Maximum Surgical Blood Ordering Schedule in Orthopedic Department at UNAIR Hospital January-June 2021

Diah Puspita Rini¹, Alexa Surya Romansyah², Andre Triadi Desnanto³

¹ Department of Clinical Pathology, Faculty of Medicine, Universitas Airlangga/Universitas Airlangga Hospital, Surabaya, Indonesia
² Faculty of Medicine, Universitas Airlangga, Surabaya, Indonesia. E-mail: axrom909@gmail.com
³ Department of Orthopedic, Universitas Airlangga Hospital, Surabaya, Indonesia

ABSTRACT

Excessive ordering of blood components causes problems such as a lack of proper distribution of blood products between centers, increased costs, and workload of blood banks. Effective use of MSBOS will reduce the cross-match of patient blood samples and reduce unnecessary testing. This is also expected as a way to improve the quality of health services at UNAIR Hospital and reduce patient treatment costs. This study aimed to find out the MSBOS profile for orthopedic surgery at UNAIR Hospital in the period January-June 2021. This study is a cross-sectional study with a sample of orthopedic patients at UNAIR Hospital. The period was 6 months (January-June 2021). Cross-match to Transfusion Ratio (CTR), transfusion probability, and transfusion index calculations were carried out so that MSBOS could be formulated. A total of 33 units of blood were cross-matched from 21 patients in this study, whereas only 5 units of blood were transfused to 4 patients. It was found that 7 out of 8 types of surgeries had a CTR value of more than 2, a total of 6 types of surgeries had a low transfusion probability (below 30), and 6 types of surgeries had a TI below 0.5. In Total Hip Replacement (THR) and ORIF plating symphysis surgery, it is recommended that 2 units of blood be MSBOS, while for others, Group, Screen, Hold (GSH) is recommended. Further research with larger samples is needed to obtain more accurate results.

Keywords: Orthopedic surgery, CTR, transfusion probability, MSBOS

INTRODUCTION

Transfusion in surgery is expected to be effective and efficient, but this is not in accordance with the situation in Indonesia, it was found that in several hospitals excessive surgical blood transfusion occurs. In 2012 at Sanglah Hospital, Denpasar, Bali, the total unused blood orders reached 6,719 bags per year.¹ According to research by Herlinah et al., in 2013 there was a 32% increase in canceled blood and 40.9% return, indicating that several conditions are still not appropriate to use blood transfusions.²

Excessive ordering of blood components causes problems such as a lack of proper distribution of blood products between centers, increased costs, and workload of blood banks. Blood is a valuable resource and the wastage of blood in low socioeconomic countries can have a very serious impact on health care. Inadequate availability of blood components due to wastage can interfere with blood transfusion in patients requiring surgery and can lead to hypovolemic shock if not administered.³-four

At the University Hospital in Michigan, the Maximum Surgical Blood Ordering Schedule (MSBOS) has been implemented with a profit of $57,335 per year.² Various types of surgeries are performed every day, indicating how important the MSBOS is to estimate pretransfusion as needed. The potential for success of MSBOS is quite high and will generate benefits for patients and hospitals. In previous studies at University Teaching Hospital in Northern Thailand, savings were found at $1,200 with the application of this MSBOS.⁵ The right step to deal with the wastage of blood is the implementation of MSBOS. According to Hashemi et al., MSBOS is designed for surgery based on reports from each hospital about the amount of blood used during surgery of various types.⁶

The effective use of MSBOS will reduce the crossmatch of patient blood samples and reduce unnecessary testing.² This is also expected as a way to improve the quality of health services and reduce patient treatment costs. UNAIR Hospital has a blood bank facility and one of its functions is regarding blood transfusion.⁷ Orthopedic surgery has many types of surgery and requires the most pre-transfusion blood preparation than any other surgery.² Indonesia is a country that has the largest fracture incidence in Southeast Asia as much as 1.3 million annually with a population of 238 million in Indonesia. In cases of
injury, this constitutes 9% of deaths worldwide and creates a huge demand for medical care and rehabilitation services. This makes the demand for blood in Orthopedic surgery increase for surgery. According to Adegboye, it was reported that more than 31% of the blood was used by orthopedic surgeons and cardiac surgeons, so researchers wanted to examine MSBOS in orthopedic surgery cases at the UNAIR Hospital.

METHODS

This research is a cross-sectional study. This study aimed to find out the MSBOS profile for orthopedic surgery at UNAIR Hospital during the January-June 2021 period. Subjects were orthopedic patients at UNAIR Hospital, Surabaya. The study was held for 6 months (January-June 2021). The data sources in this study were secondary data from medical records and blood banks at UNAIR Hospital from orthopedic patients who have provided blood request forms to the blood bank at UNAIR Hospital. The subjects were all patients who needed blood transfusions in orthopedic surgery at UNAIR Hospital in January-June 2021. The inclusion criteria in this study were all orthopedic patients who needed blood transfusions and filled out the blood request form of the UNAIR Hospital Blood Bank. Patients with incomplete medical records were excluded.

The first data collected were demographic data, including gender and age. Other data collected were the type of surgery, number of patients transfused, number of patients cross-matched, number of units cross-matched, and number of units transfused. For each type of surgical procedure, the total number of patients (the number of cross-matched patients), the number of patients transfused, the number of units transfused, and the number of cross-matched units were calculated.

Then CTR, transfusion probability, and Transfusion Index (TI) were calculated using the formula below:

**Cross-match to Transfusion Ratio (CTR):**

\[
CTR = \frac{\text{Number of units cross-matched}}{\text{Number of units transfused}}
\]

**Transfusion probability (%):**

\[
TP = \frac{\text{Number of patients transfused}}{\text{Number of patients cross-matched}} \times 100
\]

**Transfusion Index (TI):**

\[
TI = \frac{\text{Number of units transfused}}{\text{Number of patients transfused}}
\]

MSBOS: MSBOS = 1.5 X TI

MSBOS was formulated using Mead’s criteria, which stated that the calculated red blood cell count was one and a half times the TI for each surgical procedure. So, using Mead’s criteria and clinical experience, MSBOS is recommended for every surgical procedure.

This study has received approval from the Biomedical Research Ethics Commission of Universitas Airlangga Hospital number UA-02-2178.

RESULTS AND DISCUSSIONS

In this study, 21 patients in the age range of 0-83 years old that met the inclusion criteria were included (Table 1). A total of 21 patients underwent 8 types of orthopedic surgery, which included blood ordering and cross-matching. The research limitations are the number of samples and wide age range, different patient clinical conditions, with a wide age range, are clinical factors that also affect the need for transfusion.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Quantity</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>7</td>
<td>33.3</td>
</tr>
<tr>
<td>Female</td>
<td>14</td>
<td>66.7</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>100</td>
</tr>
</tbody>
</table>

A total of 33 blood units were cross-matched for 21 patients but only 5 units (15.2%) were transfused. Table 2 shows data on the type of surgery with the number of cases, the number of cross-matched units, the number of cross-matched patients, the number of units transfused, and the number of patients transfused. The type of surgery that has the most patients was THR with the highest number of cross-matched units and cross-matched patients, namely 17 and 10. In this study, only transfusion data were obtained for 2 types of surgery, THR and ORIF plating symphysis, respectively.

The results obtained CTR>2 in all types of surgeries. The results of the transfusion probability (%) <30 were found in 6 types of surgery, namely spine, TKR, femur fracture (ORIF), tibiofibular fracture (ORIF), ankle arthrotomy, and multiple fractures. Transfusion Index (TI) results were <0.5 in 6 types of
Table 2. Number of patients, unit cross-matched, patients cross-matched, unit transfused, and patient transfused on various orthopedic surgeries

<table>
<thead>
<tr>
<th>Type of Surgery</th>
<th>Number of Patients</th>
<th>Unit Cross-Matched</th>
<th>Patients Cross-Matched</th>
<th>Unit Transfused</th>
<th>Patient Transfused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spine</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>THR*</td>
<td>10</td>
<td>17</td>
<td>10</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>TKR**</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Femur fracture (ORIF)</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Tibiofibular fracture (ORIF)</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ankle arthrotomy</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>ORIF plating symphysis</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Multiple fractures</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>33</td>
<td>21</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

Abbreviations: THR, Total Hip Replacement; TKR, Total Knee Replacement

Table 3. Cross-match to transfusion ratio, transfusion probability, transfusion index, calculated MSBOS and recommended MSBOS for orthopedic surgeries

<table>
<thead>
<tr>
<th>Type of Surgery</th>
<th>CTR</th>
<th>T (%)</th>
<th>TI</th>
<th>MSBOS</th>
<th>Recommended MSBOS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spine</td>
<td>~</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>GSH</td>
</tr>
<tr>
<td>Total Hip Replacement (THR)</td>
<td>4.25</td>
<td>30</td>
<td>1.33</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total Knee Replacement (TKR)</td>
<td>~</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>GSH</td>
</tr>
<tr>
<td>Femur fracture (ORIF)</td>
<td>~</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>GSH</td>
</tr>
<tr>
<td>Tibiofibular fracture (ORIF)</td>
<td>~</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>GSH</td>
</tr>
<tr>
<td>Ankle arthrotomy</td>
<td>~</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>GSH</td>
</tr>
<tr>
<td>ORIF plating symphysis</td>
<td>2</td>
<td>100</td>
<td>1</td>
<td>1.5</td>
<td>2</td>
</tr>
<tr>
<td>Multiple fracture</td>
<td>~</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>GSH</td>
</tr>
<tr>
<td>Total</td>
<td>6.6</td>
<td>19.05</td>
<td>1.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*GSH: Group, Screen, Hold

surgery, namely spine, TKR, femur fracture (ORIF), tibiofibular fracture (ORIF), ankle arthrotomy, and multiple fractures. MSBOS calculations using Mead's criteria were performed on all 8 types of orthopedic surgery and MSBOS recommendations were set, taking into account the clinical experience of the orthopedic surgeon and patient variables. Based on Table 3, it can be seen that THR and ORIF plating symphysis surgeries have an MSBOS recommendation of 2 bags, while other surgeries receive a recommendation for MSBOS with the Group, Screen, Hold (GSH) method.

In this study, the CTR was 6.6. Total hip replacement surgery has the most cross-match units of 17 units with a CTR of 4.25. In the ORIF plating symphysis surgery, the CTR result was 2. In other types of surgeries, there were no transfusion units, so the results of the CTR calculation were infinite. The results of the CTR calculation above show that there is wastage in blood ordering. According to Adegboye, the results of CTR>2 indicate an indication of blood wasting.\(^9\) In 7 types of surgery in this study, blood was wasted and only 1 type of surgery (ORIF plating symphysis) did not waste blood.

The research of Hashemi et al. obtained a CTR of 1.56 surgical procedures at Imam Ali Hospital, Iran.\(^1\) It can be seen that the efficiency of ordering blood is better in this study. This difference may occur due to the difference in sample size. In that study, 1568 samples were used while in this study only 21 samples were used. The results obtained in Adegboye's research were a CTR of 2.3 in orthopedic surgery at a tertiary hospital in North Central Nigeria.\(^10\) This value when compared with this study is far enough to waste the blood of approximately 1:3.

Overall, 4 patients were transfused and 21 patients were cross-matched with a transfusion probability of 19.05%. According to Adegboye's research, a transfusion probability <30 is considered an indication of significant blood wastage.\(^9\) In this study, there were 2 types of surgery with no indication of wasting blood, namely THR and ORIF.
platting symphysis with a transfusion probability value of 30% and 100%. Meanwhile, in other surgeries, a value of 0% was obtained, which indicates significant blood wastage.

The transfusion index obtained is 1.25. According to research by Raghuwanshi et al., TI >0.5 is considered a significant indication of blood utilization. In the THR and ORIF platting symphysis surgeries, TIs were 1.33 and 1, which indicated efficient use of blood. In other types of surgery, a TI of 0 is obtained, which indicates that no blood order is required for the surgery.

In THR and ORIF platting symphysis surgery, MSBOS were obtained at 2 and 1.5. The MSBOS value for other types of surgery is 0. In this study, the recommended MSBOS for THR and ORIF platting symphysis surgery is 2 bags. The MSBOS recommendation for other types of surgery is to perform GSH.

In the implementation of MSBOS, patient variables, the clinical experience of practitioners, and the surrounding circumstances must also be considered. This guideline must be reviewed periodically and made adjustments so that the recommended MSBOS is effective and in accordance with current conditions. It is hoped that this MSBOS can have a positive impact on patients and the management of the UNAIR Hospital.

CONCLUSIONS AND SUGGESTIONS

Maximum surgical blood ordering schedule data obtained from hospital data will be objective evidence for decision-making that can reduce the number of unnecessary blood cross-matches. This can be a guideline for orthopedic specialists at UNAIR Hospital to determine blood orders for several types of surgery. These MSBOS guidelines must also take into account the practitioner’s clinical experience, patient variables, and surrounding conditions.

Further research is needed with a larger number of samples so that the data obtained better describes the actual conditions.

REFERENCES