



The Evaluation of Blood Requests for Transfusion and It's Utilization in Four Iranian Hospitals

Azita Chegini^{1*}, Alireza Ebrahimi² and Amirhossein Maghari³

¹Blood Transfusion Research Center, High Institute for Research and Education in Transfusion Medicine, Tehran, Iran.

²Department of Hematology, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran.

³Department of Biostatistics, New Hearing Technologies Research Center, Baqiyatallah University of Medical Science, Tehran, Iran.

Authors' contributions

This work was carried out in collaboration between all authors. Author AC designed the study, wrote the protocol, and wrote the first draft of the manuscript. Authors AC, AE and AM managed the literature searches, analyses of the study performed the spectroscopy analysis and managed the experimental process and identified the species of plant. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/IBRR/2015/17177

Editor(s):

(1) Dharmesh Chandra Sharma, Incharge Blood Component and Aphaeresis Unit, G. R. Medical College, Gwalior, India.

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Complete Peer review History: <http://sciencedomain.org/review-history/11201>

Original Research Article

Received 1st March 2015
Accepted 8th August 2015
Published 1st September 2015

ABSTRACT

Background: Transfusion is one of the most important elements of healthcare. In order to save human lives, 85 million blood units are used in the world annually. Access to blood products is a common problem throughout the world. Presently, demand is increasing significantly for blood usage. The main goal is to evaluate blood usage in four hospitals by comparing them with international standards and utilization of efficient methods to prevent unnecessary transfusions.

Materials and Methods: This is a retrospective hospital based survey carried out at Tehran Blood Transfusion Centre. Data regarding blood transfusion requests, units requested, units cross matched, unused units returned and other details were collected from the blood bank laboratory records in four Iranian hospitals. The crossmatched to transfusion ratio was evaluated.

*Corresponding author: E-mail: azita_chegini@yahoo.com;

Results: There were a total of 548,568 requests for units of blood in total. 196, 059 units were crossmatched and 82,320 units were transfused. The proportion of C/T (total) was 2.38 and the proportion of transfusions to the number of beds was 16. The C/T ratios for all hospitals were 2.38. Only 42% of blood cross matched units was utilized. One of four hospitals in our survey which specializes in cardiac the C/T ratio is 1.86 and the ratio of blood infusion to hospital bed is 19.7. Another hospital specializes in pediatric hematology oncology and C/T ratio is 1.04 (the ratio of blood infusion to hospital bed=19.6). A 1,000 bed general hospital with cardiac and oncology departments in which C/T ratio is 2.94.

Conclusion: We saw over ordering requests of blood units which is different in 4 hospitals. The number of beds and departments can have a direct effect on the C/T ratio. The quantity of blood used depends on the number of beds and fields of specialization present at the hospital. Suitable usage of blood depends on great hospital and number of expertise. There is a need to expand our hemovigilance teaching program. Use of abscreening helps to achieve a more efficient blood utilization and should be engaged in our locality to prevent unnecessary demands.

Keywords: Blood component transfusions; blood grouping and cross matching; erythrocyte transfusions.

1. BACKGROUND

Transfusion is one of the most important elements of modern healthcare. In order to save human lives 85 million blood units are used in the world annually [1]. According to World Health Organization the amount of required blood in Southeast Asia is around 16 million units per year from which 9.4 million units are collected [2]. The improper use of medical technology plays a vital role in the escalation of treatment costs. Inappropriate blood usage is another major factor. Other factors contributing to the rising expenditures are infusions of blood products, collection, logistics, laboratory tests and prescriptions [3].

Access to blood products is a common problem all over the world. At the moment demand has increased significantly for blood usage. A high percentage of blood products are wasted due to excess demand for blood products in elective surgeries and a lot of time and a very high quantity of reagent is wasted. Extensive research in the United States of America and Australia has shown that with proper usage, collection of information from blood banks and routine training, expenditures can be significantly reduced. It is possible to avoid unnecessary cross matches through blood group tests and Abscreening in low risk surgeries and following maximum surgical blood order schedule standards [4].

In 1975, Henry Boral suggested that utilization of cross matched units to transfusion units ratio would be effective in the application of blood products. American Association of Blood Banks

recommends that cross matched units to transfusion units ratio should equal 2 or less for surgical patients and almost 1 for medical patients [5,6]. In some other sources the cross matched units to transfusion units ratio standard is mentioned as less than 1.5 for medical patients. The ideal ratio for cross matched units to transfusion units ratio is equal to 1 and if the C/T ratio is more than 2.5, it means there are unnecessary cross matches and demonstrates that less than 40% of cross matched units are injected. The standard according to World Health Organization is 6-16 blood units per hospital bed [7]. The purpose of this survey is to evaluate cross matched to transfusion ratio as a measure or efficient blood utilization in Tehran.

2. MATERIALS AND METHODS

This is a retrospective study carried out at Tehran blood transfusion Centre. Data was collected on blood product pattern of requests and utilization from different blood bank's hospitals in the region over a period of three years, between 2010 and 2012 were retrieved. Blood Bank's hospitals sent completed forms monthly. Information in the form included: units requested, units cross matched, units transfused, units returned unutilized and Blood groups of transfused. Four hospitals had selected included:

- A- University hospital specialized in cardiac surgery with 460 active beds.
- B- General hospital with 1000 active beds.
- C- Private General Hospital with 150 beds.
- D- Private pediatric hematologic hospital with 100 beds.

This data was used to evaluate the C:T ratio, which was described as the number of cross match units transfused/ number of cross matched units requested. Data is analyzed by using IBM SPSS (ver.21) software.

3. RESULTS

Four hospitals were studied; two private and two public. They had requests for 548,568 units of blood in total. Out of 548,568 units of blood, 196,059 units were cross matched and 82,320 units were transfused. The proportion of C/T (total) is 2.38 and the proportion of transfusion to the number of beds is 16. Only 42% of blood cross matched units was utilized.

Hospital A- University hospital has 460 beds and specializes in cardiovascular surgery. The total blood request for a 3 year period was 79,411. Number of cross matched, transfused and returns are present in Table 1. During the stated three years the number of transfusions per bed was reduced but the number of returns increased. A noticeable difference is apparent during these 3 years (p=0.008).

Hospital B is a general hospital with 1,000 beds. The total blood requests for a 3 year period were 456,265. Number of cross matched, transfused and returns are seen in Table 2. The proportion

of cross matched units to transfusion units ratio is 2.94. The proportion of transfusion to the number of beds is 15. But the number of transfusions during the three years of the study is not statistically significant, however, there is a noticeable difference in the number of returns for the 3 year period with hemovigilance education (p=0.002).

Hospital C is a general private hospital with only major departments. Total blood requests for a 3 year period were 6,755. Number of cross matched, transfused and returned units are seen in Table 3. The proportion of cross matched units to transfusion units ratio was 1.79. The proportion of transfusions to the number of beds is 8.7. But the number of transfusions did not vary enough to be of statistical importance. However, there is a noticeable difference in the number of returns for the 3 year period (p=0.002).

Hospital D has 100 beds and specializes only in pediatric hematologic and oncology. The proportion of C/T is 1.04. The proportion of transfusions to the number of beds is 19.6. The proportion of transfusions to the number of beds increased in the third year and reached 21.03, but there is no noticeable difference in the number of returns (Table 4).

Table 1. Distribution of requested, cross matched, transfused, returned packed cell units in a university hospital specialized in cardiac surgery with 460 active beds during 2010-2012

	Requested units	Cross matched units	Transfused units	Returned units	Ratio C/T	Transfused to beds ratio
2010	26236	16555(63%)	9443(36%)	3815(23%)	1.75	21.46
2011	27584	17178(62%)	9409(37%)	4204(24.5%)	1.82	21.38
2012	25591	16643(65%)	8336(50%)	4920(29.6%)	2	18.95
Total	79411	50376(63.4%)	27188(54%)	12939(25.7%)	-	-

Table 2. Distribution of requested, cross matched, transfused, returned packed cell units in hospital B-general hospital with 150 beds during 2010-2012

	Requested units	Cross matched units	Transfused units	Returned units	Ratio C/T	Transfused to beds ratio
2010	158453	45014(28.4%)	15544(34.5%)	168(0.37%)	2.91	15.5
2011	151940	44708(29.4%)	15455(34.6%)	0	2.9	15.4
2012	145872	43080(29.5%)	14340(33.3%)	0	3.01	14.3
total	456265	132802(29%)	45339(34%)	168(0.1%)	-	-

Table 3. Distribution of requested, cross matched, transfused, returned packed cell units in hospital C- general private during 2010-2012

	Requested units	Cross matched units	Transfused units	Returned units	Ratio C/T	Transfused to beds ratio
2010	2142	2142(100%)	1135(53%)	17(0.8%)	1.9	7.57
2011	2421	2421(100%)	1491(61.9%)	32(1.3%)	1.64	9.94
2012	2192	2190(99.9%)	1284(58.6%)	49(2.2%)	1.84	8.6
total	6755	6753(99.9%)	3910(57.9%)	98(1.4%)	-	-

Table 4. Distribution of requested, cross matched, transfused, returned packed cell units in hospital D-private pediatric hematologic oncologic during 2010-2012

	Requested units	Cross matched units	Transfused units	Returned units	Ratio C/T	Transfused to beds ratio
2010	1876	1867(99.5%)	1824(97.7%)	15(0.8%)	1.02	18.24
2011	2054	2054(100%)	2013(98%)	18(0.8%)	1.04	21.03
2012	2208	2208(100%)	2189(99%)	19(0.8%)	1.05	21.03
total	6138	6129(99.8%)	6026(96%)	52(0.8%)	-	-

Distribution of blood groups and Rh according to requested units are follow as Table 5.

Table 5. Distribution of Blood groups and Rh according to requested units of four hospitals

Group	Percent
O ⁺	33.2
A ⁺	29.6
B ⁺	20.9
AB ⁺	7.1
O ⁻	3.3
A ⁻	3.1
B ⁻	2.1
AB ⁻	0.7

4. DISCUSSION

Blood and its products play a great role in saving lives during emergency and elective operations. With great advances in medical sciences, the demand and utilization of blood has grown tremendously but the supply has remained constant [8]. A study on blood utilization was published by Friedman and his associates in 1973, his conclusion was that 1-2.5 figure in cross matched units to the transfusion units (C/T) ratio is a sufficient ratio for utilization. It is also stated in this study that TI (transfusion index) ratio would provide a good method to assess the efficiency of the number of transfusions (TI =Transfusion/Cross matched) [9].

Numerous other studies carried out on the same subject have reached the same conclusion as the Friedman study, which states consumption is always greater than supply [10,11]. In a comprehensive study in India of the 1,145 units of cross matched blood units, 23.14% were transfused and the other 76.86% were not used at all [12].

The results of a more detailed study carried out in Nigeria during a three months period on 986 patients are as follow:

Trauma department C/T = 2.74, emergency department C/T = 2.61, general

surgery = 3.11. The percentage of unused blood units for emergency department was 63.10 %, general surgery 71.19% and trauma department 62.99%. In total, the ratio of C/T in this hospital is reported at 2.90 (cross matched =1608, transfused =555) [13].

Although our study is not as detailed as above mentioned cases and it only includes four hospitals that do not perform antibody screenings and the C/T ratio for all hospitals is 2.38. The expiration date of stored red blood cell products in our country is 35 days. Our study was carried out within a 3 years period on all four hospitals: Hospital A, C/T =1.86, Hospital B C/T=2.94, Hospital C C/T=1.79, Hospital D C/T=1.04. We had educated hemovigilance in 2012 and there is difference between years as shown Tables 1, 2, 3.

In Germany the quantity of blood infusions varies greatly among hospitals and the same trend is present in this study. Blood usage is varied among different hospitals and the ratio of blood infusion to hospital bed is as follow: Hospital A: 19.7, Hospital B:15.1, Hospital C: 8.7,Hospital D: 19.6. The above variation depends on care provided to patients and hospitals' specialization.

Blood loss varies in elective surgery patients but cancer and heart surgeries usually have a high quantity of blood consumption. Heart surgeries consume 20% of available blood. One study illustrates that cross match to transfusion ratio for the cardiac team is 2.48 [14]. But at hospital A in our survey which specializes in cardiac the C/T ratio is 1.86. Hospital D specializes in pediatric hematology oncology and C/T ratio is 1.04.

Hospital B is a 1,000 bed general hospital with cardiac and oncology departments in which C/T ratio is 2.94. The number of beds and departments can have a direct effect on the C/T ratio. The quantity of blood used depends on the number of beds and fields of specialization present at the hospital.

Numerous studies have shown that by utilizing a variety of tables (MSBOS); it is possible to reduce the number of requests and it is conceivable to reach an effective and economical solution for this problem through the use of such tables. Although our study is only descriptive and is not as detailed as the above mentioned cases and it only includes four hospitals and the average C/T ratio for the four hospitals is 2.38. There is a need to expand our teaching program, Antibody screening, do further research, gather more details and use the mentioned MSBOS tables in order to reach a more efficient method to prevent unnecessary demands.

Table 5 demonstrates blood type requests of the four hospitals in our survey which is similar to the country as a whole. Requests for A+, B+, AB +and O+ blood types shown in our study are 29.6%, 20.9%, 7.1% ,3.3% respectively. In Pourfathollah and associates study on Iranian blood donors during a one year period; of the total quantity donated 30.25% was blood type A and 37.62% was Blood O and 24.36% was blood type B and 7.77% was blood type AB [15].

5. CONCLUSION

One of four hospitals in our survey which specializes in cardiac the C/T ratio is 1.86 and the ratio of blood infusion to hospital bed is 19.7. Another hospital specializes in pediatric hematology oncology and C/T ratio is 1.04 (the ratio of blood infusion to hospital bed=19.6). A 1,000 bed general hospital with cardiac and oncology departments in which C/T ratio is 2.94. Only 42% of blood cross matched units was utilized. The number of beds and departments can have a direct effect on the C/T ratio. The quantity of blood used depends on the number of beds and fields of specialization present at the hospital.

Suitable usage of blood depends on reviewing ordering schedules. There is a need to expand ab-sceening test and our hemovigilance teaching program. Use of MSBOS helps to achieve a more efficient blood utilization and should be engaged in our locality to prevent unnecessary demands.

CONSENT

This study is not against the public interest, that the release of information is allowed by legislation.

ETHICAL APPROVAL

The authors have obtained all necessary ethical approval from suitable Institutional Committee.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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