The Prevalence of Transfusion-Transmissible Infection in Blood Donors in Thammasat University Hospital between 2007-2012

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Background: Due to the campaign for increasing amount of blood donation, a safe blood donation strategy is an important goal to serve clinical use in medical practice.

Objective: Study the prevalence of transfusion transmitted infections in donated blood after the well-planned safe blood donation strategy.

Material and Method: Retrospective data of blood donation to the Blood Bank Unit of Thammasat University Hospital, between 2007 and 2012 was reviewed and studied the trend after the implementation of a well-planned safe blood donation strategy in 2010. This strategy included well planned active campaign, donor selection and screening process. The blood was analyzed according to age, sex, first time blood donation, and repeated blood donation, for transfusion transmitted infection by using CMIA for HIV, HBsAg, HCV, and Syphilis. Sequential test was done for NAT for HIV, HBV, and HCV. The data were analyzed by percentage and Chi-square test.

Results: The amount of blood donation increased 83.18%, from 7,792 units in 2007 to 14,273 units in 2012, including an increase of 314% at the mobile site donation. The increasing amounts were donated from the lower positive prevalence groups:- repeated blood donors, female blood donors, 17 to 20 years old first time blood donors in greater proportion than the higher positive prevalence groups (p<0.001). Prevalence of infection-donated-blood decreased in the last three years (2010 to 2012), compared to the first three years (2007 to 2009), 0.14-0.18%, 0.52-0.82%, 0.10-0.17%, and 0.21-0.32% vs. 0.26-0.28%, 0.97-1.42%, 0.26-0.42%, and 0.35-0.53% for HIV, HBsAg, HCV, and Syphilis respectively (p<0.001). Prevalence of infection-donated-blood also decreased in all groups in the last three years, compared to the first three years (p<0.001). Prevalence of repeated donation from previous-positive-infectious-markers-blood-donors also decreased.

Conclusion: The increasing amount of blood donation with decreasing prevalence of transfusion transmitted infection indicates a well planned active campaign, an improving donor selection and screening strategy in safe blood donation service.

Keywords: Blood donation, Prevalence of HIV, HBsAg, HCV, Syphilis
Microparticle Immunoassay (CMIA) of the donor blood sample would be repeatedly tested by using the same methods for the blood from both sample-tube and intravenous line. A positive test result would be done after the results of both tests were positive, which indicated an infected blood unit. That blood unit would be discarded and destroyed. The positive infectious marker blood donor would be notified not to give further donation and counseled. Every unit that had negative result would be tested using nucleic acid amplification technology (NAT) for HIV, HBV, and HCV.

The prevalence of positive infectious markers in general population depends on various factors such as age, sex, behavior, culture, life style, location. There were reports of lower prevalence of positive infectious markers in some groups, such as the repeated blood donor that had been verified by the previous blood donation, the female donor due to less behavioral risk, and the younger age group (17 to 20 years old) due to less exposure. The objectives of the present study are to study the prevalence of transfusion transmitted infection of the donated blood in the Blood Bank Unit of Thammasat University Hospital between 2007 and 2012. We analyzed the trend after implementing the in-service well-planned active blood donation strategy and the improvement in donor selection process in 2010.

Material and Method

The retrospective study was done from the data record of the Blood Bank Unit of Thammasat University Hospital between 2007 and 2012 with the approval of the ethical committee, Faculty of Medicine Thammasat University. The data included age, sex, first time donation, repeated blood donation, site of donation (blood bank or mobile site), and the results of infectious marker tests including anti-HIV, HIV Ag, HBsAg, Anti-HCV, and TPHA by using CMIA, and HIV, HBV, and HCV by using NAT.

The in-service well-planned active blood donation strategy has been implemented since 2010. It included the cooperation with Pathumthani Province Red Cross Teamwork to provide intensive motivation campaigns in low positive prevalence infectious disease populations such as young age group between 17 and 20 years old, female, repeated blood donor, a selection of site that the target group usually had activity or easily joined such as the big department store center (Future Park), and a selection of time that provided convenience for donation, such as holidays or in the afternoon period. The improvement in donor selection process have also been launched since 2010, including pre-donation counseling using self-selected information sheets in combination with intensive screening interview for the donors and using the blood bank deferral registry data record to identify the ineligible donors before any blood drawn.

The number of blood donation each year was summarized, but due to the big flood in Pathumthani province in the last trimester of 2011, there was no blood donation service during that time. The blood donation service has resumed operation again on the first trimester of 2012.

Statistical analysis

Data were reported in frequency and percentage. The comparison was analyzed by Chi-Square test for trend at significant level of 0.05 with SPSS version 17.

Results

The amount of blood donations in the last three years, between 2010 and 2012 increased from 8,609 to 14,273 units, which was an even bigger increase than the first three years, between 2007 and 2009 that increased from 6,090 to 7,792 units. This was because of the increasing amount of mobile site donations, which more than offset the decrease in blood bank donations (Table 1). Therefore, the ratio of mobile site donations and blood bank donations in the last three years was reversed from the first three years (Fig. 1).

The ratio of repeated blood donations and first-time blood donations in the last three years (69.83% vs. 30.17% to 75.93% vs. 24.07%) statistically

<table>
<thead>
<tr>
<th>Year</th>
<th>Units</th>
<th>Blood bank</th>
<th>Mobile sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>7,792</td>
<td>5,047 (64.77)</td>
<td>2,745 (35.23)</td>
</tr>
<tr>
<td>2008</td>
<td>6,090</td>
<td>3,780 (62.07)</td>
<td>2,310 (37.93)</td>
</tr>
<tr>
<td>2009</td>
<td>7,205</td>
<td>3,770 (52.32)</td>
<td>3,435 (47.68)</td>
</tr>
<tr>
<td>2010</td>
<td>9,520</td>
<td>3,289 (34.55)</td>
<td>6,231 (65.45)</td>
</tr>
<tr>
<td>2011</td>
<td>8,609</td>
<td>2,297 (26.68)</td>
<td>6,312 (73.32)</td>
</tr>
<tr>
<td>2012</td>
<td>14,273</td>
<td>2,904 (20.35)</td>
<td>11,369 (79.65)</td>
</tr>
<tr>
<td>Total</td>
<td>53,489</td>
<td>21,087 (39.42)</td>
<td>32,402 (60.58)</td>
</tr>
</tbody>
</table>
significant increased from the first three years (71.68% vs. 28.32% to 74.37% vs. 25.63%) \((p<0.001)\).

The proportion of female blood donations in the last three years (43.77 to 48.51%) increased from the first three years (37.39 to 42.93%), whereas the proportion of male blood donations in the last three years (56.23 to 51.49%) decreased from the first three years (62.61 to 57.07%), although both of them increased in amounts. This made the female/male blood donation ratio increased in the last three years compared to the first three years with statistical significance \((p<0.001)\) (Table 2).

The age group of 17 to 20 years old, which was the highest proportion of the first-time blood donor age group, distribution in the last three years (47.21 to 51.19%) increased from the first three years (44.31 to 49.89%) with statistical significance \((p<0.001)\) (Table 3).

In the present study, we found 114 units of blood were donated from 82 repeated serology positive blood donors in six years, gradually decreasing in the number of blood units and the donors. It started from 37 units in 29 donors in 2007 to 12 units in nine donors in 2012 (Table 4). The repeated serology positive blood donations in mobile site (106 units, 92.98%) were more than in the blood bank (8 units, 7.02%), showed in Table 5.

There was no HIV Ag positive in 53,489 blood donors in this study. There was also no HIV, HBV,
The prevalence of HIV, HBV, HCV, and Syphilis in blood donors in the last three years (0.14 to 0.18%, 0.52 to 0.82%, 0.10 to 0.17%, and 0.21 to 0.32%, respectively) decreased from the first three years (0.26 to 0.28%, 0.97 to 1.42%, 0.26 to 0.42%, and 0.35 to 0.53%, respectively) with statistical significance \((p<0.001)\) (Fig. 2).

The prevalence of HIV, HBV, HCV, and Syphilis in the first-time blood donors in the last three years (0.49 to 0.53%, 2.06 to 2.65%, 0.32 to 0.53%, and 0.52 to 1.16%, respectively) decreased from the first three years (0.63 to 0.77%, 3.43 to 4.58%, 0.77 to 1.18%, and 1.02 to 1.45%, respectively) with statistical significance \((p<0.001)\) (Fig. 3).

The prevalence of HIV, HBV, HCV, and Syphilis in the repeated blood donors in the last three years (0.20 to 0.25%, 0.83 to 1.29%, 0.12 to 0.20%, and 0.26 to 0.47%, respectively) decreased from the first three years (0.32 to 0.37%, 1.36 to 1.89%, 0.29 to 0.56%, and 0.38 to 0.67%, respectively) with statistical significance \((p<0.001)\) (Fig. 4).

The prevalence of HIV, HBV, HCV, and Syphilis in the female blood donors in the last three years (0.07 to 0.10%, 0.15 to 0.34%, 0.07 to 0.14%, and 0.14 to 0.17%, respectively) decreased
from the first three years (0.13 to 0.18%, 0.29 to 0.81%, 0.22 to 0.32%, and 0.26 to 0.33%, respectively) with statistical significance ($p<0.001$) (Fig. 4).

The prevalence of HIV, HBV, HCV, and Syphilis in the age group of 17 to 20 years old first-time blood donors (0.18%, 2.36%, 0.37%, and 0.47%, respectively) were the lowest of all first-time blood donors age groups ($p<0.001$) (Fig. 5).

The prevalence of all infectious diseases increased with the age of the first-time blood donors with statistical significance ($p<0.001$), except the prevalence of HBV, which was reversed between the age group of 21 to 30 years old first-time blood donors (3.71%) and the age group of 31 to 40 years old first-time blood donors (3.30%) with statistical significance ($p<0.001$) (Fig. 5).

**Discussion**

The present study showed the amount of blood donation of the Blood Bank Unit of Thammasat University Hospital increased 83.18% from 7,792 units in 2007 to 14,273 units in 2012. The donations from the mobile site markedly increased by about 314%
This was the result of the new implementation of active blood donation strategy in the cooperation with a well-planned campaign of Pathumthani Province Red Cross Teamwork. The present study also showed that the safety of the blood donation with the new improvement in donor selection processes was the most important aspect apart from the increasing amount of blood donation. The results were a decreasing prevalence of positive of all four infectious markers (HIV, HBsAg, HCV, and Syphilis) in donated blood in the last three years (2010 to 2012) compared to the first three years (1997 to 1999) (Fig. 2). The present study showed that the new strategic blood donation program paid attention to the target groups with lower prevalence of infectious diseases such as the repeated blood donor, the female blood donor, and the younger age group between 17 and 20 years old. This is also shown in the other studies (2-5,7,8,12,19,21,24,27,29). The result of the present study showed that the percentages of the amounts of blood donation from these target groups increased more than the percentages of the amounts of blood donated from the groups with higher prevalence of infectious diseases, such as the first-time blood donor, the male blood donor, and the older age groups, in the last three years compared to the first three years (Table 2, 3 and Fig. 3-5).

The present study also showed that the surveillance system to prevent repeated donation from previous positive infectious markers blood donors was effective in the six years of study (Table 4), but there was still more prevalence in the mobile site (Table 5). This may be due to the inadequate data in donor selection process, or the screening process in the mobile site that was not sensitive enough. This could require further improvement (13,14).

The present study also showed that the prevalence of all positive infectious markers in all groups of blood donors such as the first-time blood donor, the repeated blood donor, the male blood donor, the female blood donor, and the first-time blood donor with different age groups decreased in the last three years when compared to the first three years. However, the decline in the lower positive prevalence groups (those had been described) was more than the higher positive prevalence groups. These may be due to decrease prevalence of the infectious diseases in the general population (5,16,21,32-35), or the result of the well-planned campaign with effective heath education for blood donor, such as the intensive motivation of low infectious disease prevalence population, young age group-first-time blood donor motivation, the comprehensive education of self-healthcare, and decreased behaviors at risks in regular blood donors.

The conclusion of the improvement in donor selection and screening process, such as pre-donation counseling, self-evaluation, and intensive screening interview for the donor, and using the blood bank deferral registry data record (5,12,15,17,19,20,27,32,36,37) may have help reaching this goal. For the post-donation blood screening test, the present study also confirmed the negative results in every blood unit by using NAT for HIV, HBV, and HCV to insure the safety of donated blood. There was a report of breakthrough transmissions after NAT screening (38), which made the donor selection even more important. This sequential testing is cost-effective in high prevalence of transfusion transmitted infection area (39).

Conclusion

With the increasing amount of blood donation, the prevalence of transfusion transmitted infection could be minimized by the intensive recruitment of lower infectious disease prevalence blood donors, including the repeated blood donor, the female blood donor, and the first-time blood donor young age group of 17-20 years old. A well-planned active blood donation strategy, and improving donor selection and screening processes are a great procedures to lower the risk.

What is already known on this topic?

Safe blood donation is the important goal in blood donation service. Repeat blood donors, female blood donor, and young-age group have low prevalence of transfusion transmitted infection.

What this study adds?

This study presented how to recruit safe blood donors in the blood donation service. Well-planned active blood donation campaign with intensive motivation of low prevalence transfusion transmitted infection population group is the key process in increasing safe blood donation. Improvement of donor selection process is the important step in safe blood donation.

Acknowledgement

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Potential conflicts of interest

None.

References

ความชุกของการติดเชื้อในเลือดของผู้บริจาคโลหิตในโรงพยาบาลธรรมศาสตร์เฉลิมพระเกียรติ ระหว่าง พ.ศ. 2550-2555

ผู้เขียน เจียมจรรยา

ยุทธศาสตร์: การเพิ่มปริมาณการรับบริจาคโลหิต ควบคู่กับมาตรการการจัดหาโลหิตที่ปลอดภัย เป็นเป้าหมายสำคัญของการบริการโลหิตในกากรักษาทางการแพทย์

วัตถุประสงค์: การทำให้ความชุกของการติดเชื้อในเลือดที่รับบริจาคลดลง เป็นการควบคู่กับการจัดหาโลหิตที่ปลอดภัย

วิสัยทัศน์: การเพิ่มปริมาณการรับบริจาคโลหิต ระหว่าง พ.ศ. 2550 ถึง พ.ศ. 2555 ของโรงพยาบาลธรรมศาสตร์เฉลิมพระเกียรติ ซึ่งมีการใช้มาตรการเชิงรุกในการจัดหาโลหิตที่มีการวางแผนเป็นอย่างดี รวมถึงการพัฒนากระบวนการคัดเลือกและตรวจคัดกรองกุมวิรัชที่มีประสิทธิภาพ ดังนั้น พ.ศ. 2553 โดยวิเคราะห์ข้อมูลด้านอายุ เพศ ผู้บริจาคโลหิตครั้งแรก ผู้บริจาคหลอดเดียว ผลการตรวจการติดเชื้อ HIV, HBsAg, HCV และ Syphilis แล้วคำนวณความชุกของการติดเชื้อ และเปรียบเทียบโดยใช้สถิติ Chi-square ทดสอบ

ผลการศึกษา: ปริมาณการรับบริจาคโลหิตเพิ่มขึ้นถึงร้อยละ 83.18 จาก 7,792 ยูนิต ใน พ.ศ. 2550 เป็น 14,273 ยูนิต ใน พ.ศ. 2555 โดยเฉพาะอย่างยิ่งจากการบริจาคในสถานที่ เหมือนเดิม ร้อยละ 314 ปริมาณการรับบริจาคโลหิตเพิ่มขึ้นจากกลุ่มผู้บริจาคที่มีความชุกของการติดเชื้อที่ต่ำ เช่น ผู้บริจาคโลหิตครั้งแรก ผู้บริจาคโลหิตเพศหญิง ผู้บริจาคโลหิตครั้งแรกที่มีอายุ 17-20 ปี ในอัตราส่วนที่มากกว่า กลุ่มที่มีอัตราการติดเชื้อสูง (p<0.001) แนวโน้มความชุกของการติดเชื้อในเลือดที่รับบริจาคลดลงในช่วง 3 ปีหลัง (พ.ศ. 2553-2555) เมื่อเปรียบเทียบกับ 3 ปีแรก (พ.ศ. 2550-2552) ทั้ง HIV, HBsAg, HCV และ Syphilis ที่ดังนั้น ร้อยละ 0.14-0.18, 0.52-0.82, 0.10-0.17 และ 0.21-0.32 จากร้อยละ 0.26-0.28, 0.97-1.42, 0.26-0.42 และ 0.35-0.53 ตามล่าสุด (p=0.001) แนวโน้มความชุกของการติดเชื้อต่าง ๆ ในเลือดที่รับบริจาคจากผู้บริจาคโลหิตครั้งแรก ตรงกันได้โดยชัดเจน ในช่วง 3 ปีหลัง เมื่อเปรียบเทียบกับในช่วง 3 ปีแรก (p=0.001) นอกจากนี้ปริมาณการรับบริจาคโลหิตขึ้นจากผู้บริจาคโลหิตที่เคยตรวจพบว่ามีเชื้อแล้ว

สรุป: การรับบริจาคโลหิตเพิ่มขึ้นตามกลุ่มผู้บริจาคที่มีการติดเชื้อลดลง ประสิทธิภาพกระบวนการจัดหาโลหิต ซึ่งมีการควบคุมคุณ และการตรวจสอบการติดเชื้อเร็วที่มีประสิทธิภาพและมีความปลอดภัย