complex. Sample size was calculated using WHO sample size calculator with 3.5% margin of error and 95% confidence interval keeping 7.5% prevalence of malaria in donors.

A total of 218 blood donors, after informed consent, were included as per inclusion criteria and consecutive, non-probability sampling technique was used. The inclusion criteria were blood donor of either gender with age between 18–65 years. A blood donor with body weight less than 50 Kg, history of blood donation within 3 months and pregnant or lactating woman were excluded from the study.

Three mL venous blood of the donor was collected in an EDTA containing vacutainer, after following aseptic techniques of blood collection. The complete blood count was obtained on CELL-DYN Ruby[®] analyzer. Geimsa stained thick and thin blood films were made from each donor's blood and were examined for malarial parasite under ×100 objective lens (oil immersion lens) using a light microscope.

The demographic and clinical data of all patients including age, gender, address, occupation, and presence or absence of malarial parasite were recorded on a pre-designed proforma. The data were entered and analyzed using SPSS-23. Malaria was stratified among age, gender, a history of blood transfusions, and any history of fever in the previous six months. Chi-square test was applied for determination of association between blood transfusion and history of fever with transmission of malarial parasite, and $p \leq 0.05$ was considered statistically significant.

RESULTS

Mean age of the subjects was 32 ± 11.46 years. The age distribution among 218 donors showed that 74 (34%) were between the ages of 18 and 30 years, 70 (32%) of donors were between the ages of 31 and 40 years, whereas 52 (24%) donors were between the ages of 41 and 50 years, 22 (10%) donors were in age range 51–65 years. Regarding gender distribution 192 (88%) donors were male and 26 (12%) were female.

Twenty-eight (13%) out of 218 donors had a history of receiving a blood transfusion themselves, and 179 (82%) donors didn't receive any blood transfusion. In the preceding 6 months 48 (22%) donors had a history of fever while 170 (78%) donors did not have fever in the preceding 6 months. Nine (4%) donors had malarial parasite while 209 (96%) donors didn't have malarial parasite in their blood smear. The demographic data is shown in Table-1.

Stratification of malarial parasite with respect to blood transfusions and history of fever in past six months is tabulated as Table-2.

Table-1: Demographic data of blood donors (n=218)

Demographic	Observations	Frequency	Percentage
Age (Yrs)	18–30	74	34
	31–40	70	32
	41–50	52	24
	51–65	22	10
Gender	Male	192	88
	Female	26	12
History of receiving blood transfusion	Yes	39	18
	No	179	82
History of fever	Yes	48	22
	No	170	78
Malarial parasite in blood smear	Yes	9	4
	No	209	96

Table-2: Stratification of malarial parasite with demographic data (n=218)

Observations	Malarial Parasite		p
	Yes	No	
History of blood transfusion	2	37	0.73
History of fever	5	43	0.013

DISCUSSION

Because of poor transfusion techniques, 'Transfusion Transmissible Infections (TTIs) threaten millions of people around the globe. Blood and blood component should be analysed to assess the prevalence of TTIs such as HIV, HBV, HCV, syphilis, and malaria in the blood donors.¹¹ This ensures safety of the blood transfusion. There has been a paucity of information concerning the distribution and potential role of the different Plasmodium species in transfusion-related malaria cases.¹² Most infections occur in case of transfusion of blood stored for less than 5 days and it is rare in transfusions of blood stored for more than 2 weeks. Frozen plasma is not known to transmit malaria. The blood transfusion system in Pakistan is decentralized, demand-driven, and primarily based on uncontrolled transfusion techniques. This is especially prevalent in small towns and rural areas.¹³

Recently, Naeem *et al*¹⁴ found that 0.1% of blood donors had malarial parasite in the northern region of Pakistan. However, in current study, malarial parasite was detected in 4% blood donors. Olawumi *et al*¹⁵ have reported malaria parasitemia in 27.3% of blood donors in Ilorin, Nigeria. *Plasmodium falciparum* was identified in greater numbers (85.7%) than *Plasmodium malariae* (14.3%). Malaria parasitemia did not differ by age or gender ($p > 0.05$). However, the malaria parasitemia was reported to be higher in donors with blood group 'O' than the donors with blood groups A and B.¹⁶ Another study from Kaduna, Nigeria reported 27 (7.5%) positive cases of malarial parasites among the blood donors; only the *P. falciparum* was found while no other parasite was reported in the donated blood.¹⁷ Bahadur *et al*¹⁸ found only 3 (0.03%) blood unites infected with malarial parasite upon malaria rapid detection test (RDT) of 11,736 units of donated blood.

The statistically insignificant higher seroprevalence of malaria antibody in donors having history of fever within the last 3 months (22%) as compared with that in normal donors (16.9%) does not provide enough evidence at this stage to prove or disprove usefulness of such criteria, and results need to be confirmed on a larger sample study to prevent unnecessary donor deferrals. Dubey *et al*¹⁹ have reported that in patients suffering from thalassemia with history of fever, the prevalence of malarial antibodies was 17.4%. In our study, 22% of the blood donors had a history of fever in the past six months. However, only 5 blood donors had a history of fever with malarial parasite detected in their blood.

CONCLUSION

The frequency of malarial parasite was found to be 4% in blood donors presenting at a single centre. A significant association was found between the transfusion related transmission of malarial parasite and history of fever in the blood donors. Large, multi-centre study is recommended to elaborate our results in general population.

REFERENCES

1. Slot E, Janssen MP, Marijt-van der Kreek T, Zaaijer HL, van de Laar TJ. Two decades of risk factors and transfusion-transmissible infections in Dutch blood donors. *Transfusion* 2016;56(1):203–14.
2. Vijayalakshmi A, Rajesh Kanna B. Deep learning approach to detect malaria from microscopic images. *Multimed Tools Appl* 2020;79(21):15297–317.
3. Abdullah S, Karunamoorthi K. Malaria and blood transfusion: major issues of blood safety in malaria-endemic countries and strategies for mitigating the risk of Plasmodium parasites. *Parasitol Res* 2016;115(1):35–47.
4. Okoroiwu HU, Okafor IM, Asemota EA, Okpokam DC. Seroprevalence of transfusion-transmissible infections (HBV, HCV, syphilis and HIV) among prospective blood donors in a tertiary health care facility in Calabar, Nigeria; an eleven years evaluation. *BMC Public Health* 2018;18:645.
5. Arshad A, Borhany M, Anwar N, Naseer I, Ansari R, Boota S, *et al*. Prevalence of transfusion transmissible infections in blood donors of Pakistan. *BMC Hematol* 2016;16:27.
6. White NJ. Malaria parasite clearance. *Malar J* 2017;16(1):88.
7. Antwi-Baffour S, Kyeremeh R, Amoako AP, Annison L, Tetteh JO, Seidu MA. The incidence of malaria parasites in screened donor blood for transfusion. *Malar Res Treat* 2019;2019:1457406.
8. Hassan Bin Asad MH, Nazir H, Khalid S, Bibi S, Afzal K, Al-Kharaman YM, *et al*. Erupt of malaria, dengue and chikungunya in Pakistan: Recent insights about prevalence, diagnosis and treatment. *Pak J Pharm Sci* 2019;32(4):1545–54.
9. Ghanchi NK, Shakoor S, Thaver AM, Khan MS, Janjua A, Beg MA. Current situation and challenges in implementing malaria control strategies in Pakistan. *Crit Rev Microbiol* 2016;42(4):588–93.
10. Kamran M, Mahmood RT, Khan MA, Mehmood A, Nisar L, Asad MJ. Prevalence of transfusion transmitted infections among blood donors: A prospective study. *Am J Phytomed Clin Ther* 2014;2(4):540–43.
11. Ahmadpour E, Foroutan-Rad M, Majidiani H, Moghaddam SM, Hatam-Nahavandi K, Hosseini SA, Rahimi MT, *et al*. Transfusion-Transmitted Malaria: A Systematic Review and Meta-analysis. *Open Forum Infect Dis* 2019;6(7):ofz283.
12. Javed SO, Saleem A, Sahito AM, Hasan MM. Transfusion Transmitted Infections: A Present-Day Danger for Pakistan. *Am J Trop Med Hyg* 2022;106(5):1311–4.
13. Ehsan H, Wahab A, Anwer F, Ifikhar R, Yousaf MN. Prevalence of transfusion transmissible infections in beta-thalassemia major patients in Pakistan: a systematic review. *Cureus* 2020;12(8):e10070.
14. Bhatti MM, Junaid A, Sadiq F. The prevalence of transfusion transmitted infections among blood donors in Pakistan: A retrospective study. *Oman Med J* 2022;37(3):e386.
15. Olawumi HO, Fadeyi A, Babatunde SK, Akanbi II AA, Babatunde AS, Sani MA, *et al*. Malaria parasitaemia among blood donors in Ilorin, Nigeria. *Afr J Infect Dis* 2015;9(1):10–3.
16. Degarege A, Gebrezgi MT, Ibanez G, Wahlgren M, Madhivanan P. Effect of the ABO blood group on susceptibility to severe malaria: a systematic review and meta-analysis. *Blood Rev* 2019;33:53–62.
17. Garba DD, Ameh JB, Whong CM, Aminu-Mukhtar M. Prevalence of malaria parasites among blood donors in Kaduna, Nigeria. *Int J Res Med Sci* 2016;4(6):2112–9.
18. Bahadur S, Pujani M, Jain M. Use of rapid detection tests to prevent transfusion-transmitted malaria in India. *Asian J Transfus Sci* 2010;4(2):140–1.
19. Dubey A, Elhence P, Ghoshal U, Verma A. Seroprevalence of malaria in blood donors and multi-transfused patients in Northern India: relevance to prevention of transfusion-transmissible malaria. *Asian J Transfus Sci* 2012;6(2):174–8.

Address for Correspondence:

Dr. Sidra Humayun, Department of Pathology, Muhammad College of Medicine, Yaseenabad, Peshawar, Pakistan.

Cell: +92-333-9833313

Email: drsidrafarooq4@gmail.com

Received: 20 Dec 2021

Reviewed: 31 May 2022

Accepted: 1 Jun 2022

Contribution of Authors:

ZSJ: Manuscript writing

NSJ: Data collection

HS: Data collection

AR: Result compilation

KAK: Discussion and analysis

SH: Analysis and compilation

Funding: There was no special support for this project from any government, private, or non-profit funding sources.

Conflict of Interest: The authors have no evident conflicts of interest to state regarding this article.