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The Attitudes of Doctors Working in the Surgical Clinic of a University Hospital for Patient Blood Management: A Survey-Based Study

Bir Üniversite Hastanesinin Cerrahi Kliniğinde Çalışan Doktorların Hasta Kan Yönetimine Yönelik Tutumları: Ankete Dayalı Bir Çalışma

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ABSTRACT

Objective: Our aim is to evaluate the attitudes of the doctors working in the surgical clinics of a university hospital on Patient Blood Management (PBM).

Methods: This cross-sectional study was conducted in Zonguldak Bülent Ecevit University, Faculty of Medicine between December 2019 and January 2020, after obtaining ethical permission. The survey data were obtained by handing out the survey forms which consist of 33 questions to the doctors working in the hospital's surgical clinics to fill out. The questions include demographic data, and attitudes on PBM.

Results: Fully completed 91 surveys were evaluated. Of the participants, 81% were research assistants and 30% were anesthesiologists. The 61.5% of participants had PBM knowledge, 91% of them knew the relationship between preoperative anemia (POA) and preoperative morbidity, and mortality, and 54% were found to treat POA regularly. The 85% of the participants stated that anemia should be treated before elective surgery, and for this purpose, they transfused erythrocyte suspension (RBC) (67.5%) immediately before surgery. Apart from the hemoglobin (Hb) value, the most commonly used parameter in the RBC transfusion decision was the amount of bleeding >1000 mL. While it was found that the most common practice to reduce intra-operative blood transfusion was the diagnosis and correction of POA (85%), only 27.5% of the participants reported that it is necessary to act restrictively to ensure normothermia and for the Hb threshold value in the decision of transfusion. When participants were asked 'how should they be treated if they are an anemic patient without cardiopulmonary disease and bleeding', 69% of them said they 'want their anemia to be recognized and treated before elective surgery'. Only 22% of the participants were aware that there was no written protocol on PBM in their institution.

Conclusion: Study findings suggest that the adoption of PBM guidelines should be encouraged, more momentum should be given to implementing these programs, and other studies in this area are needed.

Keywords: Patient blood management, perioperative anemia management, perioperative care

ÖZ

Amaç: Amacımız, bir üniversite hastanesi cerrahi kliniklerinde çalışan doktorların Hasta Kan Yönetimi (HKY) konusundaki tutumlarını değerlendirmektir.

Yöntem: Bu kesitsel çalışma, yerel etik kurul izni alındıktan sonra Aralık 2019-Ocak 2020 tarihleri arasında Zonguldak Bülent Ecevit Üniversitesi Tıp Fakültesi'nde yapıldı. Anket verileri, 33 sorudan oluşan anket formlarının hastanemiz cerrahi kliniklerinde çalışan doktorlara elden dağıtılıp doldurulmasıyla elde edildi. Sorular; demografik verileri, HKY uygulamaları hakkındaki tutum ve davranışlarını içermektedir.

Bulgular: Eksiksiz doldurulan 91 anket değerlendirildi. Katılımcıların %81'i araştırma görevlisi ve %30'u anestezistti. Katılımcıların %61,5'i HKY ve %91'i de preoperatif anemi (POA) ile perioperatif morbidite ve mortalite arasındaki ilişki hakkında bilgi sahibiydi. Katılımcıların %54'ünün de POA'yı rutin olarak tedavi ettiği saptandı. Katılımcıların %85'i elektif cerrahi öncesi aneminin tedavi edilmesi gerektiğini ve bu amaçla ameliyattan hemen önce eritrosit süspansiyonu (ES) (%67,5) transfüze ettiklerini belirttiler. Hemoglobin (Hb) değeri dışında ES transfüzyonu kararında en sık kullanılan parametre, kanama miktarı >1000 mL (%80) idi. İntraoperatif kan transfüzyonunu azaltmak için en sık yapılan uygulamanın POA'nın teşhisi ve düzeltilmesi (%85) olduğu saptanırken, katılımcıların yalnızca %27,5'inin normoterminin sağlanması ve transfüzyon kararında Hb eşik değeri için restriktif davranılması gerektiğini bildirdiler. Katılımcılara kardiyopulmoner hastalığı ve kanaması olmayan anemik bir hasta olmaları durumunda kendilerine nasıl davranılması gerektiği sorulduğunda; %69'unun 'elektif cerrahi öncesi anemisinin tanınmasını ve tedavi edilmesini istedikleri' görüldü. Katılımcıların sadece %22'si kurumlarında HKY konusunda yazılı bir protokolün olmadığının farkındaydı.

Sonuç: Bulgularımız HKY kılavuzlarının benimsenmesinin teşvik edilmesi, bu programları uygulamak için daha fazla ivme kazandırılması gerektiğini ve bu alanda yapılacak başka çalışmalara ihtiyaç olduğunu düşündürmektedir.

Anahtar sözcükler: Hasta kan yönetimi, perioperatif anemi yönetimi, perioperatif bakım

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INTRODUCTION

The term patient blood management (PBM) was introduced in 2005 by Professor J. Isbister, a hematologist (1). The PBM, which focuses on the patient rather than blood components, is a term used to describe certain medical and surgical approaches regarding the elimination or reduction of the need for allogenic transfusion by aiming to protect the patient's own blood and keeping it at a sufficient level (1,2).

Research evidence on transfusion has shown that the practice itself is not entirely benign, that it can result in increases in morbidity, mortality, and hospital stay duration, and that a remarkable number of transfusions are unnecessary and can be avoided (2,3). After improvements in the medicine of transfusion, there has been an observed decrease in complications due to blood transfusion (4,5). Nevertheless, the procedure is a common clinical practice, especially in surgical clinics and the systematic implementation of the PBM program improves postoperative clinical outcomes (6-9).

Although there is research on the methods, purpose, and results of PBM in the theoretical sense, research on the sufficiency of knowledge and experience in the effective implementation of PBM projects in hospitals remains rare. This study aims to evaluate the attitudes of doctors working in the area of PBM among the surgical clinics of a university hospital.

MATERIAL and METHODS

After obtaining approval from the local Ethics Committee (Meeting decision no: 2019/18, ClinicalTrials.gov Identifier: NCT05567705), this cross-sectional study was conducted in Zonguldak Bülent Ecevit University Hospital, Turkey, between 05 December 2019 to 31 January 2020.

Survey Form

Survey questions compiled from studies in this subject were read to 10 people (who did not participate in the study) to ascertain the intelligibility of the survey (10-14). The survey consisted of 2 parts: The first part contained demographic questions relating to the participants' gender, their duties, term of office (including medical education), and the surgical clinic where they worked. The second part comprised questions about the attitude and behavior of the doctors in relation to PBM (see Appendix-1 for the questionnaire form).

Data Collection Method

The data were obtained from the doctors working in the surgical clinics of our university hospital. They were handed printed questionnaires, which they filled out voluntarily. The participants were told that they could provide more than one answer to some questions. Incomplete surveys were excluded from the evaluation.

Statistical Analysis

Statistical evaluation was completed using the Statistical Package For Social Sciences (SPSS Inc., Chicago, IL, USA) program version 18. For questions with multiple choice answers, where every clinician could tick all answers, frequencies of a single answer referred to the total number of respondents from that hospital so the sum of percentages is over 100%. Descriptive statistics are given as number and percentage.

RESULTS

A total of 146 physicians agreed to participate in the survey, and 91 (62.3%) completed surveys were evaluated. The participants' gender, duties, length of experience as doctors, and the surgical clinics they worked in are shown in Table I.

We found that 61.5% (n=56) of the participants had PBM knowledge and that 37.4% (n=34) did not have enough knowledge on the subject.

We found that all participants routinely checked the hemoglobin (Hb) levels of patients before elective surgery and that 91.2% (n=83) of them were knowledgeable about the relationship between preoperative anemia (POA) and perioperative morbidity and mortality. Furthermore, 70.3% (n=64) of them stated that POA treatment could positively affect mor-

Table I. Characteristic Data of Participating Physicians (n=91)

	n (%)
Gender	
Female	33 (36.3)
Male	58 (63.7)
Term of office (including medical education)	
11≤ years	52 (57.1)
12-16 years	18 (19.8)
17 ≥ years	21 (23.1)
Duties	
Research assistant	74 (81.3)
Teaching staff	17 (18.7)
Discipline	
Anesthesiology and Reanimation	27 (29.7)
General Surgery	12 (13.2)
Orthopedics and Traumatology	10 (11)
Gynecology and Obstetrics	10 (11)
Urology	10 (11)
Ear, Nose, Throat Surgery	7 (7.7)
Neurosurgery	6 (6.6)
Plastic surgery	4 (4.4)
Other	5 (5.4)

Other: Ophthalmology (n:3) and Pediatric surgery (n:2).

bidity and mortality in surgeries with an expected blood loss of > 500 mL.

We found that 53.8% (n=49) of the participants regularly treated POA and that, of those treated, 53.1% were all patients, 38.8% had an expected blood loss of >1000 mL, and 8.2% had an expected blood loss of 500–1000 mL. The reasons reported as to why 46.2% (n=42) of the participants did not treat POA were as follows: lack of preoperative time and/or organization (76.2%, n=32), high cost (23.8%, n=10), lack of human resources (16%, n=7), lack of communication (n=1), endoscopic surgery (n=2), and avoidance of complications relating to blood products (n=2).

The participants were asked what they thought about anemia treatment before elective surgery: 84.6% (n=77) of them thought that anemia should be treated during the preoperative period; 11% (n=10) stated that they did not have sufficient knowledge about this subject; and 4.4% (n=4) stated that it did not need to be treated.

Regarding being asked about their treatment method for POA, the participants provided 77 answers: 67.5% (n=52) of them transfused erythrocyte suspension (RBC) just before surgery; 63.6% (n=49) used preoperative iron, B12, or folic acid supplements; and 5.2% (n=4) used erythropoiesis-stimulating agents.

When asked which Hb threshold value would be appropriate for the treatment of anemia before elective surgery, 14 responses were received: 6% (n=42.9) of the participants stated Hb ≤ 8 g dL^{-1} in females and Hb ≤ 9 g dL^{-1} in males; 3% (n=21.4) of them stated Hb ≤ 9 g dL^{-1} in females and Hb ≤ 10 g dL^{-1} in males; 2% (n=14.3) of them stated Hb ≤ 11 g dL^{-1} in females and Hb ≤ 12 g dL^{-1} in males; and the remaining 3% (n=21.4) stated Hb=10–12 g dL^{-1} in females and Hb=11–13 g dL^{-1} in males.

Forty-eight percent of the participants anticipated blood loss from elective surgery of >1000 mL; 42.9% (n=39) anticipated blood loss from elective surgery of 500–1000 mL; and 8.8% (n=8) stated that they only treated iron deficiency in patients who refused a blood transfusion in the preoperative period.

The participants noted that the most common causes of anemia were iron and B12/folic acid deficiencies and chronic disease anemias (99%, 76%, and 71.4%, respectively) as well as anemia from renal failure in 38.5%, hematological disorders in 18%, and unclear etiology in 20% of cases.

Table II shows the answers to the question regarding the Hb threshold value used in the decision regarding preoperative and postoperative RBC transfusions in patients with or without cardiopulmonary diseases. We determined that Hb < 10 g dL^{-1} was frequently used for those with cardiopulmonary disease and Hb < 8 g dL^{-1} for those without cardiopulmonary disease in both preoperative and postoperative RBC transfusion decisions.

Table III presents the answers to the question regarding the parameters used in preoperative and postoperative RBC transfusion decisions with the exception of the Hb threshold value. Except for all parameters, we found that only 2 participants used the surgery size (n=1) and shock index < 1 (n=1) values in the preoperative RBC transfusion decision.

Eighty-nine answers were received for the following question: "When RBC transfusion is required in stable, non-bleeding patients, on what basis do you perform transfusion?" Sixty percent of the participants re-evaluated the clinical status and Hb level after each 1-unit (U) RBC transfusion; 34% re-evaluated the clinical status and Hb level after 2U; and 3.4% stated that 1U RBC was not a basis for transfusion and that they always performed transfusion at least 2U RBC.

Table II. Hemoglobin Threshold Values Used in the Preoperative and Postoperative RBC Transfusion Decision in Patients with and without Cardio-Pulmonary Disease (n=91)

Hb Threshold Value g dL^{-1}	Patients with Cardio-Pulmonary Disease (n=91) (%)		Patients without Cardio-Pulmonary Disease (n=91) (%)	
	Preoperative	Postoperative	Preoperative	Postoperative
<6	-	-	3 (3.3)	5 (5.5)
<7	-	-	21 (23.1)	21 (23)
<8	18 (19.8)	18 (19.8)	43 (47.3)	45 (49.5)
<9	18 (19.8)	21 (23)	-	4 (4.4)
<10	55 (60.4)	48 (52.8)	24 (26.3)	8 (8.7)
None	-	2 (2.2)	-	6 (6.6)
Other	-	2 (2.2)	-	2 (2.2)

Other: According to preoperative Hb value.

Table III. Other Parameters Used in Preoperative and Postoperative RBC Transfusion Decision Except Hb Threshold Value (Multiple Response Possible)

Parameters	Preoperative n (%)	Postoperative n (%)
Blood loss > 1000 mL	76 (83.5)	75 (82.4)
Tachycardia without identifiable cause	46 (50.5)	58 (63.7)
Hypotension without identifiable cause	44 (48.4)	51 (56)
ECG changes without identifiable cause when Hb is <10 g dL^{-1}	34 (37.4)	33 (36.3)
Lactic acidosis without identifiable cause	27 (29.7)	28 (30.8)

Table IV. Practices to Reduce the Need for Intraoperative Blood Transfusion (Multiple Answers Possible)

	n (%)
Preoperative anemia diagnosis and correction	77 (84.6)
Blood-saving surgical techniques	44 (48.4)
Use of tranexamic acid	40 (44)
Acute normovolemic hemodilution	29 (31.9)
Normothermia	25 (27.5)
Restrictive action for Hb threshold value at the start of transfusion	25 (27.5)
Restricted blood volume and number of blood samples collected for diagnostic purposes	11 (12.1)
Cell Salvage	3 (3.3)

Furthermore, 69.2% of the participants performed transfusion one day before surgery; 9.9% one week before surgery; 5.5% just before surgery; and 2.2% on the day of surgery. In addition, 85.7% (n=78) of the participants performed postoperative control of Hb and transfused accordingly in order to treat postoperative anemia.

Regarding the unnecessary daily RBC transfusion in the preoperative and postoperative periods, 62.6% and 65.9% of the participants stated that they had no idea, respectively, while others stated that for both periods, the rates may range from 0.3–70%.

The applications used by the participants to reduce the need for intraoperative blood transfusion are shown in Table IV.

In total, 82.4% (n=75) of the participants had no experience with the cell salvage method.

When the participants were asked how they would like to be treated if they were an anemic patient without cardiopulmonary disease and bleeding, 69.2% (n=63) wanted their anemia diagnosed and treated before elective surgery; 18.7% (n=17) did not want a transfusion if Hb > 9 g dL^{-1}; 16.5% (n=15) stated that restrictive behavior was needed regarding transfusion and wanted their clinical situation to be re-evaluated following every 1U RBC transfusion; 8.8% (n=8) did not want transfusion under any circumstances.

The participants were asked to indicate the risks associated with RBC transfusion in order of frequency, which they listed as follows: allergic reactions (n=29), circulatory overload (n=26), bacterial/viral infections (n=25/24), incorrect blood transfusion (n=20), and transfusion-associated lung injury (TRALI, n=18).

They were also asked whether there was a written protocol in their practice on PBM. Forty percent said “yes,” while 22% said “no.” Thirty eight percent had no idea.

DISCUSSION

In this study, the responders had no written PBM protocol in their institutions, the response rate was 62.3%, while the awareness about PBM among physicians was 61.5%. We found that 57% of the participants had less than 11 years of experience; 81% were research assistants; and 30% were anesthesiologists.

The World Health Organization has encouraged all member states to implement PBM programs, and a decision was taken in 2010 to ensure the quality, safety, and effectiveness of blood products. With this decision, various projects have been carried out in the member states of the European Union (15). Additionally, in order to implement the PBM system, training was provided to various target groups, especially clinicians who most frequently utilized blood, guidelines were created on the subject, and there were urgent calls to inte-

grate PBM into the routine management of elective surgery patients in order to improve transfusion practice (16,17). For this purpose, training for all physicians has been provided at intervals.

Manzini et al. conducted the largest multi-centered survey study regarding PBM knowledge and practices among doctors working in the fields of internal and surgical medicine and anesthesiology (11). Other studies include one involving only anesthesiologists and intensive care specialists; one focusing on the PBM practices of physicians just before 2013 and after 2014 regarding the implementation of a PBM program and PBM applications for 3 specific surgeries (knee, hip replacement, and coronary artery bypass grafting) at 11 hospitals; and various survey studies on PBM practices, including participation from 130 centers (12-14,18). Manzini et al. reported low (16%) and variable (6–21%) response rates from 7 hospitals, which were interpreted as a lack of interest among physicians in transfusion medicine, especially in PBM. They also reported that blood supply was easy and that transfusion was safe, potentially leading to the perception that there was no need to change the practice or learn PBM (11). In similar studies conducted in Europe, there are differences in survey participation rates (7.6% and 37.8%) (12,14). One of the strengths of the current survey is the high participation (62.3%) and awareness (61.5%) rates relating to PBM compared to recently published surveys. The fact that the majority of the survey participants were anesthetists who were familiar with transfusion protocols can be considered a factor affecting response bias.

It has been reported that 90% of physicians routinely evaluate the Hb value before elective surgery (11,14). Furthermore, 10% of those who did not routinely evaluate Hb values reportedly did so because only minor surgical interventions were performed on patients (7%), emergency surgery (2%), and there were high costs or lack of human resources (1%) (14). In this study, all the participants controlled their patients' Hb levels before elective surgery, regardless of the size of the surgery.

Possible difficulties of POA management may include lack of personal and financial resources, the need for expertise, and lack of time to implement anemia screening and treatment (11,14,19). Hofmann et al. reported that different work practices, communication and lack of experience about PBM have been the most important obstacles related to PBM (20). Van der Linden and Hardy reported that 40% of anemic patients were treated in only one out of 11 hospitals evaluated in 2010–2011 and that the treatment rate in the other 10 hospitals varied between 0 and 15% (18). The fact that the causes of untreated POA in this study were compatible with evidence in the literature shows that it is very important to allow a sufficiently long timeframe before surgery for effective treatment of POA.

Despite studies confirming that POA is an independent risk factor for postoperative adverse outcomes, there are also studies reporting on insufficient information about the correlation between POA and perioperative morbidity and mortality (11,20-26). Fischer et al. asked for doctors' opinions about the positive effects of POA treatment on morbidity and mortality and reported a 25% rate before the implementation of the PBM protocol, increasing to 37% afterward (13). Manzini et al. reported that although approximately 24% of physicians were not aware of the correlation between POA and perioperative morbidity and mortality, most of them evaluated their patients for POA. In the study, approximately 22% of the physicians stated that the probability of POA treatment positively affecting morbidity and mortality in surgeries with expected blood loss of > 500 mL was either low or they had no idea about this issue (11). Abad-Motos et al. reported that although 99.7% of their participants thought that the detection and treatment of POA in patients who underwent total knee/hip surgery may affect the postoperative results, 10% of them did not routinely measure Hb (14). In a study comparing the results of 69,229 patients who were anemic after surgery and 158,196 patients who were not, it was reported that anemia increased postoperative morbidity and mortality, length of hospital stays, and the risk of admission to postoperative intensive care (23). According to the study carried out in 12 countries in order to learn from the practical experiences of the PBM application; consensus has been reached that patients will benefit from PBM with improved outcomes, including morbidity, mortality, quality of life, average length of hospital stay, and patient safety (20). The results of the present study were quite high since 91.2% of the participants had knowledge regarding the relationship between POA and perioperative morbidity and mortality, and 70.3% stated that POA treatment could positively affect morbidity and mortality in surgeries with expected blood loss of > 500 mL.

Current guidelines state that RBC transfusion may be indicated when Hb < 7 g dL^{-1}, that it can be applied when Hb = 7–10 g dL^{-1} due to comorbidities, intravascular volume, and blood loss, and that it is unnecessary when Hb > 10 g dL^{-1} (26-31). However, the indications for intraoperative RBC transfusion are not clearly defined, and the Hb = 7–10 g dL^{-1} range is left to the discretion of physicians (29,30). In Baron et al. for patients without cardiovascular disease and active bleeding, 56% of physicians stated Hb = 7–9 g dL^{-1} as the transfusion threshold, while 37% stated Hb > 9 g dL^{-1}, and 7% stated Hb < 7 g dL^{-1} (12). A multicenter study reported that for RBC transfusion in patients without cardiopulmonary disease, 45% of physicians targeted Hb < 8 g dL^{-1}, 48% targeted Hb < 7 g dL^{-1}, and 7% Hb < 6 g dL^{-1}. The same study found that this target

was Hb < 10 g dL^{-1} for 24% of physicians, Hb < 9 g dL^{-1} for 34%, and Hb < 8 g dL^{-1} for 42% of physicians treating patients with cardiopulmonary disease. In Manzini et al. 74% of physicians used the Hb threshold value for RBC transfusion, and there were significant differences between hospitals. The PBM project was implemented in a single hospital, where restrictive transfusion guidelines were used. Furthermore, more than 50% of clinicians used Hb = 6 g dL^{-1} as the transfusion predictor; only 7% of participants used the most restrictive cut-offs; and 93% transfused RBC for Hb < 7/8 g dL^{-1} (11). Elsewhere, 43% of participants targeted Hb < 8 g dL^{-1}, while 60% targeted Hb < 10 g dL^{-1} as the transfusion threshold for patients without cardiovascular disease (14). In the Turkish National Perioperative Transfusion Study, values of 7–10 g dL^{-1} were frequently used as the intraoperative Hb threshold; however, the justification for all these transfusions was not reported by the participants. With these findings, it was reported that the restrictive transfusion strategy was not routinely adopted among anesthesiologists; POA was either not treated or RBC was transfused; and low Hb concentration explained all preoperative RBC transfusions (21). In this study, regarding the decision on RBC transfusion in patients with cardiopulmonary disease, 60.4% of the participants targeted Hb < 10 g dL^{-1} preoperatively and 52.8% postoperatively, while in patients without cardiopulmonary disease, approximately 50% of the participants targeted Hb < 8 g dL^{-1} in both periods. The observation that it targets the threshold value suggests that the findings of the present study substantiate those in the literature. Considering the use of higher transfusion thresholds, we believe that there is still a lack of optimization in anemic patients, which may explain the avoidable blood transfusion rates.

Preoperative anemia and low intraoperative Hb concentration are important determinants of perioperative RBC transfusions. Many studies have shown that one-half to one-quarter of patients are taken into surgery as anemic, which increases the need for transfusion 2–3 times (20,21). In elective surgeries, anemia should be treated first, followed by surgery. However, the treatment should comprise etiological and hematinic drugs, not transfusion (31). In our study, it was determined that 69.2% of the participants performed RBC transfusion one day before the surgery to treat POA in elective surgery. This indicates the high frequency of POA and the use of blood transfusion to treat it. Thus, there is an urgent need for a behavioral change in this area.

Iron deficiency anemia (IDA) is the most common (50–60%) cause of anemia in surgical patients and can be treated with oral or intravenous iron replacement, depending on the timing of the surgery (11,14,31). In order to provide sufficient time for anemia screening and treatment based on international guidelines, it is recommended that preoperative iron supplementation and anemia screening be performed 4–8 weeks before the operation in order to provide sufficient time for preoperative iron supplementation in patients with an expected blood loss of > 500 mL or a probability of RBC transfusion of > 10% (28,31). Abad-Motos et al. stated that 35% of their respondents treated all anemic patients before surgery; 26% only treated patients with anemia or IDA and an estimated blood loss of > 500 mL; 22% treated IDA patients with or without anemia; and 7% did not treat any of these patients (14). In this study, 98.9% of the participants stated that the most common cause of anemia was IDA. We found that the rate of routine treatment of POA before elective surgery was 53.8%. We found that 53.1% of respondents treated all anemias and 38.8% treated anemia in patients with an estimated blood loss > 1000 mL. We observed that preoperative RBC was frequently transfused for the treatment of anemia (67.5%), and only 48.4% of the participants used preoperative iron therapy in patients with expected blood loss of > 1000 mL. No time limit was specified for the detection of POA in our survey. Therefore, we think that RBC transfusion is frequently performed to avoid postponing elective surgery to treat POA. There is also a need to focus on raising awareness among surgeons about the indications for RBC transfusion and the timely management of POA.

Fischer et al. reported that transfusion thresholds have changed over the years and that physicians used the value of Hb < 6 g dL^{-1} as an indicator for RBC transfusion just before (22%) and after (29%) the implementation of a PBM program. It also seems that the rate at which physiological transfusion markers (electrocardiographic (ECG) changes or lactic acidosis, etc.) are used increased one year later (31%) compared to the time before the PBM program (27%), affecting the transfusion-related behavior. The same study reported that 38% of clinicians in 2013 and 56% in 2014 analyzed Hb after each 1U RBC and re-evaluated the patient clinically. These results show that the implementation strategies of PBM are correct and that they are effective in changing physicians' risk perception, attitude, and knowledge of PBM principles; however, there is still potential for improvement (13). Another study reported that in addition to Hb levels, hypotension (87%), tachycardia (81%), ECG changes (53%), oliguria (47%), and elevated lactate levels (46%) were considered transfusion indications (14). In a multicenter study conducted in our country, the indications for RBC transfusion in major elective surgery were Hb threshold, presence of bleeding, and physiological transfusion markers (21). In this study, we observed that the parameters used in the RBC transfusion decision, except for the Hb threshold value, occurred at a similar frequency as in the literature.

In order to avoid excessive transfusion in anemic, non-bleeding, and stable patients, a 1U transfusion policy has been rec-

ommended, including in some guidelines in various countries (11,29-31). Baron et al. showed that this policy was adopted by 72% of anesthetists, especially in Western Europe, and in younger clinicians compared to the elderly (12). Manzini et al. reported that the 1U policy, which was accepted and implemented by 89% of clinicians, seemed to be strictly implemented only in one hospital, while the implementation of this policy was lower among the other 6 hospitals. Manzini et al. also reported that 65% of clinicians reassess their clinical status and Hb level after each 1U RBC transfusion; 29% reevaluate after 2U; and 6% always transfuse from 2U RBC (11). In another study, 75% of physicians thought that they used "restrictive thresholds," while 90% followed the 1U transfusion policy (14). In this study, 59.6% of the participants re-evaluated their clinical status and Hb level after each 1U RBC transfusion in a stable, non-bleeding patient. Based on the literature, we believe that we are less selective about transfusion policies and that there is still a high transfusion rate.

Studies preceding the implementation of PBM showed that the majority of unnecessary transfusions were performed in elective surgeries; therefore, PBM especially targeted patients undergoing elective surgery (2). In a retrospective study, 911 transfusions were performed on 468 patients; 19% of these transfusions had Hb levels higher than 9 g dL^{-1} before the transfusion, deviating from internationally accepted rules (32). In the report, which evaluated the appropriateness of doctors' transfusion habits, 49 clinical studies were evaluated: 11.8% of transfusions were considered appropriate, 59.3% inappropriate, and 28.9% uncertain, and the study found that transfusion was an almost arbitrary practice that varied according to the doctor, not the patient (3). Unal et al. stated that postoperative RBC transfusions were mainly performed according to an Hb threshold and that the reason for the higher rate of inappropriate postoperative RBC transfusions (43%) compared to the intraoperative period (23%) was that surgeons were more reluctant to use restrictive Hb thresholds (21). In our study, we determined that more than half of the participants had no idea that transfusions could be unnecessary, either preoperatively and postoperatively.

As previously unknown aspects of blood transfusions have emerged, there is a preference for either reducing their frequency or deploying alternatives. Transfusion-related reactions that develop post-transfusion and cause serious consequences in the patient are a crucial factors in reducing transfusions. In particular, transfusion-related acute lung injury, post-transfusional purpura, and graft-versus-host disease may result in mortality (11,14,20,21). One factor cautioning against unnecessary transfusions are transfusion-transmitted infections (2). It is difficult to determine whether the observed adverse events and mortality were related to POA or the increase in allogeneic transfusions secondary to anemia. However, the overall outcome following transfusion was unfavorable, so POA should be treated in a timely manner. Unfortunately, even in centers where regular inspections are conducted, POA management remains inadequate (33). In Manzini et al. approximately 96% of physicians were aware of the risks associated with RBC transfusion. However, when they were asked to rank these risks in order of frequency, 11% said that they lacked sufficient information to do so. Furthermore, approximately 89% of the participants reported that the most common risks associated with transfusion were circulatory overload, allergic reaction, TRALI, incorrect blood component transfusion, and bacterial infection (11). In our study, there were frequent reports of complications such as allergic reactions and circulatory overload. Although allogeneic RBC transfusion is a life-saving intervention in special situations, its side effects should always be considered in terms of patient safety. Therefore, emphasis should be placed on education and urgent changes in attitudes, including raising awareness of the need for transfusion alternatives.

Collaboration between anesthetists, hematologists, nurses, and surgeons is essential to optimize the blood preservation approach in the perioperative period, and the contribution of surgeons in this area is crucial. Compared with open and invasive surgery, laparoscopic and minimally invasive surgical techniques are known to reduce blood loss (34). In recent years, the benefits of using Tranexamic acid (TXA) in reducing the risk of blood loss and transfusion have been demonstrated (35). Unal et al. reported that the rate of use of both TXA (9.5%) and cell salvage (0.2%) was quite low (21). In Abad-Motos et al. 31% of the participants reported that they used intraoperative cell salvage in patients contraindicated for TXA, while 8% reported that they always used cell salvage (14). Manzini et al. while the frequency of using cell salvage by physicians was 53%, Baron et al. this rate was reported as 28% in the study (11,12). It has been reported that these high usage rates, which are different from the literature, are due to the fact that the hospitals studied are university hospitals. The importance of maintaining normothermia (59–89%) in reducing the need for intraoperative RBC transfusion should not be overlooked (11,12,14). In this study, we found that blood-saving surgical techniques (48%) and the use of TXA (44%) were frequently applied in order to reduce intraoperative blood transfusion, while only 27.5% of the participants acted restrictively for the Hb threshold value when providing normothermia and initiating transfusion. Additionally, we determined that 82.4% of the participants had no experience with the use of cell salvage and that only 3 people preferred the cell salvage method to reduce intraoperative blood loss. Since some of the strategies described were relatively easy and inexpensive to implement (e.g. surgical techniques, use

of TXA, providing normothermia, and restrictive behavior in initiating transfusion), efforts should be made to apply them more frequently.

In Abad-Motos et al. 55% of the participants stated that there was no established PBM protocol in their hospital (14). The fact that only 22% of the participants were aware of this in this hospital, which does not currently have a written PBM policy, shows the importance of in-house training.

There are some limitations of this study. First, the educational status of physicians regarding the PBM policy was not questioned. Second, it was a pooling of various surgical clinics using different interventions. In addition, our survey questions are not sufficient to fully question the PBM practices; Preoperative evaluation of the patients' bleeding risk and physiological reserve, and issues including postoperative patient management should have been questioned.

CONCLUSION

Finally, we observed that the participants did not have enough complete and up-to-date information on PBM practices but our findings cannot be generalized since only one center was included in the study. In perioperative PBM, we found that the basic elements were often ignored; RBC transfusion was often performed in the treatment of POA; and restrictive behavior was not performed for the Hb threshold value in the transfusion decision. The study findings suggest that the adoption of PBM guidelines should be encouraged, more momentum should be given to implementing these programs.

AUTHOR CONTRIBUTIONS

Conception or design of the work: GK, BGK, HA
Data collection: GAY, HAA
Data analysis and interpretation: GK, BGK, HA
Drafting the article: GK, BGK, HA
Critical revision of the article: HA
Other (study supervision, fundings, materials, etc): GK, BGK, HA
All authors (GK, BGK, HA, GAY, HAA) reviewed the results and approved the final version of the manuscript.

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APPENDIX

Dear Colleague,

Patient blood management (PBM) is an evidence-based multidisciplinary approach to optimising the care of patients who might need transfusion. The following questions have been prepared to determine the attitudes and behaviors of surgical doctors on patient blood management. Volunteering is essential in answering the survey questions. It is not required to write your name and surname on the forms given to you. The confidentiality of the research will be ensured by the researchers. Please, after reading the statements, choose the option that suits you best. The questionnaire consists of 33 questions and the time required to answer is 20 minutes. If you have answered our survey before, please do not respond again. Thank you in advance for answering the survey.

1. **Your gender?** □ Female □ Male
2. **How long have you been in this profession? (including your training period)**
   □ 11≤ years □ 12-16 years □ 17 ≥ years
3. **Duties?** □Assistant doctor □Teaching staff
4. **In which discipline do you work?**
   □ Orthopedics and Traumatology
   □ Ear Nose Throat surgery
   □ Gynecology and Obstetrics
   □ Urological surgery
   □ General surgery
   □ Neurosurgery
   □ Plastic surgery
   □ Anesthesiology and Reanimation
   □ Others (please specify):…….
5. **Do you have knowledge on patient blood management?**
   □ Yes
   □ I don't know enough about this subject yet
   □ No
6. **Are you aware of a correlation between preoperative anemia and perioperative morbidity and mortality?**
   □ Yes
   □ I don't know enough about this subject yet
   □ No
7. **Do you think that preoperative anemia treatment can positively affect morbidity and mortality in operations with expected blood loss > 500 mL?**
   □ Definitely
   □ Probably
   □ I have no opinion on this subject
8. **Do you routinely check your patients' hemoglobin (Hb) levels before elective surgery? (or review recent Hb levels?)**
   □ Yes (Go to 10) □ No (Go to 9)
9. **Why do you not routinely check Hb? (Multiple answers possible)**
   □ Because of cost
   □ Because of lack of human resources
   □ Because of lack of pre-operative time
   □ Because of other reason(s) (please specify):……
10. **Do you routinely treat anemia before surgery? (According to WHO recommendations, Hb levels to diagnose anemia are as follows: non-pregnant women: <12 g dL^{-1}, pregnant women: <11 g dL^{-1}, men: <13 g dL^{-1}).**
    □ Yes (Go to 11) □ No (Go to 12)

11. In which patients do you routinely treat pre-operative anemia?
- □ In all patients
- □ In patients with an expected blood loss even though minimal (from 500 to 1000 mL)
- □ Only in patients with an important expected blood loss (>1000 mL)
- □ Only in patients refusing blood transfusion (e.g. Jehovah's Witnesses)

12. Why do you not routinely treat pre-operative anemia? (Multiple answers possible)
- □ Because of cost
- □ Because of lack of human resources
- □ Because of lack of pre-operative time
- □ Because of other reason(s) (please give details in the box below):

13. What do you think about anemia treatment before elective surgery?
- □ I recommend pre-operative treatment (Go to 14)
- □ I do nothing - preoperative treatment of anemia is not necessary (Go to 15)
- □ I don't know enough about this subject yet (Go to 15)

14. Which of the following pre-operative treatments would you offer? (Multiple answers possible)
- □ Red blood cell transfusion immediately before surgery
- □ Pre-operative iron/B12/folic acid supplementation
- □ Pre-operative use of EPO / Erythropoiesis Stimulating Agents

15. Anemia treatment before elective surgery is suitable for patients with which of the following characteristics?
- □ Women: Hb ≤ 8 g dL^{-1}, men: Hb ≤ 9 g dL^{-1}
- □ Women: Hb ≤ 9 g dL^{-1}, men: Hb ≤ 10 g dL^{-1}
- □ Women: Hb ≤ 10 g dL^{-1}, men: Hb ≤ 11 g dL^{-1}
- □ Women: Hb ≤ 11 g dL^{-1}, men: Hb ≤ 12 g dL^{-1}
- □ Women: Hb ≤ 12 g dL^{-1}, men: Hb ≤ 13 g dL^{-1}
- □ None of the above. Please give reasons why you would not treat the anemia:

16. For which patients do you routinely treat iron deficiency?
- □ Only if expected blood loss for elective surgery is between 500 - 1000 mL
- □ Only if expected blood loss for elective surgery is > 1000 mL
- □ Only in patients refusing blood transfusion (e.g. Jehovah's Witnesses)

17. What are the most common causes of anemia? (Multiple answers possible)
- □ Vitamin B12/folic acid deficiency
- □ Iron deficiency
- □ Renal failure
- □ Haematological disorders such as myelodysplastic syndrome (MDS)
- □ Anemia of chronic disease
- □ Anemia of unclear aetiology
- □ Other (please specify):.....

18. Which Hb hemoglobin threshold value do you use in the preoperative RBC transfusion decision in patients without cardiopulmonary disease?
- □ Hb < 6 g dL^{-1}
- □ Hb < 7 g dL^{-1}
- □ Hb < 8 g dL^{-1}
- □ Other (please specify)…….

19. Which Hb threshold value do you use in your preoperative RBC transfusion decision in patients with cardiopulmonary disease?
- □ Hb < 8 g dL^{-1}
- □ Hb < 9 g dL^{-1}
- □ Hb < 10 g dL^{-1}
- □ Other (please specify)…….

20. What are the other parameters you use in your preoperative RBC transfusion practices?: (Multiple answers possible)

□ Tachycardia without identifiable cause
□ Hypotension without identifiable cause
□ Lactic acidosis without identifiable cause
□ Blood loss > 1000 mL
□ ECG changes without identifiable cause when Hb is <10 g dL^{-1}
□ Other (please specify)……

21. When RBC transfusion is required for a stable, non-bleeding patient, according to which situation below would you transfuse?

□ 1 unit of RBC is not a transfusion. I always transfuse at least two units of RBC
□ After each RBC, I clinically reevaluate and check for Hb
□ After two RBC, I clinically reassess and check for Hb
□ Other (please specify)……

22. In the pre-operative period, when do you give RBC transfusion to an elective surgery patient to treat anemia?

□ 1 week before surgery
□ 1 day before surgery
□ Surgery day
□ Just before going into surgery
□ Other (Please specify):

23. In your opinion how many of your patients are receiving unnecessary RBC transfusions per day before the operation?

□ I have no idea
□ Other (Please specify): %……

24. Which of the following procedures are used in your day to day practice to reduce the need for intra-operative blood transfusion: (Multiple answers possible)

□ Pre-operative anemia diagnosis and correction
□ Acute normovolaemic haemodilution
□ Normothermia
□ Cell Salvage
□ Blood saving operative techniques
□ Restricted blood volume and number of blood samples collected for diagnostic purposes
□ Use of Tranexamic acid
□ Restrictive red blood cell transfusion trigger
□ None of the above
□ Other (please specify): ……

25. Which of the following situations is appropriate for transfusion of erythrocytes collected by intraoperative cell salvage? (Multiple answers are possible)

□ I have no experience using cell salvage
□ I would use the same transfusion triggers as for donor red blood cell transfusion
□ I would use a more generous transfusion trigger (higher Hb) than for donor red blood cell transfusion
□ I would use a more generous transfusion trigger (higher Hb) than for donor red blood cell transfusion in patients refusing blood transfusion (e.g. Jehovah's Witnesses) or in patients in which compatible donor blood is difficult to find
□ I always re-transfuse all salvaged red cells, whatever the patient's Hb
□ I do not use cell salvage because:……..

26. Which Hb threshold value do you use in the decision of postoperative RBC transfusion in patients without cardio-pulmonary disease?

□ Hb < 6 g dL^{-1}
□ Hb < 7 g dL^{-1}
□ Hb < 8 g dL^{-1}
□ None
□ Other (please specify)……

27. Which Hb threshold value do you use in the decision of postoperative RBC transfusion in patients with cardio-pulmonary disease?

□ Hb < 8 g dL^{-1}
□ Hb < 9 g dL^{-1}
□ Hb < 10 g dL^{-1}
□ None
□ Other (please specify)…….

28. What are the other parameters you use in your post-operative RBC transfusion practices? (Multiple answers possible)

□ Tachycardia without identifiable cause
□ Hypotension without identifiable cause
□ Lactic acidosis without identifiable cause
□ Blood loss > 1000 mL
□ ECG changes without identifiable cause when Hb is <10 g dL^{-1}
□ Other (please specify)…….

29. When do you transfuse RBC to treat anemia in an elective surgery patient in the postoperative period?

□ After the surgery, I check the Hb value and plan the transfusion accordingly.
□ I routinely transfuse after surgery in a patient who I think has excessive intraoperative blood loss.
□ Other (Please specify): ……..

30. In your opinion how many patients receive unnecessary RBC transfusions per day postoperatively?

□ I have no idea
□ Other (Please specify): %…….

31. If I were a stable non-bleeding anaemic patient without cardio-pulmonary disease I would like: (Multiple answers possible)

□ Not be transfused under any circumstances
□ To have pre-operative recognition and treatment of anemia before elective surgery

<u>To have no transfusion if my:</u>

□ Hb > 6 g dL^{-1}
□ Hb > 7 g dL^{-1}
□ Hb > 8 g dL^{-1}
□ Hb > 9 g dL^{-1}
□ To be transfused to maintain Hb ≥ 10 g dL^{-1}
□ To be managed using a restrictive transfusion protocol based on Hb, clinical assessment of my situation, clinical reassessment and Hb check following each single red blood cell transfusion
□ I do not know enough about this subject yet

32. In your opinion what is the frequency of the following risks associated with RBC transfusion? (rank in order from 1 for the risk that occurs most frequently to 6 for the risk that occurs rarely)

<u>Ranked (1-6)</u>
Transfusion-associated circulatory overload
Transfusion-related acute lung injury
Incorrect blood component transfused
Bacterial contamination
Infection such as HIV, Hepatitis C
Allergic reaction

33. Is there a written protocol in your practice on PBM?

□ Yes
□ I don’t know
□ No

Thank you for your participation!