Prevalence of malaria among blood donors in blood bank, Jhalawar Hospital & Medical College Society, Jhalawar, Rajasthan

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Abstract

Introduction: Transfusion Transmitted Malaria (TTM) is the great concern in endemic countries. Transmission of malaria by blood transfusion was one of the first recorded incidents of transfusion transmitted infection. The drugs and cosmetic act in India mandates the testing of all blood donations for human immunodeficiency virus (HIV) hepatitis B surface antigen (HbsAg), hepatitis C virus (HCV), malaria and syphilis. The present study aims to determine the prevalence of malarial among voluntary and replacement blood donors in Blood Bank, Jhalawar Hospital & Medical college society, Jhalawar, Rajasthan. Material and Methods: A retrospective review of donors record covering the period between Jan 2017 to Dec 2017 at Blood Bank, Jhalawar Hospital & Medical college society, Jhalawar, Rajasthan, India. The blood samples were then obtained by standard procedures of venepuncture. Malarial parasites were screened by microscopy (peripheral blood smear) and rapid Antigen card detection in blood bank. The study detected the presence of malaria parasites in donated blood units. Results: 5 out of 16495 donor population were positive (Prevalence 0.03%) on Immunochromatographic rapid diagnostic test for malarial antigen detection (Rapid Antigen Card Test). Conclusion: Blood donors in Blood Bank, Jhalawar Hospital & Medical college society, Jhalawar, Rajasthan, India have a 0.03% prevalence and voluntary donations are safer as compared to replacement donation. By strict donor selection, proper donor testing and post testing counselling, the rate of TTM can be further minimized.

Keywords: TTM, Blood Donors, Peripheral blood smear, Rapid Antigen Card Test, Malaria, Microscopy

Introduction

Blood donation is the most important and essential part of blood transfusion services, usually donated voluntarily or in the form of replacement. Millions of lives are saved each year through blood transfusions, who have lost large volumes of blood from serious accidents, major Surgical Operation, Cancer patients requiring therapy, women with haemorrhage at child birth, patients of hereditary disorders like Haemophilia and Thalassaemia, severe burn victims as well as for individuals who have symptomatic anemia from medical or hematologic conditions or cancers.

Blood transfusion carries the risk of transmitting major infections such as hepatitis, HIV, syphilis, and malaria. In minority cases, viral infections such as cytomegalovirus, herpes virus, and Epstein–Barr virus along with toxoplasmosis and brucellosis may be transmitted [1]. Therefore Blood banks are obligated to provide adequate and safe blood to the community. In India, it is mandatory to test every unit of blood collected for hepatitis B, hepatitis C, HIV, syphilis and malaria [2]. The donated blood was discarded whenever the pilot donor sample was found positive for any TTI. Transmission of malaria by blood transfusion was one of the first recorded incidents of transfusion transmitted infection [3]. Testing of blood for malarial parasite is mandatory as per the drugs and cosmetic act part X11 B of Schedule F.

Although malaria transmission occurs principally through mosquito bites, transfusion-transmitted malaria (TTM) is an accidental *Plasmodium* infection caused by the transfusion of whole blood or a blood component from a malaria infected donor to a recipient, described for the first time by Woolsey in 1911. The frequency of transfusion transmitted malaria varies from 0.2 per million cases for non-endemic countries to 50 or more
cases per million in endemic areas [4]. The microscopic detection of blood though considered the gold standard for malaria diagnosis for decades, it is quite labor intensive and require adequate technical skill and man power. This had spurred the development of other microscopic malarial and rapid detection test based on the detection of malarial parasite antigen in the whole blood [5]. Donors who are implicated as the source of transfusion transmitted malaria cases typically have very low level of parasitemia undetectable even on several thick films [6].

The parasites load in infected donors may be very low; therefore, no clinical symptoms may be observed and Plasmodium species may live in the donors for years. This study was undertaken to determine the prevalence of malaria among voluntary and replacement blood donors.

Material & Methods

Type of study: Retrospective study

Result

Out of the 16495 blood donors, 5013(30.39%) were voluntary donors and 11482 (69.61%) were replacement donors. Maximum blood donors were Rh positive. There was a higher rate of male blood donation than females. Most of the donors were from age groups of 20–40 years. Thus indicating more youngster population as donors

| Transfusion transmitted infections(TTI) | Voluntary donors(5013) | Replacement donors(11486) | Total donors(16495) |
|---------------------------------------|------------------------|---------------------------|---------------------|
| Malaria                               | 0                      | 5                         | 5                   |
| HIV                                   | 03                     | 14                        | 17                  |
| Hepatitis B                           | 109                    | 202                       | 311                 |
| Hepatitis C                           | 03                     | 31                        | 34                  |
| Syphilis                              | 0                      | 4                         | 4                   |

Table-2: Percentage of various infections in total TTI.

| Transfusion transmitted infections | % of Total TTI |
|-----------------------------------|----------------|
| Malaria                           | 1.34%          |
| HIV                               | 4.58%          |
| Hepatitis B                       | 83.82%         |
| Hepatitis C                       | 9.16%          |
| Syphilis                          | 1.078%         |

Totally, 2.25% (n = 371) bags were seropositive for transfusion transmitted infections (TTI) out of 16495 donors. Prevalence of Hepatitis B is highest 1.88% (311 donors) followed by infected with HCV 0.20% (34 donors), HIV 0.10% (17 donors), malarial 0.03% (5 donors) and syphilis 0.024% (4 donors) (Table 1). Hepatitis B was the leading cause among the TTI 83.82% followed HCV 9.16% and HIV 4.58% (Table 2).5 out of 16495 donor population were positive on Immuno chromatographic rapid diagnostic test for malarial antigen detection. In our study all 5 malaria positive donors were replacement donor.
Discussion

Malaria, one of the most important parasitic diseases in under-developed countries, is a serious transfusion transmitted infection ranked after viral hepatitis and HIV.

The extensive use of blood and its products, and close contacts of human beings, enhanced the risk of transfusion transmitted malaria. Plasmodium species can be transmitted by transfusion of cellular components in labile blood products, and unlikely by frozen/thawed therapeutic plasma. All Plasmodium species are able to survive in stored blood, even if frozen, and retain their viability for at least 1 week, possibly well over 10 days depending on the conditions of storage; in fact, microscopically detectable malaria parasites were present even after 28 days of storage at 4°C although a decrease of infectivity after 2 weeks was observed [6,7,8]. Asymptomatic carriers have potential role as the source of infection for Anopheles vectors as well as blood recipient.

Presence of Plasmodium falciparum in blood may lead to fatalities when the blood is transfused especially in the children under 5 years, pregnant women, and accident victims etc [6]. A recent international forum showed that in Europe, as well as the USA, prevention of transfusion associated protozoa infections depend mainly on selection of donors using questionnaires. A donor is rejected for 3 years after their last visit to the endemic area [9]. Persons from the non endemic areas, who visited the malaria endemic area, are rejected for 4-12 months [10]. Over the last decade only a few cases of transfusion transmitted malaria were reported in various countries.

There is evidence that ABO histocompatibility of blood groups not correlated to the incidence of malaria [9], but it has been linked as a coreceptor in parasite and vascular cytoadherence with higher rosette rates among non group O compared to group O erythrocytes [11]. Donors who are implicated as the source of transfusion transmitted malarial cases typically have very low level of parasitemia undetectable even on several thick films [12]. Several studies have demonstrated an overall high sensitivity of Histidine Rich Protein (HRP 2) based diagnostic assays and their potential clinical utility for the diagnosis of malaria in symptomatic patients [13,14,15].

In our study there are only 5 cases(all cases found in replacement donors) found positive on Rapid detection test by immunochromatography (0.03% prevalence rate). which was comparable with study conducted by Bahadur et al (prevalence 0.03%) [5], Fernandes H et al (prevalence 0.01%)[16], Pallavi et al were unable to find a single case of malaria [17], Yadav et al were unable to find a single case of malaria [18], Negi et al (prevalence 0.002%) [19], Rajesh Kumar et al (prevalence 0.006%) [20], Fulzele et al (prevalence 0.0177%)[21] and Akanksa Rawat et al (prevalence rate 0.06%) [22]. Authors Ali MSM et al[23], Okocha EC et al[24], Owusu-Ofori Alex K et al[25] found very high prevalence of 6-55% in their studies may be due to high endemic area.

| S.N. | Study | Malaria positivity (%) |
|------|-------|------------------------|
| 1    | Bahadur et al, LadyHarding MC, Delhi [5] | 0.03% |
| 2    | Fernandes H et al, Mangalore (India)[16] | 0.01% |
| 3    | Pallavi et al, Mysore[17] | 0.00% |
| 4    | Yadav et al, Central India [18] | 0.00% |
| 5    | Negi et al, Uttarakhand [19] | 0.002% |
| 6    | Rajesh kumar et al, Ludhiana [20] | 0.006% |
| 7    | Fulzele et al, Mumbai [21] | 0.0177% |
| 8    | Akanksha Rawat et al, Delhi [22] | 0.06% |
| 9    | Ali MSM et al, Sudan [23] | 6.5% |
| 10   | Okocha EC et al, Nigerian teaching hospital[24] | 30.2% |
| 11   | Owusu-Ofori Alex K et al, Northern Nigeria[25] | 55% |
| 12   | Present study | 0.03% |

The drugs and cosmetic act in India mandates the testing for malaria but there is no definite guidelines on the choice of the test. Since apparently healthy individuals those selected for blood donation may have very low density and may be easily missed [26]. Donors who are considered as the source of transfusion transmitted malaria cases, typically have very low level of parasitemia. Which undetectable even on thick smears.
Malaria antibody screening is not indicative of active infection and results in unnecessary high discarding of collected blood units. Malaria antibody may persist up to several years after infection. PCR test have limited availability. Also malaria immunoprophylaxis to all blood recipients is also not feasible practically. Post-transfusion malaria may cause severe clinical symptoms in the recipients, especially in those with no previous exposure to malaria or in immunocompromised patients due to other coexisting diseases [27]. An important difference between the natural infection and TTM is that the former undergoes an initial asymptomatic phase (pre-erythrocytic) which allows the activation of innate immunity cells against malaria parasites. Infected blood transfusions directly release malaria parasites in the recipient’s blood stream triggering the development of high risk complications and potentially leading to a fatal outcome [28]. Delayed or missed diagnosis of P. falciparum in particular increases the risk of severe disease which may be fatal especially in non-immune individuals.

In case a patient is transfused with a malaria positive blood, the patient can be given a curative regimen of antimalarials, especially when the patient falls into the malaria vulnerable group (children, pregnant women, immigrants from outside malarious regions).

**Conclusion**

Our study result showed that Blood donors in Blood Bank, Jhalawar Hospital & Medical College Society, Jhalawar, Rajasthan have low prevalence of malaria. Voluntary donations are safer as compared to replacement donation.

**Recommendations:** Use of rapid detection devices with peripheral smear screening of positive cases (2) strict donor selection, proper donor testing and post testing counseling. (3) Voluntarily blood donations should be encouraged so as to prevent blood donations from being made under emergency situations because in such cases the likelihood of transfusing infected blood will be higher.

**Contribution from authors**

- **Dr. Manish Kumar:** Preparation of manuscript, Data collection, Data compiling, literature review, final approval.
- **Dr. Brajendra Shakyawal:** Manuscript editing, literature review, final approval
- **Dr. Yogendra Madan:** Literature review, Final approval

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