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Original Research Article

Maximum Surgical Blood Order Schedule (MSBOS) in Orthopedic Surgeries in Hospitals of Tabriz

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ABSTRACT

Blood transfusion in orthopedic surgery is unavoidable; But not all people and all surgeries need a blood transfusion; Guidelines are needed to prevent blood transfusions and blood transfusions for eligible blood transfusions; Therefore, the aim of this study was to investigate the pattern of MSBOS ordering in orthopedic surgeries in hospitals in Tabriz. This cross-sectional study was performed in Shohada and Imam Reza hospitals (Tabriz University of Medical Sciences) in 2020 compared to 2019 as a pilot program of MSBOS ordering; The number of injected units and the number of cross-matched units calculated in the mentioned two years were compared with each other. C/T ratio was considerably reduced following MSBOS implementation from 3.97 to 1.57 (CI: 3.97-1.70; p=0.001). Transfusion index, following MSBOS implementation, considerably increased from 25.2% to 63.6% (CI: 36.25-40.55; p=0.001). Transfusion probability increased from 24.7% to 59.4% (CI: 31.73-37.67; p=0.001). In this study, cross-matching percent after MSBOS implementation was considerably reduced, suggesting its effectiveness in optimizing blood usage. Therefore, training surgeons and highlighting blood requests based on MSBOS contribute to efficient blood order management.

KeyWords: MSBOS, Orthopedic Surgery, Blood Transfusion.

Introduction

Despite dramatic advances in medical science, there is still no viable alternative to blood. Therefore, volunteer blood donors are the only source of blood products(1). The existence of healthy donor selection guidelines, lower donor numbers, and season-dependent donor numbers are factors that disrupt adequate blood supply(2). On the other hand, an increased need for advanced and complicated surgical procedures, costly blood bags, and a limited shelf life suggest the importance of efficient blood usage(3). Therefore, creating a balance between the capabilities of the Blood Transfusion Organization in supplying adequate safe blood and allocating such products is necessary. An efficient request for blood leads to enhanced health of recipients and reduces the processing costs and waste of blood(4).

As a result, different strategies have been proposed to optimize blood use efficiency. The Maximum Surgical Blood Order Schedule (MSBOS) was established four years ago by Friedman et al. to optimize requests for blood units preoperatively(7). MSBOS calculates the required blood units based on the maximum number of blood units that may be needed perioperatively. Moreover, MSBOS determines the number of blood units to be crossmatched preoperatively(8). Different studies have been done to investigate the effectiveness of MSBOS in optimizing blood use. Crossmatch to transfusion ratio (C/T ratio) is used to measure blood utilization. C/T ratio of higher than 2.5 suggests inefficient blood use. Given that orthopedic surgeries are among surgical procedures with high blood use, this study aimed to investigate the effectiveness of MSBOS adoption in optimizing blood use and reducing storage cost using the C/T ratio in orthopedic hospitals of Tabriz.

Methodology

This cross-sectional study was conducted in Shohada Hospital and Imam Reza Hospital, both affiliated to Tabriz University of Medical Sciences, to compare 2019 data to 2020 data after pilot MSBOS implementation. This pilot implementation was designed and considered in coordination with specialists in orthopedic surgery, anesthesia, and blood bank based on the current conditions for elective surgery.

To this end, educational classes were held for the surgeons to introduce MSBOS to them and highlight the significance of efficient blood order based on this system. To assess the

effectiveness of this system, the amount of blood use and C/T ratio in operative departments were compared before and after MSBOS implementation at similar months. In this study, the number of ordered blood units, the number of transfused blood units, and the C/T ratio before and after MSBOS implementation were investigated in all orthopedic surgical procedures. The only intervention was the introduction of MSBOS and all procedures in orthopedic surgeries were considered. The transfusion probability was calculated by the number of patients transfused divided by the number of patients cross-matched. Moreover, the transfusion index was calculated by dividing the number of transfused units by the number of cross-matched units. The effectiveness of MSBOS adoption in terms of cost was estimated at 53,592 rials by considering cross-matching cost in the Relative Value of Health Services (2019).

This cost was compared before and after MSBOS implementation. The collected data were presented in percentage and frequency to compare the year before and after MSBOS implementation. The researchers were committed to all ethical considerations. Obtaining the approval of the Ethics Committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1398.828), ensuring the confidentiality of data, and making coordination with authorities of Imam-Reza Hospital and Shohada Hospital were among those ethical considerations.

Results

The number of crossmatched units, number of blood units transfused, C/R ratio, and C/R ratio in elective surgeries (minor surgeries, major surgeries, trauma surgeries, and intermediate surgeries) were investigated before and after MSBOS implementation in 2020. Table 1 presents data by elective surgery units. In the first three months of 2019, only 1380 out of 5484 cross-matched units were used for 530 patients. This is while 1704 out of 2680 blood units crossmatched for 1,693 patients were administered to 1005 patients in the first three months of 2020. C/T ratio was considerably reduced following MSBOS implementation from 3.97 to 1.57 (CI: 3.97-1.70; $p = 0.001$). Transfusion index, following MSBOS implementation, considerably increased from 25.2% to 63.6% (CI: 36.25-40.55; $p = 0.001$). Transfusion probability increased from 24.7% to 59.4% (CI: 31.73-37.67; $p = 0.001$). The highest (4.92 to 1.32) and lowest (2.69 to 1.42) C/T ratio reductions were observed in the orthopedic and major surgery departments,

respectively. Moreover, the number of crossmatching tests was reduced by 51.13% ($p = 0.001$). Crossmatching cost also reduced from 293898528 to 143626560 rials.

Table 1. Data on blood order, transfusion, C/T ratio, and percent of transfusion before and after MSBOS implementation in different surgical groups

Year	Sections	Number of cross-matched blood bags	Number of blood transfused bags	Injection percentage	Crossmatch to inject
2019	Major	2136	529	25.00	4.03
	Minor	559	115	30.50	4.86
	Mild	611	275	33.00	2.22
	Trauma	2019	759	22.50	2.66
2020	Major	758	389	80.50	1.94
	Minor	185	90	70.50	2.05
	Mild	103	78	69.50	1.32
	Trauma	1036	556	55.00	1.86

Discussion

In this study, the transfusion index considerably increased after MSBOS implementation from 21% to 61%. The transfusion index of higher than 30% is indicative of efficient blood use. Therefore, the transfusion index was optimized following MSBOS. Moreover, transfusion probability increased from 24% to 63.7%. Transfusion probability of higher than 50% is indicative of efficient blood use; in addition, the C/T ratio was 4.12, which reduced to 1.13 after MSBOS implementation. In 1975, Boral and Henry first used the C/T ratio to assess blood use efficiency. Ideally, this ratio should be near 1. The C/T ratio lower than 2.5 is indicative of efficient blood use and the effectiveness of MSBOS in optimizing blood usage. Previous studies showed the effectiveness of MSBOS in reducing the waste of blood and optimizing blood use(9). Before introducing MSBOS in this study, only 21% of crossmatched blood units were used for transfusion; whereas, 61% of the crossmatched blood units were transfused following MSBOS implementation. In other studies, almost 70% of crossmatched blood units were used perioperatively following MSBOS implementation. As a result, MSBOS helps surgeons to make more efficient blood orders(11).

Blood and blood products have a major role in surgical procedures. However, due to resource limitations, the heavy workload at the blood bank, and the costly process of blood collection,

transfusion decisions should be made efficiently. Physicians should only order blood units for their patients when advantages exceed disadvantages(12). The majority of surgeons overestimate perioperative bleeding, which causes an inefficient request for blood prior to surgical procedures. These inefficient requests have challenged the Blood Transfusion Organization. Moreover, it leads to a huge waste of blood because of outdated and limited access to some blood groups. It also results in considerable cost to hospital blood banks because of unnecessary crossmatching. In this study, a high C/T ratio in surgical procedures is indicative of an over-ordering habit of surgeons, which has been observed in previous studies. This can be attributed to physicians' desire and habit of over-ordering of blood units and their lack of awareness of the consequences, physicians' lack of knowledge about the transfusion indications, and the benefits of optimal order of blood units for transfusion. Fear of unavailable blood units perioperatively is another reason for inefficient orders. In many cases, preoperative ordering patterns may be more often guided by habit than clinical needs. Despite available guidelines, many surgeons may make habitual blood orders. Previous studies have also shown varying behaviors in blood orders for patients undergoing heart surgery despite the existence of a guideline(13).

Therefore, holding several educational classes for surgeons to highlight guideline-based blood orders and the consequences of inefficient requests can be an effective approach. Surgeons should be aware of the importance of MSBOS-based blood orders and be ensured about the availability of blood if needed. Its prerequisite is cooperation and coordination between physicians, blood banks, and the Blood Transfusion Organization. The adoption of MSBOS is recommended to optimize preoperative blood orders made by physicians. Based on MSBOS, the required blood units for each surgical procedure is 1.5 x of the required number of blood units. As a result, this index changes with changing the required blood units over time.

Among MSBOS limitations are different needs of patients based on their demographic characteristics and underlying diseases, which results in a difference in the number of blood units needed. As a result, patients should be carefully examined for the effective factors of blood requirement preoperatively. Among these factors are preoperative anemia, feminine gender, type of surgery, surgeon's skill, duration of surgical procedure, small body size and low body weight, underlying diseases, and perioperative hemorrhage. It seems that MSBOS is more useful in surgeries where there is a low chance of bleeding and thus a low need for blood transfusion. In

such surgeries, using MSBOS optimizes blood requests and reduces workload in the blood bank, without affecting the patient.

In this study, the highest reduction in C/T ratio after MSBOS implementation was observed in the department of major surgeries; whereas, the least reduction was observed in the department of trauma surgeries. In a previous study, the highest and lowest C/T ratio reductions were observed in the urology and kidney transplant departments, respectively. In another study, the lowest and highest C/T ratios were observed in the department of obstetrics and department of orthopedics, respectively. The Blood Transfusion Organization selects donors and performs screening tests very carefully to enhance access to safe blood and reduce infection risks. Although this contributes to access to safe blood units, it can affect adequacy. Therefore, an efficient blood order mechanism is essential to have sufficient blood units available for emergency cases. In this study, the number of requested blood units, the number of transfused blood units, and the C/T ratio before and after MSBOS implementation were investigated in all orthopedic surgical procedures. The only intervention was the introduction of MSBOS and its implementation in all surgeries. In this study, only the crossmatching tariff was considered to determine the effectiveness of using MSBOS in terms of cost. This is while other costs from not using blood units, reserved units, and outdated were not considered.

Conclusion

In this study, crossmatching percent after MSBOS implementation was considerably reduced, suggesting its effectiveness in optimizing blood usage. Therefore, training surgeons and highlighting blood requests based on MSBOS contribute to efficient blood order management.

References

1. W. Qin, M. Baruah, A. Stefan, M. Van der Auweraer, N. Boens, *ChemPhysChem*. 6, 2343 (2005).
2. D. Frath, JE. Yarnell, G. Ulrich, FN. Castellano, R. Ziessel, *ChemPhysChem*. 14, 3348(2013).
3. G. Ulrich, A. Barsella, A. Boeglin, S. Niu, R. Ziessel, *ChemPhysChem*. 15, 2693 (2014).

4. ML. Agazzi, JE. Durantini, NS. Gsponer, AM. Durantini, SG. Bertolotti, EN. Durantini, *Chem Phys Chem*, 20, 1110 (2019).
5. Z-H. Pan, G-G. Luo, J-W. Zhou, J-X. Xia, K. Fang, R-B. Wu, *Dalton Trans.*, 43, 8499 (2014).
6. J. Kabatc, B. Jedrzejewska, A. Bajorek, and J. Paczkowski, *J. Fluoresc*, 16, 525 (2006).
7. EN. Kaya, B. Köksoy, S. Yeşilot, M. Durmuş, *Dyes and Pigments*, 172, 107867 (2020).
8. Y. Liu, L. Yang, C. Ma, A. Tangb, *Dyes and Pigments*, 173, 107981 (2020).
9. A. Ortiz, *Dyes and Pigments*, 171, 107690 (2019).
10. T. Rappitsch, I. Klimant, S.M. Borisov, *Dyes and Pigments*, 174, 108037 (2020).
11. T. Xu, C. Yan, Y. Wu, C. Yuan, X. Shao, *Dyes and Pigments*, 168, 235 (2019).
12. Z. Khanjari, B. Mohtat, R. Ghiasi, H. Djahaniani, F. K. Behbahani, *Main Group Chemistry*, 20, 59 (2021).
13. R. Ghiasi, Z. Zandiyeh, *Inorganic Chemistry Communications*, 124, 108412 (2021).

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