# Monitoring Blood Consumption with Emphasis on MSBOS Table in Educational Hospitals Zahedan, Iran, 2014

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## ABSTRACT

*The proper utilization of blood is only clear in the application of blood transfusion to treat cases that lead to mortality and cannot be effectively prevented or treated by other methods [1]. Blood transfusion process faces cases such as storage time limitation and high preserving costs [2]. This study was conducted with the aim to determine blood consumption indices in patients hospitalized in educational hospitals in Zahedan. This descriptive-analytic study was carried out in educational hospitals of Zahedan, Iran, 2014. All submitted orders from the hospitals sections to the blood bank were assessed. Two major indices of crossmatch-to-transfusion ratio (C/T ratio) and Transfusion probability (TI%) were calculated for all the patients and individual sections and compared with the standard value. In relation to the C/T ratio index: the anesthetic section had the highest value with a ratio of 2.7 and the hematologic section had the lowest value with a ratio of 1.04. Furthermore, pediatric, internal, ICU and hematology sections were in a good position in terms of the C/T index. In relation to the TI index: the internal section had the highest value of 2.8 and the pediatric section had the lowest value of 0.87. In general, the orders of blood products and consumption are in a proper situation in the educational hospitals in Zahedan. Despite this, comparisons between the different studies can reveal contradictions in the situation of blood orders and consumption in the country.*

**Key words:** Blood Transfusion, Cross Match, Blood Products, Transfusion Probability

## INTRODUCTION

The proper utilization of blood is only clear in the application of blood transfusion to treat cases that lead to mortality and cannot be effectively prevented or treated by other methods [1]. Blood transfusion process faces cases such as storage time limitation and high preserving costs [2].

It is important to pay attention to the high costs of preparing blood products. In a study by a medical center in the United States of America, it was found that the basic price for preparing a single pack cell unit is $ 111 [3]. The cost of producing a pack cell (PC) unit is calculated to be $ 7.7 in Italy and $ 7. 4 in France [4]. Today, excessive blood orders is one of the most common problems in elective surgeries, which causes issues such as the inadequate distribution of blood products among different centers, rising blood supply costs, and increasing the workload of blood banks [5].

There are evidences based on the significant differences in the pattern of clinical utilization of blood among hospitals, clinicians and even peer doctors in one group [1]. Many doctors make their cross matched blood transfusion order based on a habit whose unnecessary consumption can cause shortage for the cases with real need. This increase in demand is due to fears of inadequate

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access to enough blood during surgery regardless of whether it is utilized or not used during surgery, or due to lack of a specific pattern for ordering blood, which ultimately causes blood shortages and worsens the overall state of keeping it [6].

To assess the rationality of blood orders and consumption, the ratio of cross matched blood to injected blood is used, whose acceptable value is 2 to 3. The higher values imply that the orders are not logical [7]. The major index of the crossmatch-to-transfusion ratio (C/T ratio) and the transfusion probability (% Transfusion probability) TI index are calculated for all the patients and individual sections and compared with the standard value. The acceptable value of the crossmatch-to-transfusion is 2-3, and its ideal value is 1. The transfusion probability of more than 37 indicates a significant need for blood. The C/T ratio of less than 2.5 indicates a significant need for blood [5].

Considering the fact that various specialized practices such as neurosurgery, orthopedics, burns, etc. are performed in the educational treatment centers of the University of Zahedan and these centers are also referral centers of the province, many patients are in urgent need of blood. In many cases, crossmatch and blood orders are routinely performed, but blood is not utilized and returned in some cases. Therefore, this study was conducted with the aim to determine blood consumption index in patients admitted to surgery in the educational hospitals of Zahedan.

## MATERIALS AND METHODS

This descriptive-analytical study was performed on all orders submitted to the blood bank of the educational hospitals of Zahedan, Iran, 2014. The inclusion criteria included not having thalassemia disease because those patients are constant consumers of blood, and the exit criteria included having thalassemia and inadequate recorded information.
The sections studied included pediatrics, emergent and internal surgery, general surgery, internal, emergency, gynecology, hematology, burns, orthopedic, neurological, dialysis, internal neurology, operating room, ICU, NICU, PICU, PCCU and ENT. The data was completed by an expert at the hospital's follow-up and supervising unit for six months from October, 20, 2014.

Two major indices of crossmatch-to-transfusion ratio (C/T ratio) and transfusion probability (TI%) were calculated for all the patients and individual sections and compared with the standard value. The acceptable value of the crossmatch-to-transfusion ratio is 2-3 and its ideal value is 1. The transfusion probability of more than 0.5 indicates a significant need for blood [5].

The collected data from the patients were entered into SPSS version 15. Qualitative variables were characterized by percentage, and for quantitative variables, mean, standard deviation, standard error of the mean, and minimum and maximum values were used. In the study of the quantitative variables, the distribution of the variables was studied using Kolmogorov-Smirnov (KS) test, and P Value> 0.05 was considered as a normal distribution. Parametric and nonparametric tests are used according to their distribution to compare the mean of each group. Chi-square statistical test was used to investigate the qualitative variables.

## RESULTS

The frequency of patients demanding blood, cross matched blood units, blood units utilized, the average of units per patient, C/T ratio index and TI index are shown in table 1.

Chi-square test shows significant differences in the frequency of cross matched blood and blood units utilized based on the sections (Table 1).

χ²= Chi square test, Unit mean per patient: The ratio of the number of cross matched blood to the number of patients

C/T: The ratio of cross matched blood to injected blood, TI: The ratio of the number of blood units injected to the number of patients with cross matched blood

The frequency of requested products including FFP, Plt, Whole Blood and Cryoprecipitate according patients demanding blood, cross matched, utilized product, the average of units per patient, C/T ratio index and TI index are shown in table 2.

Chi-square test shows significant differences in the frequency of cross matched and utilized product based on the blood products (Table 2).

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**Table 1: Blood information and indices by the hospital's sections**

| Section | | Number of patients | Cross match | Consumed product | Unit's mean per patient | C/V | TI |
|---|---|---|---|---|---|---|---|
| Pediatrics | | 46 (11.5%) | 46 | 41 | 1 | 1.14 | 0.88 |
| Internal | | 46 (11.5%) | 186 | 133 | 4 | 1.39 | 2.90 |
| Anesthesia | | 17 (4.25%) | 142 | 52 | 8.35 | 2.72 | 3.07 |
| Gynecology | | 93 (23.25%) | 319 | 122 | 3.43 | 2.62 | 1.31 |
| Emergency | Pediatric emergency | | 46 | 46 | | 1 | |
| | Emergency medicine | | 12 | 12 | | 1 | |
| | Emergency | | 168 | 35 | | 4.83 | |
| | Overall | 46 (11.5%) | 225 | 93 | 4.89 | 2.43 | 2.02 |
| ICU | ICU | | 23 | 17 | | 1.33 | |
| | NICU | | 12 | 12 | | 1 | |
| | PICU | | 6 | 6 | | 1 | |
| | Overall | 35 (8.75%) | 41 | 35 | 1.16 | 1.16 | 1 |
| Hematology | Adults | | 110 | 110 | | 1 | |
| | Pediatrics | 75 (18.75%) | 52 | 46 | | 1.125 | |
| | Overall | | 161 | 157 | 2.15 | 1.03 | 2.09 |
| | Total | 400 | 1119 | 632 | 3.57 | 1.65 | 1.89 |
| χ² | | | 67.53 P< 0.001 | 41.82 P< 0.001 | | | |

**Table 2: Information and blood indices by requested product type**

| Product type | Number of patients | Cross match | Utilized product | Mean of units per patient | C/T | TI |
|---|---|---|---|---|---|---|
| **FFP** | 137(28.8%) | 437 | 170 | 3 | 2.57 | 1.24 |
| **Packed Cell** | 331(69.6%) | 572 | 361 | 2 | 1.58 | 1.09 |
| **Plt** | 90(18.9%) | 92 | 92 | 1.80 | 1.00 | 1.80 |
| **Whole Blood** | 2(0.42%) | 15 | 9 | 7.50 | 1.67 | 4.50 |
| **Cryoprecipitate** | - | - | - | - | - | - |
| χ² | | 90.21 P =0.00 | 10.29 P =0.00 | | | |

*χ2= Chi square test    FFP: Fresh Frozen Plasma,    Plt: Platelet*

## DISCUSSION

The overall mean of the average of blood units per patient in the hospital was 3.57.

Furthermore, pediatric, internal, ICU and hematologic sections are in good condition in terms of the C/T index.

The overall mean of the TI index in the hospital is 2.09. The study of blood indices according to the requested product type indicates that the study of the frequency of patients requesting blood sample indicates that of 400 patients in the considered time period, 28.8% of the patients requested FFP, 69.6% requested packed cell, 18.9% requested Plt and 0.42% requested Whole Blood.

The anesthetic section has the highest value of 3.07 and the pediatric section has the lowest value of TI index 0.88.

The comparison of cross matched blood amount according to the requested blood product is significant according to the Chi-square test. The highest demand is for Packed Cell and the lowest for Whole Blood.

The comparison of the amount of blood consumed according to the requested blood product is significant according to the Chi-square test. The highest consumption was for packed cell and the lowest for whole blood.

Comparing the results of this study and the results of the study by Karami, the highest section requesting blood products in the recent years changed from surgical emergencies in the study by Karami with 14.2% [8], to the obstetrics and gynecology section with 45%, which could be due to a greater number of patients in this section than in other sections in present study. Of course, considering the two C/T and TI indices, which are 2.62 and 1.31, in the gynecology section, it can be said that there is no standard pattern for requesting blood product compared to other sections.

The gynecology section is ranked third in terms of C/T index after the sections of adult emergency

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and anesthesia. Furthermore, Packed Cell is the most demanded product.

In the study by Koushesh *et al.,* the highest C/T ratio was in the gynecology section with 9.8 and the lowest in the orthopedic section with 1.2. This ratio was 1.94 and 2.28 in the sections of general surgery and urology respectively [9], and the highest C/T index in our study was related to the adult emergency section with 4.83.

In the study by khoshrang *et al.,* the overall C/T index was acceptable as compared with the expected value 2-3, but there was a clear difference in different centers [10]. The most frequent requests were from surgery sections (42.8%) and the least was from the internal sections (7.1%). The mean of hemoglobin in the patients who received blood was 9.03 ± 2.19, which differed from our study in terms of the most request from a section.

In the study by Koushesh *et al.,* the highest C/T ratio was in the gynecology section with 9.8 and the lowest in the orthopedic section with 1.2 [9], which was close to our study.

## CONCLUSION

In general, the demand for blood products and blood consumption is in a favorable situation in the educational hospitals of Zahedan, and it shows that blood reservation is not performed according to a specific instruction in some sections and the need for quantitative and qualitative control in the area of reserving and consuming blood is necessary in the treatment centers. In spite of this, comparisons of different studies can reveal contradictions in the state of requesting and consuming blood in the country.

### Acknowledgements

### Conflict of Interest
The authors declare that they have no conflict of interest regarding the manuscript.

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