A Survey of Blood Request Versus Blood Utilization at a University Hospital in Iran

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Abstract

Background: Reservation of blood leads to blood wastage if the blood is not transfused. Therefore, in some centers only blood type and screen are evaluated. In this study, the efficacy of a blood crossmatch-to-transfusion ratio was measured and then compared with the standard levels.

Methods: This prospective study was conducted during one year in a university hospital. During this period, 398 patients for whom blood had been requested were studied. In these patients, at the first surgical type, the laboratory tests (hematocrit, hemoglobin, platelet count, and prothrombin time) and the number of preoperative crossmatched and intraoperative transfused blood units were recorded. Then the crossmatch-to-transfusion ratio, transfusion probability, transfusion index, and correlation between related factors, and the transfusion ratio were evaluated.

Results: In this cross-sectional study, blood was requested for 398 patients. According to available blood unit deficiency, from 961 blood unit requisitions, only 456 units were crossmatched and 123 units were transfused. The crossmatch-to-transfusion ratio, transfusion probability, and transfusion index were 3.71 (7.81 if all requisitions were crossmatched), 16.83%, and 0.31, respectively. The most unfavorable indexes were observed in patients who had ear, nose, and throat surgeries (0 transfused from 19 crossmatched blood units) and obstetric and gynecologic surgery (crossmatch-to-transfusion ratio was 18.6). The best indexes were related to thoracic surgery and neurosurgery (crossmatch-to-transfusion ratio was 1.53 and 1.54, respectively). There were no significant correlations between hemoglobin, hematocrit, platelet count, and prothrombin time with the number of transfused blood units ($P = 0.2, 0.14, 0.26,$ and $0.06$, respectively).

Conclusion: The data for the crossmatch-to-transfusion ratio, transfusion probability, and transfusion index were suboptimal at this center, especially for ear, nose, and throat and obstetric and gynecologic surgeries. Further multidimensional studies and determination of a new model for blood requests and to decrease blood wastage are needed.

Keywords: Blood grouping and crossmatching, Blood products, Blood transfusion
of transfused units); the values >0.5 are considered appropriate for blood quality (3-5,7).

The current limitations in blood accessibility have led to the use of the maximum surgical blood order schedule (MSBOS) to reduce blood wastage. The MSBOS comprises of a list of surgeries that require crossmatching and another list of surgeries for which only blood types and screens are needed (5,8). Based on this schedule, crossmatching is limited to only the surgeries with a high need for blood transfusion. The MSBOS is used to determine crossmatched blood units that can be formulated with a transfusion index multiplied by 1.5.

Because blood access is problematic in emergency cases, the aim was to evaluate the current blood reservation system in elective surgeries to reduce over ordering and increase the reservation of blood units in the future.

Materials and Methods
After approval by the Deputy Research of Medical Sciences, this study was conducted in a university hospital in 2013. During one year, we studied all surgical patients at the hospital for whom blood was crossmatched. Demographic data, such as age and sex, and the parameters that increased the probability of a need for blood transfusion, such as type of surgery, hemoglobin (Hb), hematocrit (Hct), platelets, and prothrombin time (PT), were assessed. Transfusion was done and recorded during surgeries while taking into consideration the blood loss of patients and the need to maintain an Hct level of 30% (maximum allowable blood loss = estimated blood volume × [initial Hct – final Hct/average Hct]). If no transfusion was needed, the blood bank was informed so that the crossmatched blood could be removed from the waiting list. Patients with open heart surgery, massive preoperative blood loss, Hct <30%, and confirmed coagulopathy were excluded from this study.

The C/T ratio, transfusion probability (number of crossmatched patients/number of transfused patients × 100), and transfusion index (number of crossmatched patients/number of transfused units) were measured in total and based on the type of surgery.

Data were analyzed using the SPSS version 16 software (IBM, Armonk, NY). The C/T ratio, transfusion probability, and transfusion index were measured for various surgeries. Multiple linear regression was used to assess the relationship between independent parameters (Hb, Hct, platelets, and PT) and the C/T ratio.

Results
This cross-sectional prospective study was performed over a period of one year with surgical patients aged 43.7±18.1 years. During this period, 398 patients for whom blood had been requested were studied (58.3% female and 41.7% male). Preoperative Hct, platelets, and PT were 41.3 ± 0.8%, 128.2 ± 18.5 × 10³, and 13.5 ± 0.5 s, respectively [Table 1].

For all the studied patients, a total of 961 blood units was requested by the surgery department, and only 456 units were crossmatched by the blood bank staff (based on blood deficiency and without special guidelines). A total of 123 blood units were transfused to the study patients. The C/T ratio, transfusion probability, and transfusion index obtained were 3.71, 16.83%, and 0.31, respectively [Table 1].

After separating the surgical groups, we found that the highest numbers of blood units requested were for orthopedic, gynecological, and general surgeries, respectively. The highest numbers of crossmatched units were in orthopedic and gynecological surgeries.

<table>
<thead>
<tr>
<th>Surgical type</th>
<th>Cross matched patients (N)</th>
<th>Transfused patients (N)</th>
<th>Cross matched units (N)</th>
<th>Transfused units (N)</th>
<th>C/T Ratio</th>
<th>Transfusion probability</th>
<th>Transfusion index</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENT surgery</td>
<td>19</td>
<td>0</td>
<td>19</td>
<td>0</td>
<td>∞</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gynecological and obstetric</td>
<td>89</td>
<td>3</td>
<td>93</td>
<td>5</td>
<td>18.6</td>
<td>3.37</td>
<td>0.06</td>
</tr>
<tr>
<td>General surgery</td>
<td>86</td>
<td>5</td>
<td>90</td>
<td>9</td>
<td>10</td>
<td>5.81</td>
<td>0.10</td>
</tr>
<tr>
<td>Urology</td>
<td>36</td>
<td>5</td>
<td>39</td>
<td>9</td>
<td>4.33</td>
<td>13.89</td>
<td>0.25</td>
</tr>
<tr>
<td>Orthopedic</td>
<td>94</td>
<td>18</td>
<td>110</td>
<td>32</td>
<td>3.44</td>
<td>19.15</td>
<td>0.34</td>
</tr>
<tr>
<td>Neurosurgery</td>
<td>57</td>
<td>27</td>
<td>82</td>
<td>53</td>
<td>1.54</td>
<td>47.37</td>
<td>0.93</td>
</tr>
<tr>
<td>Thoracic surgery</td>
<td>17</td>
<td>9</td>
<td>23</td>
<td>15</td>
<td>1.53</td>
<td>52.94</td>
<td>0.88</td>
</tr>
<tr>
<td>Total</td>
<td>398</td>
<td>67</td>
<td>456</td>
<td>123</td>
<td>3.71</td>
<td>16.83</td>
<td>0.31</td>
</tr>
</tbody>
</table>
Several studies have been conducted in Iran as well, with transfusion probabilities of 26.9%, 47%, 59%, and 86.74%, respectively, having been observed (1, 7, 11, 12). In Nigeria, Ethiopia, India, and Egypt, transfusion probabilities were 18.8%, 8.69%, and 2.94% respectively, indicating a need for reassessment of the blood preparation policy.

In these three groups, transfusion probabilities were 36.4, 26.9, and 35.5, in the medium-risk, and 35.3, 26.9, and 35.2, in the low-risk groups (10).

Kozarzoska et al.'s research the general C/T ratio was 0.26, and 0.06, respectively [Table 3].

In developing countries, various C/T ratios have been reported (13-15).

The SBOE is a more advanced method than the MSBOS. In the SBOE, various surgery-related factors such as preoperative and postoperative Hb and perioperative bleeding are assessed, and the number of units needed for crossmatching in different surgeries is evaluated accordingly. This criterion decreases blood wastage compared with the conventional method. In Kajja's study the C/T ratio decreased from 2.3 to 1.5 when this method was used (17). Furthermore, in Mahadevan's study use of the SBOE rather than the MSBOS reduced the C/T ratios in hip surgery from 3.24 to 1.21 and in knee surgery from 7.95 to 1.2 (18). In addition, in other studies, SBOE has been more effective than the MSBOS in improving blood maintenance quality and reducing blood wastage (19-21).

A number of other factors are involved in the need for blood transfusion. In a study by Goundan on cesarean section the factors that seemed to be involved in the need for blood transfusion included placenta previa, anemia, placental disruption, atonic uterus, general anesthesia, and insufficient care during child delivery (22). In Bameshki's investigation on burn graft surgeries transfusion need was directly and inversely related to burn level and preoperative Hb, respectively (23).

In the present study, the C/T ratio, transfusion probability, and transfusion index were 3.71, 16.83%, and 0.31, respectively, which was not desirable compared to the other methods.

### Table 3. Correlation between preoperative Hb, Hct, platelet and Pt with blood transfusion; mean (standard deviation)

<table>
<thead>
<tr>
<th>Transfused blood units</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>P-value</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hb (mg/dl)</td>
<td>13.6 (0.9)</td>
<td>138. (0.6)</td>
<td>13.9 (0.8)</td>
<td>13.8 (0.4)</td>
<td>0.20</td>
<td>0.10</td>
</tr>
<tr>
<td>Hct (%)</td>
<td>41.1 (3.1)</td>
<td>42 (2.1)</td>
<td>42.1 (2.5)</td>
<td>42.4 (0.5)</td>
<td>0.14</td>
<td>0.11</td>
</tr>
<tr>
<td>Plt count (n/micl)(*1000)</td>
<td>128.3 (19.7)</td>
<td>131.9 (8.7)</td>
<td>124.9 (7.9)</td>
<td>139.8 (28.4)</td>
<td>0.26</td>
<td>-0.01</td>
</tr>
<tr>
<td>PT (second)</td>
<td>13.4 (0.5)</td>
<td>13.5 (0.5)</td>
<td>13.6 (0.5)</td>
<td>13.2 (0.4)</td>
<td>0.06</td>
<td>0.08</td>
</tr>
</tbody>
</table>
with the standard value. In various surgeries, this ratio varied from 1.53 in thoracic surgery to 18.6 in obstetric and gynecologic surgery. In ear, nose, and throat surgeries, none of the 19 crossmatched blood units were transfused. With regard to the selection of patients without coagulopathy or correction of preoperative anemia, we did not observe a significant correlation of PT, platelet, Hb, and Hct with transfusion rate.

In conclusion, because the C/T ratio in our study was 3.71 (without blood bank limitation, the C/T ratio was 7.81) and above the standard, we recommend that a multicenter study with different surgery types be performed to obtain an appropriate model and guideline for correction of blood transfusion quality and to decrease blood wastage and costs.

References


