

## **Malaria and Donor Deferral at King Abdulaziz University Hospital in Saudi Arabia: A Practice Review**

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*Abstract.* One of the major occurrences initially documented of transmitted-transfusion of Malaria through blood transfusion remains uncommon, but medically serious and lethal. Several regions in Saudi Arabia documented Malaria as major health problem. Since 1958, blood establishments deferred donors based on history disclosure and previous illness to minimized risk. Careful inquiring is essential for identifying travel information and disease history to defer those at risk. Our aim is to estimate the prevalence of malaria parasites in random donors, review the efficiency practice in donor deferral, and compare our policy to other international policies. Retrospective study on record examination of blood donor questionnaire and testing files in Blood Transfusion Services at University Hospital from 2005-2010. Results provided extensive baseline data; total donor in 2006 was 2378 compared to 1987, in 2010 less number of deferral was presented. In the past five years (2006-2010), deferral rate was 22.84% and 4.2% of total donors, thus still high. Since early 2000, existing policy of blood donor deferral was adapted. Updated essential policy in accepting donors is required; suitable deferral procedures, accurate methods with proper laboratory viewing may diminish the danger factor in the coming years and thus, eliminating malaria among blood donors.

*Keywords:* Malaria, Donor testing, Donor deferral.

### **Introduction**

The most common human infections are incurred by the four types of species Plasmodium; *Plasmodium ovale* (*P. Ovale*), *Plasmodium vivax*,

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Accepted for publication: 6 February 2013. Received: 5 December 2012.

*Plasmodium falciparum* (*P. falciparum*) and *Plasmodium malariae* (*P. malariae*); caused by the bite of an anopheline female mosquito which transmits this protozoan disease through blood feeding). Consequently, most death related to malaria is caused by the severe disease, *P. falciparum*. In 1911, the first incidence of malaria transmitted infection through blood transfusion was reported, therefore considered as the most common transmitted infection worldwide<sup>[2]</sup>. To minimize transmission risk most effectively, donor deferral and specific screening for antimalarial immunoglobulin was implemented in non-endemic nations; however, still inefficient<sup>[3]</sup>.

As the traveling to malaria areas are increasing, the once eradicated disease is reemerging, thus spreading throughout the globe. Present methods are unreliable; therefore, more reliable measures are required to prevent the spreading of accidental exposure of malaria<sup>[4]</sup>. The problem is much greater in common areas as donors may possibly be infected with malaria parasites<sup>[2]</sup>, or be semi-immune with few parasite loads. Malaria transmissions have been reported to mainly transpire from the red cells product of a single-donor, platelets, and from concentrated white blood cell cryoprecipitate, in addition to thawing and washing of the frozen red cell. Hence, transmission from fresh-frozen plasma of a single-donor has not been proven; cryoprecipitate transmission is unusual, thus likely replicate the methods of preparation as well as the point for which the plasma is free from the cell<sup>[3]</sup>.

Saudi Arabia is a malaria endemic area (Fig. 1); however, the precise occurrence of transfusion-transmitted malaria is still unknown. The significance of this problem was discussed before in previous publications<sup>[4]</sup>. Jeddah, a city in the western part of Saudi Arabia near the Holy City of Makkah, is the gateway for the pilgrims visiting; therefore, the risk could be even double.

### ***Aim***

The objective is to review our present procedures in admitting donors who traveled to malarial areas and with a history of malaria, as well as to compare other international policies against our policy in order to improve donor base at our hospital.

### Method

A data based on donors retrospective analyses for the past five years of 2006 to 2010, following the local policies; permanently dismiss donors with previous malarial history or visitors who traveled in a year period to infested malaria regions. In addition, the donor questionnaire used in our hospital for donor selection related to malaria.

- 1 Have you ever had Malaria in the past?
- 2 Are you a citizen from or visited country with endemic of malaria?
- 3 In the last year have you traveled abroad?



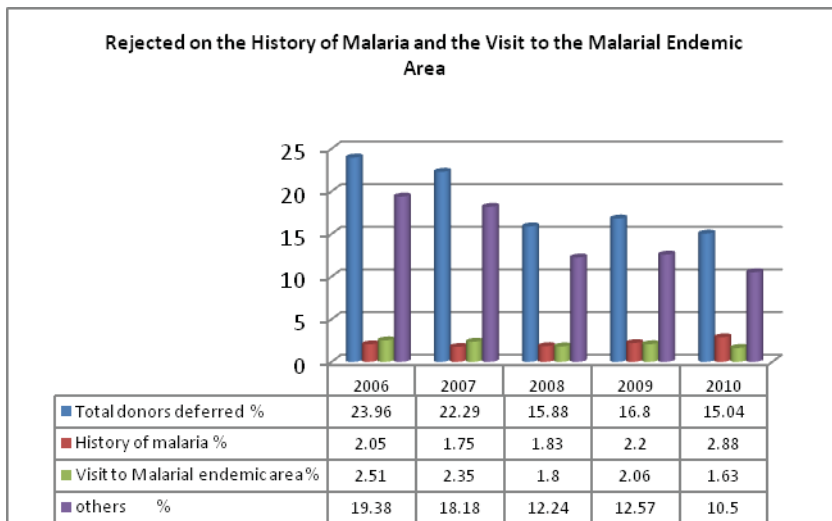
Fig. 1. Malaria map (WHO).

## Results

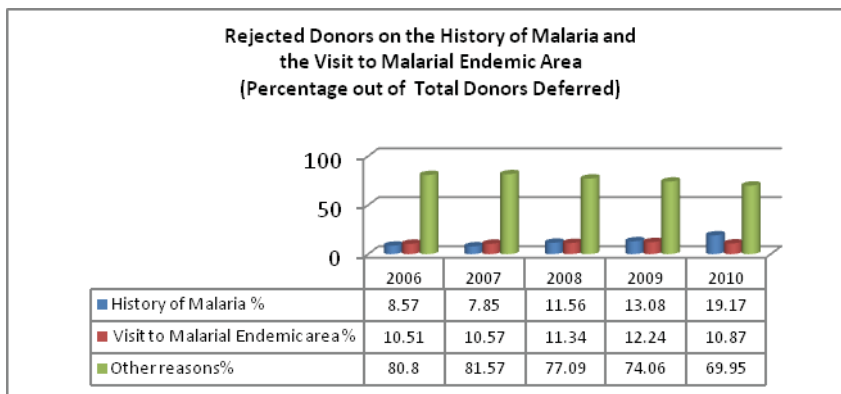
As demonstrated (Table 1), during the year of 2006, the total figure of donors accepted was 7546 (76.03%). Whereas, 2378 (23.96%) donors were rejected, out of these; per the history of malaria; permanently were 204(8.57% rejected: 2.05% of total donors). Based on visit to endemic malaria areas; temporarily were 250 (10.51% rejected: 2.51% of total donor) (Graphs 1 & 2). However, in the year 2007, total number of donors accepted was 8301 (77.07%). Number of rejected donors was 2382 (22.29%), out of these, per the history of malaria; permanently were 187(7.85% rejected: 1.75% of total donors). Rejected donors based on visiting to malarial areas (temporarily) were 252 (10.57% rejected and 2.35% of total donor) (Graphs 1 & 2).

**Table 1. Categories: Total numbers of donors rejected on the history of malaria and the visited of malarial endemic area (Year 2006-2010).**

|  | 2006 | 2007  | 2008  | 2009  | 2010  | Total |
|--|------|-------|-------|-------|-------|-------|
| Total donors                                   | 9924 | 10683 | 11215 | 12119 | 13208 | 57149 |
| Total donors deferred                          | 2378 | 2382  | 1781  | 2041  | 1987  | 10569 |
| Deferral by history of malaria                 | 204  | 187   | 206   | 267   | 381   | 1245  |
| Deferral by H/O visit to malarial endemic area | 250  | 252   | 202   | 250   | 216   | 1170  |
| Deferral due to other reasons                  | 1924 | 1943  | 1235  | 1524  | 1390  | 8016  |



**Graph 1. Percentage of donors rejected on history of malaria and visit to malarial endemic areas compared to other reasons of deferral & total deferral donors out of total donors.**



**Graph 2. Percentage of donors deferred by history of malaria and visit to malarial endemic area compared to other reasons out of total deferred donors in percent.**

Although, in 2008, the accepted total figure of donors was 9434 (84.11%). Thus, the numbers of donors rejected were 1781 (15.88%), out of these, malarial past history (permanently) were 206 (11.56% rejected; 1.83% of total donors). The number of rejected donor based on visiting malarial regions (temporarily) were 202 (11.34% rejected: 1.80% of total donor) (Graph 1 & 2). Nevertheless, in the year 2009, the donors accepted figure was 10,078 (83.15%). The numbers of rejected donors were 2041 (16.84%), from these, per the history of malaria; permanently were 267 (13.08% rejected: 2.20% of total donors). The figure of rejected donors based on visit to endemic malaria area; temporarily was 250 (12.24% rejected: 2.06% of total donor) (Graph 1 and 2).

Consequently, in the year 2010, the total number of donors accepted was 11,221 (84.95% of total donors). Rejected number of donors was 1987 (15.04% of total donors), for which, per on history of malaria (permanently) were 381(19.17% rejected: 2.88% of total donors). The total figure of rejected donors based on visit to endemic malaria area (temporarily) was 216 (10.87% rejected: 1.63% of total donor) (Graphs 1 & 2). A further looked into the donor, the number of voluntary donors for five years were 11,825 (25.38%) and number of replacement donors were 38,471 (82.59%) of the overall donors accepted. From these figures, the total number of voluntary donors were rejected based on visit to endemic area and history of malaria were (2.03%) of total rejected donors. The total numbers of replacement donors rejected by the same

criteria were 20.81% of total donors rejected, which is comparatively very high (Tables 2 and 3).

**Table 2. Total number of replacement and volunteer donors (Year 2006-2010).**

| Year | Total Collection | Total Collection | Replacement | Volunteer |
|------|------------------|------------------|-------------|-----------|
| 2006 | 8279             | 8279             | 5905        | 2374      |
| 2007 | 9038             | 9038             | 6469        | 2569      |
| 2008 | 10213            | 10213            | 7792        | 2421      |
| 2009 | 10949            | 10949            | 8181        | 2768      |
| 2010 | 11817            | 11817            | 10071       | 1746      |

**Table 3. Type of donors rejected on the history of malaria and visit to the malarial endemic area.**

|                                       | 2006 | 2007 | 2008 | 2009 | 2010 | Total |
|---------------------------------------|------|------|------|------|------|-------|
| Total Rejected donors                 | 2378 | 2382 | 1781 | 2041 | 1987 | 10569 |
| <b>History of Malaria</b>             |      |      |      |      |      |       |
| Voluntary donors                      | 49   | 12   | 15   | 34   | 14   | 124   |
| Replacement donors                    | 155  | 175  | 191  | 233  | 367  | 1121  |
| <b>Visit to Malarial Endemic Area</b> |      |      |      |      |      |       |
| Voluntary donors                      | 29   | 23   | 17   | 12   | 10   | 91    |
| Replacement donors                    | 221  | 229  | 185  | 238  | 206  | 1079  |

## Discussion

The most serious and precarious consequence is the transfusion of malaria transmitted by blood transfusion. Although the number of cases is low in non-endemic countries, nonetheless, they still transpire. A discussion conducted in an international debate on blood donations, in the last decades, one to twelve cases have been reported on transmitted protozoan infections (malaria) on non-endemic nations; the number of 'malaria risk' donors relatively low (0.003-0.75%)<sup>[5]</sup>. However, the figures are increasing as travel progresses; hence, the disease spreads in an accumulative rate. This matter is far greater in endemic countries, as possibly, most donors are infected with malarial organisms. In either situation, it is not practical to dismiss donors based on 'risk' factors as losses are unsustainable. The most effective strategy is temporary deferrals with proper screening of donors who are considered a risk factor as it provides safety while ensuring sufficiency<sup>[6]</sup>.

The two main aspects to consider when assessing malarial threats and transfusion are based on: Percentage taken on the risk of a single donor and the capability of the system to handle and identify the donor as well

as the donation. Many countries are taken a simple step, to identify and enduringly defer any persons with 'malaria risk'. Permanent deferral of a cumulative group of donor may very rapidly decrease the total donor base. Implementation of selective screening techniques for 'risk-malaria' donors, such as specific *in-vitro* screening is recommended for confirmation of malarial infection. This methodology relies upon detailed criteria of selective donors and the use of limited deferral periods. However, it facilitates the reinstatement of those donors with no evidence of infection. In both methods, the need for better and reliable donor-referral criteria is imperative<sup>[7]</sup>. Some parts of Saudi Arabia is endemic for malaria (map), therefore, a strict guidelines to determine the eligibility of a donation, which does not jeopardize the donor's pool are extremely important. Diminishing the risk of induced malaria through transfusion comprises on the positive background of donors with a recent clinical malaria occurrence. This policy is presently implemented in Saudi Arabia and in agreement with the Ministry of Health directives for potential donors, specifically in answering this point.

This report looks into the study conducted in Saudi Arabia regarding the use of malarial testing before donation for donor. Deferral revealed an overall malaria antibody prevalence of 7.6%, which is a reflection of malaria endemicity in this country. By contrast, a 0.1% prevalence rate seen among United Kingdom donors, found malaria antibody effective in the screening of selective 'risk' donor. Discarding such a high number of reactive donations will be difficult as this will result in blood shortages, especially, when most of these donors probably had recovered completely from an acute *P. falciparum* infection; the most common type of malaria in Saudi Arabia. Further complications lead to donors counseling, management and their subsequent deferral<sup>[3]</sup>. The numbers might extend to several years as antibody persistence was clearly demonstrated by the follow-up of one of our patients. Therefore, boundless care is imperative in devising appropriate testing methods to overcome any loss of donors. In contrast to the antibody assay, the *P. falciparum* antigen-test will allow for discarding of a very small number of units estimated at about 0.2%, as in this study<sup>[4]</sup>.

Serological testing and travel-based restrictions are ineffective in areas with high endemicity due to the high level of existing immunity against the history of limited blood supply. Tactics and policies to reduce the occurrences of transfusion-transmitted malaria, focuses on the

provision of antimalarial. Donor and recipient can be given Chemoprophylaxis, restricting transfusion of donated blood collected in areas of high endemicity from patients, and from those with pre-existing immunity<sup>[8]</sup>. General testing worldwide of donated blood of malaria parasites has not been possibly implemented due aptly sensitive and cost-effective test (discussed later). In many countries in Africa and India<sup>[9]</sup>, microscopic examination for malaria parasites using Giemsa-stained blood films and antigen detection by monoclonal antibody have been implemented. In Vietnam, however, the use of polymerase chain reaction (PCR) to screen donated blood (instead of microscopy) has been proposed<sup>[10]</sup>. Another potential strategy involves direct insertion of antimalarial drugs, such as chloroquine or quinine directly into the donated unit (cf, gentian violet and *Trypanosoma cruzi* (*T. cruzi*)). Though, the effectiveness of this approach till now fails to assess accurately<sup>[11]</sup>. Hence, one potential problem with this approach is that antimalarial drugs are stage specific and repeatedly given on several parasite life cycles to ensure cure. Thus, a brief exposure to an antimalarial drug at therapeutic concentration in a unit can infect the whole blood before transfusion. Subsequently, dilution and metabolism of the drug may not reduce transfusion risk significantly when administered. Furthermore, type of donation also affects donor's pool as volunteer donor has less risk of malaria infection as shown in the present results.

According to particular reports of asymptomatic persistence of malarial parasites, prolongs infected persons and in certain circumstances, it resulted in transmission of malaria. However, in the past 10 years no incidence of transmitted transfusion of malaria reported at our hospital. This was possible since the policy of permanent deferral for any donor with past history of malarial infection was implemented. This achievement will encourage in continuing or update our policy of permanent deferral donors with history of malaria infection at any time in their life. Therefore, donors who visited malarial areas, is suggested to review our practice and apply the new policy of donor deferral. According to World Health Organization (WHO) on donors deferral who visited low risk malarial areas, classification for 6 months and validated antibody screening test, plus one year to donors visited high risk malarial areas with a validated antibody screening test are required.



## Conclusion

According to this report, the result of deferral rate for malaria in the past five years (2006-2010) was 22.84% of total donor deferral and 4.2% of total donors, which is still high. The necessity to update the policy in accepting donors must be considered at our center. Lastly, recruitment of volunteer donors to increase their percentage from 25% to reach up to 100% at our hospital will lead to decrease in the number of donor deferral, and the availability for safer and uncontaminated blood.

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## مراجعة سياسة استبعاد المتبرعين المشتبه في إصابتهم بالمalaria في مستشفى جامعة الملك عبد العزيز

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*المستخلص.* يعتبر انتقال مرض الملاريا عن طريق نقل الدم من غير المؤلف ولكنه خطير وقاتل من الناحية الطبية. وقد تم توثيق الملاريا كمشكلة صحية كبيرة في عدة مناطق في المملكة العربية السعودية. منذ عام ١٩٨٥م تأخذ بنوك الدم في اعتبارها تاريخ المرض بالملاريا وأيضا الاستفسار الدقيق عن السفر إلى أي مكان موبوء، كأمر ضروري للتقليل من العدوى، وتحديد أهلية المتبرعين بالدم. تهدف هذه الدراسة إلى تقدير معدل انتشار الملاريا عند المتبرعين بالدم ومقارنة أنظمة نقل الدم وإجراءات عدم قبول المتبرعين اللذين قد سبق لهم الإصابة بالملاريا أو زيارة منطقة موبوءة بالملاريا في مستشفى جامعة الملك عبد العزيز بين أعوام ٢٠٠٦ - ٢٠١٠م بسياسات وإجراءات الدول الأخرى. وخلصت النتائج أنه في عام ٢٠٠٦م كان مجموع رفض الدم من المتبرعين حوالي ٢٣٧٨ مقارنة بـ ١٩٨٧ في عام ٢٠١٠م. وكان مجموع رفض الدم في خلال خمس سنوات من عام ٢٠٠٦م - ٢٠١٠م بسبب الملاريا حوالي ٢٢,٨٤٪، و ٤,٢٪ من حالات الرفض بمجملها وتعتبر هذه النسبة عالية. لم تحدث سياسة المنع (رفض

الدم من المتبرعين) ببنك الدم في مستشفى جامعة الملك عبد العزيز منذ عام ٢٠٠٠م لذلك من المهم تحديث وتطوير هذه السياسة وإضافة الفحوصات المخبرية المهمة التي تساعد على إكتشاف الملاريا ومن ثم التقليل من خطورة العدوى.