


Strategies for improvement of blood consumption management in the operating rooms: experts' suggestions

Maryam Gholami^a, Shima Miladi^a, Leila Riahi^b, Ali Mohammad Keshtvarz Hesam Abadi^a and Sezaneh Haghpanah ^c

^aClinical Research Development Center, Nemazee Hospital, Shiraz University of Medical Sciences, Shiraz, Iran; ^bDepartment of Health Services Management, Science and Research Branch, Islamic Azad University, Tehran, Iran; ^cHematology Research Center, Shiraz University of Medical Sciences, Shiraz, Iran

ABSTRACT

Background: In operating rooms, blood product wastage occurs with various reasons especially over-demand ordering during elective surgeries. Consequently, it imposes a heavy financial burden on health system. Therefore, managing blood consumption in the operating rooms is of special importance. Surgeons and anesthesiologists play a key role in blood transfusion practice in operating rooms.

Objective: To investigate surgeons' and anesthesiologists' perspectives in regard to the effective strategies for better management of blood transfusion practice in operating rooms.

Method: In this qualitative cross-sectional study, from January to March 2020, 60 surgeons and anesthesiologists were participated. All of them were working in surgical departments of the general hospitals affiliated with Shiraz University of Medical Sciences, in Shiraz, Southern Iran. Their viewpoints regarding the improvement of blood consumption management in operating rooms were recorded through interviews and several focus group sessions.

Results: After content analysis, the most important recommendations with the highest scores were regular training programs for surgical team (23.3%), collaboration of surgeons, anesthesiologists, and managers of the surgical departments by arrangement of monthly meetings to estimate the number of required blood bags more accurately (23.3%), establishing a well-organized electronic requesting and registration system (13.3%), promoting the ordering process by a comprehensive preoperative evaluation (11.6%), and updating transfusion protocols based on the standards and monitoring the adherence to these standards (10%).

Conclusion: Implementing the proposed policies, which are based on the invaluable experiences of related experts would be effective in improving blood consumption management in operating rooms.

ARTICLE HISTORY

Received 8 March 2021

Accepted 9 July 2021

KEYWORDS

Blood transfusion; operating rooms; blood wastage; surgeons; anesthesiologists

1. Introduction

Blood transfusion are one of the most important issues in health system in the modern world [1], so that according to the World Health Organization report, the amount of blood needed in Southeast Asia is about 16 million units per year, while only 9.4 million units are prepared in the world [2], which emphasizes the shortage of blood reserves and inadequate access to blood products as a common problem throughout the world. This issue is a threat to the lives of people who need blood and highlights the importance of appropriate management of blood consumption.

On the other hand, the costs and burden of treatment due to improper blood consumption is another significant factor that shows the importance of improving blood transfusion practice [3,4]. Part of this mismanagement is due to high percentage of wasted blood products because of high ordering rate

of blood bags in elective surgeries. Rather than blood wastage, it leads to increasing the blood stored, reduce the quality and impose heavy production costs of blood preparation and laboratory [4,5].

Several studies have shown that the major cause of high ordering rate is the fear of not enough access to the required amount of blood during the procedure, the lack of a specific pattern for requesting blood, and sometimes even the lack of the surgeons' knowledge about the appropriate ordering [2,6,7]. Today, excessive blood consumption is one of the most common problems in teaching hospitals leading to inappropriate distribution of blood products in different hospitals as well as increased costs and workload of blood banks [1,3–5].

Taken together, the issue of blood loss and blood consumption management is very important in the health care system and especially in operating rooms with the highest demand of blood consumption.

In developing countries such as Iran, where the standards related to preparation, ordering process, cross-matching, transportation, and transfusion are not performed accurately, blood products' wastage noticeably occurs [1,7–12]. Conversely, in developed countries such as the United States and Australia proper usage and monitoring of blood transfusion standards in different stages like registration of blood bank information and regular training have reduced blood loss and unnecessary cross-matching and consequently decreased the related costs [4,5,13–15].

In Iran, the majority of blood transfusions, more than 50%, belongs to the operating rooms, where ordering process is mainly performed by surgeons and anesthesiologists [11,16–18]. Moreover, unnecessary ordering resulted in incorrect estimation of required blood indicated as the main cause of blood product wastage in our country [2,11]. So in this study, we conducted a survey by participation of surgeons and anesthesiologists, as the major stakeholders in transfusion practice, in operating rooms to find effective solutions in reducing blood product wastage and promoting the situation.

2. Method

In this qualitative cross-sectional study, from January to March 2020, 60 surgeons and anesthesiologists were selected by convenience sampling method. All of them were working in surgical departments of the general hospitals affiliated with Shiraz University of Medical Sciences, in Shiraz, Southern Iran.

The study protocol was approved by the Ethics Committee of Shiraz University of Medical Sciences. Informed consents were obtained from all participants.

Several discussion sessions were conducted by focus group method in order to obtain data from an in-depth interviewing the participants for finding out the effective solutions for improving blood consumption management.

Based upon the research objective, a leading question was prepared as guidance: 'which strategies do you suggest for improvement of blood consumption management in operating rooms in this hospital'. Based on this question and focus on decreasing blood wastage, some general dimensions such as education and empowerment, collaboration, ordering process, supervision, reduction of patient's blood requirement by appropriate medical interventions before and during operation, and standard transportation of blood bags were proposed and discussed in different sessions.

We used content analysis technique to analyze the focus group data [19]. The "coding-framework,, refers to the two steps involved in the

content analysis that yields results. The first step is the initial coding which involves the generation of numerous category codes without limiting the number of codes [20]. At this stage, we listed emerging ideas, drew relationship diagrams and identified keywords used by respondents frequently as indicators of important themes. In the second stage (focused coding), we eliminated, combined and subdivided the coding categories identified in the first step.

The statistical methods used in this study were descriptive statistics including mean, standard deviation (SD), frequency and percentage, which was performed using SPSS software version 21.

3. Results

The mean age \pm SD of the participants was 43.52 ± 10.21 years including 45 surgeons and 15 anesthesiologists, 70% male and 30% female.

After analysis and summarization of the participants' viewpoints, suggestions were classified in 24 effective and practical strategies as presented in Table 1.

Considering regular training programs for surgical team (23.3%), collaboration of surgeons, anesthesiologists, and managers of the surgical departments by arrangement of monthly meetings to estimate the exact amount of the required blood bags (23.3%), establishing an electronic recording system for registering the blood consumers' specifications and blood bags requesting (13.3%), promoting the ordering process by a comprehensive preoperative evaluation of the patients regarding bleeding risk considering the type of operation (11.6%), and updating the blood preparation and transfusion protocols based on the standards and scientific references as well as monitoring the adherence to these standards (10%) were the most important factors with the highest scores in terms of frequency and agreement.

After that, forming a task force to investigate the reasons of blood transfusion, improving the surgeons' skills to control bleeding, allocating a specific space in the operating room for blood bank and special refrigerators, assignment of the blood bag ordering to anesthesiologists, checking antibodies before surgeries, and correction of anemia before surgery with medication and nutrition were recommended by 8.3% for each items. Subsequently, usage of the pediatric packs in case of transfusion in children, situation analysis of any fault occurred during transfusion practice in order to resolve the problem and making others aware by organizing conferences or e-mail services, and accelerating the cross-match process and reduction the time interval between booking and preparation were determined as other important factors with frequency of 6.6% for each suggestions.

Table 1. Summary of the proposed strategies for improvement of blood consumption management in operating rooms by surgeons and anesthesiologists.

Suggested strategies	N (%)
Regular specific training programs for all physicians, assistants, and staff involved in each stage of transfusion practice by implementing obligatory annual courses and workshops for updating their knowledge regarding blood transfusion practice (23.3)	14
Collaboration of surgeons, anesthesiologists, and managers of the surgical departments by arrangement of monthly meetings to estimate the exact amount of the required blood bags (23.3)	14
Establishing an electronic recording system for registering the blood consumers' specifications and blood bags requesting (13.3)	8
Promoting the ordering process by a comprehensive preoperative evaluation of the patients regarding bleeding risk considering the type of operation (11.6)	7
Updating the blood preparation and transfusion protocols based on the standards and scientific references as well as monitoring the adherence to these standards	6 (10)
Forming a task force to investigate the reasons of blood transfusion and follow them up	5 (8.3)
Improving the skills of surgeons to prevent bleeding such as discontinuing the medication with increased risk of bleeding during surgery at proper time before operation	5 (8.3)
Assigning blood bag ordering to anesthesiologists	5 (8.3)
Transferring part of the blood bank to the operating room, such as special refrigerators, with the purpose of close monitoring of blood utilization	5 (8.3)
Checking antibodies before surgeries	5 (8.3)
Correcting anemia prior to surgery with medication and nutrition	5 (8.3)
Using the pediatric packs in case of children instead of adult blood bag	4 (6.6)
Evaluating any fault occurred during transfusion practice and providing effective solutions to resolve the problem and making others aware by organizing conferences or e-mail services	4 (6.6)
Accelerating the cross-match process and reduction the time interval between booking and preparation	4 (6.6)
Proper continuous assessment of the blood bags' specifications and safety and returning in case of any problem	3 (5)
Giving feedback of the outcome of blood consumption to the related surgeon and anesthesiologist after each operation	2 (3.3)
More accurately arranging the schedules of the operating rooms to decrease canceling rate of operations	2 (3.3)
Recording the reason of transfusion in the patient's electronic file	2 (3.3)
Use of appropriate transportation system such as affixing the RBC products and equipping the transport containers with temperature indicators and cooling system	2 (3.3)
Substitute the invasive procedures with noninvasive or minimally invasive ones as much as possible	1 (1.6)
Referring the patients with elective major surgeries to the hematologists for preoperation bleeding risk assessment	1 (1.6)
Carrying out the type and screen as an alternative procedure of cross-match test	1 (1.6)
Following the FIFO rules	1 (1.6)
Considering the prevalence of accidents and trauma in the eventful periods in order to prevent the shortage of blood resources	1 (1.6)

FIFO: First In, First Out.

Other less frequent recommendation were as follow: continuous assessment of the blood bags' specifications and safety, giving feedback of the outcome of blood consumption to the related surgeon and anesthesiologist, accurately arranging the schedules of the operating

rooms to decrease canceling rate of operations, recording the reason of transfusion in the patient's electronic file, usage of standard transportation system, substitution of the invasive procedures with noninvasive or minimally invasive ones as much as possible, referring the patients with elective major surgeries to the hematologists for preoperation bleeding risk assessment, carrying out the type and screen as an alternative procedure of cross-match test, following the First In, First Out (FIFO) rule, and considering the prevalence of accidents and trauma in the eventful periods in order to prevent the shortage of blood resources.

4. Discussion

Considering the importance of blood products' wastage and proper use of blood reserves in operating rooms, the viewpoints of surgeons and anesthesiologists were investigated by interview. In this context, 24 different solutions were proposed that many of them have been implemented in different countries, including Iran and have shown effective results in reducing blood wastage and improving blood consumption.

Heitmiller et al. showed a greatly reduction in blood loss by implementing interventions such as reporting and publishing information related to blood bank electronically, training staff regarding blood transportation standards, evaluating temperature index, tracking blood bag information through specific labels, implementing FIFO law, and reporting cases of faults and analyzing them [5].

Also, Jefferies et al. proposed some established strategies which led to reduction of blood loss consisting of monitoring the blood bank supervisors, giving feedback to the investigation committee and analyzing individual errors, training staff and reporting the related issues to the quality improvement committee of hospital [13].

Moreover, in the study of Collins and et al., a set of effective interventions such as training programs for physicians and transport operators and the installation of digital messages were suggested leading to decrease in blood wastage and improvement of transportation process [4].

In addition, Whitney et al. organized a multidisciplinary team to provide information on blood loss through monthly meetings with blood donors, anesthesiologists, and nurses to address administrative barriers in the United States. They reported the positive impact of their efforts, on significant reduction of blood loss and their associated costs [15].

Additionally, Kanani and et al. in India, reported an improvement in the blood consumption management system by implementing information software in blood banks and the wards in order to create coordination between physicians and blood bank

staff and technically empowering and providing access to quality processing indicators as well as proper monitoring [21].

Correction of anemia before surgery, evaluation, and updating the demands of blood by examining the factors affecting blood demand through local and hospital advisory committees were amongst the other effective methods suggested by Allen and et al. [22].

Although some of these items were less frequently suggested, they seem very important and have been shown to be effective in previous studies.

5. Conclusion

Based on the experts' suggestions, the most effective dimensions resulting in improvement of the blood transfusion practice in operating rooms consisted of regular training programs, focus on appropriate estimation of blood requirement by collaboration of surgeons, anesthesiologists, and managers of the surgical wards, establishing a well-organized electronic requesting and registration system, promoting the ordering process by a comprehensive preoperative evaluation, and following the standards of transfusion protocols more precisely and close monitoring the whole process. Since majority of these suggestions had been effective in promotion of transfusion practice in other developing and developed countries, they would be helpful with high possibility in our country as well.

Acknowledgments

The authors would like to thank Shiraz University of Medical Sciences for their approval support as well as Surgeons, anesthesiologists and personnel of operating rooms for their excellent cooperation and invaluable suggestions. We also appreciate the Center for Development of Clinical Research of Nemazee Hospital.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Sezaneh Haghpanah  <http://orcid.org/0000-0002-8666-2106>

References

- [1] Kafi-Abad SA, Omidkhoda A, Pourfatollah AA. Analysis of hospital blood components wastage in Iran (2005–2015). *Transfus Apheresis Sci.* 2019;58(1):34–38.
- [2] Robati R, Nejad EM. Awareness and performance of blood transfusion standards in operating rooms of Shiraz hospitals in 2012. *Iran J Pedia Hematol Oncol.* 2015;5(2):100.
- [3] Berwick DM, Hackbarth AD. Eliminating waste in US health care. *Jama.* 2012;307(14):1513–1516.
- [4] Collins RA, Wisniewski MK, Waters JH, et al. Effectiveness of multiple initiatives to reduce blood component wastage. *Am J Clin Pathol.* 2015;143(3):329–335.
- [5] Heitmiller ES, Hill RB, Marshall CE, et al. Blood wastage reduction using Lean Sigma methodology. *Transfusion.* 2010;50(9):1887–1896.
- [6] Hashemi SM, Mousavi SHS, Tavakolikia Z. Determining Model for Maximum Blood Request (MSBOS) for surgery: an elective surgery in Imam Ali Hospital, Zahedan, Iran. *Int J Hematol Oncol Stem Cell Res.* 2019;13(2):95.
- [7] Yazdi AP, Alipour M, Jahanbakhsh SS, et al. A survey of blood request versus blood utilization at a university hospital in Iran. *Arch Bone Joint Surg.* 2016;4(1):75.
- [8] Alavi-Moghaddam M, Bardeh M, Alimohammadi H, et al. Blood transfusion practice before and after implementation of type and screen protocol in emergency department of a university affiliated hospital in Iran. *Emerg Med Int.* 2014;2014:1–4.
- [9] Javadzadeh Shahshahani H, Taghvai N. Blood wastage management in a regional blood transfusion centre. *Transfus Med.* 2017;27(5):348–353.
- [10] Najafi M, Ahmadi A, Zolfagharinia H. Blood inventory management in hospitals: considering supply and demand uncertainty and blood transshipment possibility. *Oper Res Health Care.* 2017;15:43–56.
- [11] Zaman B, Radmehr M, Sahraian A, et al. Determination of the ratio and causes of unused blood ordered from blood bank blood in elective surgery in Rasoul-e-Akram Hospital. *Sci J Iran Blood Transf Org.* 2009;6(2):141–146.
- [12] Chegini A, Ebrahimi A, Maghari A. The evaluation of blood requests for transfusion and its utilization in four Iranian Hospitals. *Int Blood ResRev.* 2015;4(2):1–6.
- [13] Jefferies L, Elizabeth Smith M, Magee D, et al. A team approach to decrease wasted blood products. *Lab Med.* 1996;27(12):833–837.
- [14] Smallwood J. Use of blood in elective general surgery: an area of wasted resources. *Br Med J (Clin Res Ed).* 1983;286(6368):868–870.
- [15] Whitney GM, Woods MC, France DJ, et al. Reducing intraoperative red blood cell unit wastage in a large academic medical center. *Transfusion.* 2015;55(11):2752–2758.
- [16] Belayneh T, Messele G, Abdissa Z, et al. Blood requisition and utilization practice in surgical patients at university of gondar hospital, northwest ethiopia. *J Blood Transfus.* 2013;2013:1–5.
- [17] Far RM, Rad FS, Abdolazimi Z, et al. Determination of rate and causes of wastage of blood and blood products in Iranian hospitals. *Turkish J Hematol.* 2014;31(2):161.
- [18] Hall TC, Pattenden C, Hollobone C, et al. Blood transfusion policies in elective general surgery: how to optimise cross-match-to-transfusion ratios. *Transfus Med Hemotherapy.* 2013;40(1):27–31.
- [19] Morgan DL. Focus groups. *Annu. Rev. Sociol.* 1996;22: 129–152.
- [20] Charmaz K. Constructing grounded theory: a practical guide through qualitative analysis. Sage. 2006.
- [21] Kanani AN, Vachhani JH, Dholakiya SK, et al. Analysis on discard of blood and its products with suggested possible strategies to reduce its occurrence in a blood bank of tertiary care hospital in Western India. *Global J Transf Med.* 2017;2(2):130.
- [22] Alen J, Bowler P, Burta O, et al. Blood supply management. 2012.