



# Evaluation of the relationship between patient blood management and anesthesia method in cesarean section: A single-center study

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## ABSTRACT

**Objectives:** Patient blood management (PBM) aims to improve patient outcome and safety by reducing the quantity of unnecessary blood transfusions and vitalizing patient-specific anemia reserves. We aimed to determine the efficiency and practicality of patient blood management in the cesarean section operating room in our hospital and the effects of the anesthesia method in cesarean section.

**Methods:** Between 2019 and 2021, 6011 patients who underwent cesarean section were reviewed at Bursa City Hospital. Patients who received perioperative or postoperative blood product transfusion were divided into two groups as Group I (n=614) and patients who were not transfused into Group II (n=5397). Demographic data of the patients, preoperative hemogram laboratory values, performed anesthesia methods, transfusion rate were recorded from the database.

**Results:** There was no statistically significant difference between the two groups in terms of demographic data ( $p>0.05$ ). The preoperative anemia rate was 35.91% (n=2159) and in these patients the blood transfusion rate was 21.86% (n=472). Total transfusion rate was reported as 10.21% (n=614). Preoperative hemoglobin levels were statistically lower in Group I. Spinal anesthesia method was found to be statistically higher in both groups.

**Conclusion:** Patient blood management is very important. In line with the guidelines on this subject, it will reduce unnecessary transfusions and therefore the risks of transfusion complications. In addition, considering the difficulty of supplying blood products, blood transfusion should not be considered primarily as a treatment. Anemia treatment should be planned before surgery and hemoglobin levels should be optimized. It is recommended to prefer regional anesthesia for PBM at cesarean section. In this way, we think that we will both increase the efficiency of patient blood management and reduce the cost and complications of blood transfusion.

**Keywords:** anemia, anesthesia, blood transfusion, patient blood management



In obstetrics, patient blood management (PBM) aims to improve clinical outcomes by avoiding unnecessary exposure to blood products. It includes three steps of optimization of blood volume and red cell mass, minimisation of blood loss and optimisa-

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tion of the patient’s tolerance of anemia [1]. Guidelines have been created to ensure the feasibility of this approach. Accompanied by guidelines, personnel involved in the blood transfusion chain, especially clinicians who use blood products the most, it is aimed to help in making transfusion decisions in the light of current and evidence based information on the PBM [1, 2]. There are some publications for cases with a high risk of bleeding, such as placenta previa [3]. However, there are very few studies in the literature on the unnecessary use of blood products during cesarean section and there is a need to make recommendations for strategies to reduce the use of blood products in obstetric practices [4, 5]. The method of anesthesia is based on optimizing blood loss at PBM. Regional anesthesia is recommended in obstetric anesthesia, but general anesthesia is generally preferred in surgeries with the possibility of major bleeding such as placenta previa. Recent opinions are that regional anesthesia is preferred as much as possible because it causes hypotension [6, 7].

In our study, we aimed to examine the effectiveness and applicability of PBM and determine the anesthesia method preference and its place in the PBM approach in caesarean section at Bursa City Hospital.

**METHODS**

Approval was received from the Bursa City Hospital Ethics Committee (2021-18/8). Between 2019-2021, the files of 6011 adult patients aged 18 and over who underwent cesarean section at Bursa City Hospital were examined. Missing data and/or patients under 18 years of age were excluded from the study. In this retrospective study, demographic data of the patients , preoperative hemoglobin (Hb) level (gr/dL), anesthe-

sia method performed, blood products were transfused or not, and the transfusion period data were recorded by scanning the hospital information data system. The relationship between transfusion and anemia with anesthesia management were examined.

Statistical analysis was performed with SPSS 26.0 (SPSS, Chicago, IL) program. Frequency and descriptive statistics were calculated. In descriptive statistics, continuous variables were presented as mean±SD and categorical variables were presented as percentages. Normal distribution of the data was investigated using the Kolmogorov-Smirnov test. Chi-Square test was used to compare categorical variables between groups. P value <0.05 was considered statistically significant.

**RESULTS**

The files of 6011 patients included in the study were examined. Patients who received blood products transfusion were divided into two groups as Group I and patients who were not transfused into Group II .While Grup I (n=614) ,10.2% received blood products transfusion, Grup II (n= 5397) , 89.8% did not receive transfusion. The transfusion rate in these patients was found to be 10.21%. There was no statistically significant difference between the two groups in terms of demographic data (p>0.05). In pregnant women, Hb level below 10.5 g/dL was considered anemia. The preoperative anemia rate was 35.91% (n=2159) and in these patients the blood transfusion rate was 21.86% (n=472) (Table 2). While Group I preoperative Hb mean values were determined as 9.64 ± 1.58 g/dL, Group II Hb mean values were determined as 11.26 ±1.38 gr/dL (Table 1).

When the period of administration of blood and blood products is examined, preoperatively 247

**Table 1. Demographic data and preoperative Hemoglobin values (gr/dL)**

	<i>Group I (n=614)</i>	<i>Group II (n=5397)</i>	<i>p</i>
Age,(mean±SD)	28,3±4,34	28,4±3,86	>0,05
Hb,gr/dL (mean±SD)	9,64±1,58	11,26±1,38	<0,001
Hb, (% ,n)			
<7 gr/dL	3,2 (20)	0 (0)	<0,001
7-8 gr/dL	14,1 (87)	0,8 (46)	<0,001
8-9 gr/dL	29,3 (180)	4,5 (243)	<0,001
9-10,5 gr/dL	30,1 (185)	25,9 (1398)	<0,001
>10,5 gr/dL	23,1 (142)	68,7 (3710)	<0,001

Group I: Group blood transfusion Group II: Group not blood transfusion  
Hb: Hemoglobin

**Table 2. Transfusion status according to anemia status**

	<i>Group I</i>	<i>Group II</i>
<b>Hb&lt; 10,5 gr/dL (n)</b>	472 (21,9 %)	1687 (78,1 %)
<b>Hb&gt;10,5 gr/dL (n)</b>	142 (3,7 %)	3710 (96,3 %)

Group I: Group blood transfusion Group II: Group not blood transfusion  
Hb: Hemoglobin

(40.3%), peroperatively 53 (8.6%) and postoperatively 314 (51.1%) patients received transfusion were observed. Spinal anesthesia method was found to be statistically higher in both groups ( $p<0.001$ ). The rate of spinal anesthesia was higher in Group II than in Group I (Table 3).

## DISCUSSION

The patient blood management approach was first brought to the agenda in 2007 [8]. Since then, it has been aimed to minimize the problem effectively at the appropriate time, optimizing the application of the appropriate blood product to the appropriate patient with the appropriate indication [9]. Australia demonstrates very successful examples of the PBM approach. It was stated that they should make their own protocols for every hospital has blood transfusion [1, 10].

Determination and correction of anemia are included in the protocols by optimizing the erythrocyte volume. Pregnant women are one of the groups where anemia is frequently seen. For cesarean section, it is undesirable for patients to be anemic due to the risk of bleeding. Organizing anemia treatment primarily under elective conditions and providing optimal preoperative Hb values are aimed. The World Health Organization (WHO) defines anemia during pregnancy as Hb level of less than 11 g/dL, while the Centers for Disease Control and Preventions (CDC) and American College of Obstetricians and Gynecologists (ACOG) consider Hb level of less than 10.5 g/

dL during the second trimester as the criterion for diagnosing anemia [11-13]. A more specific Hb range (other than statistically determined anemia) associated with the optimal gestational Hb range and perinatal outcomes has not been determined yet. In our study, we determined preoperative Hb value to be <10.5 g/dl as anemia. The rate of anemia was 35.91% detected in our study. Stevens et al while the prevalence of anemia in pregnant women worldwide was 38% in their studies, the prevalence of anemia in pregnant women in European people was reported that it was 25.8% [14]. In our study, it was determined that 472 out of 2159 patients (21.9%) in the anemic group, which had a high rate, received blood transfusion. The fact that 40.3% of blood transfusions are in the preoperative period is also a very high rate. Patterson et al. reported in their study that unnecessary blood transfusion was performed in cesarean sections and pregnant women [15]. In our study, we are thinking that unnecessary blood transfusion was performed and it can be optimized with oral and/or intravenous iron preparations before anemia treatment [16].

Optimization of total erythrocyte volume, blood loss and physiological reserve of the patient are steps of PBM [17]. The method of anesthesia is based on optimizing blood loss at PBM. It is thought that spinal anesthesia may cause less blood loss than general anesthesia due to sympathetic blockade and hypotension. General anesthesia is more preferred in patients with the risk of hemodynamic instability due to major hemorrhage such as placenta previa [18]. Additionally, since coagulation disorders caused by massive

**Table 3. Transfusion status according to anesthesia method and anemia**

		<i>Group I</i>	<i>Group II</i>	<i>P</i>
<b>Spinal Anesthesia (n,%)</b>	Hb< 10,5 gr/dL	349 (36,8)	1406 (26,0)	<0,001
	Hb>10,5 gr/dL	82 (13,3)	2995 (55,4)	<0,001
<b>General Anesthesia (n,%)</b>	Hb< 10,5 gr/dL	123 (20,1)	281 (5,2)	<0,001
	Hb>10,5 gr/dL	60 (9,7)	715 (13,2)	<0,001
<b>Total</b>		614	5397	

Group I: Group blood transfusion Group II: Group not blood transfusion  
Hb: Hemoglobin

hemorrhage and transfusion may increase the risk of epidural or spinal hematoma, general anesthesia may be preferred [19]. In our study, it was determined that spinal anesthesia was performed at a very high rate in cesarean sections. As a limitation, we could not obtain sufficient data in the records regarding placental anomalies. Recently, in operations with a high risk of bleeding, such as placenta previa, it is recommended to start with regional anesthesia and return to general anesthesia when necessary [6]. We think that this result is due to the recommendation of regional anesthesia method in cesarean section and the opinion that it can reduce blood loss [7, 20].

Unnecessary blood transfusion occurs due to individual opinions and traditional approaches.

There are many minor and major complications like as allergic reactions, TRALI etc. of unnecessary blood transfusion. There have been many publications about the effects of transfusion on mortality, morbidity and the differences between clinicians' practices in recent years [21-23]. The limitation of our study is uninvestigating early and late complications of blood transfusion and anemia.

## CONCLUSION

Unnecessary blood transfusion and complications can be prevented by providing early diagnosis and treatment of antenatal anemia. Correction of patients' anemia is preferred for regional anesthesia in caesarean section. To ensure that, preoperative blood transfusion is observed to be quite high. In order for PBM to be more effective, we must make our in-hospital protocols accompanied by guidelines and make them applicable. Blood products are costly and difficult to obtain. By using protocols, appropriate time, appropriate patient and appropriate product application can be achieved. In cesarean section, instead of blood transfusion to increase the preoperative Hb level, we should ensure that it is optimized with oral or intravenous iron preparations beforehand.

### Conflict of Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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### Ethical Approval

The protocol of the study was approved by the Medical Ethics Committee of Bursa City Hospital, Bursa, Türkiye. (Decision number: 2021-18/8, date: 06.10.2021).

### Authors' Contribution

Study Conception: ST; Study Design: ST; Literature Review: ST; Critical Review: ST; Data Collection and/or Processing: ST; Analysis and/or Data Interpretation: ST; Manuscript preparing: ST.

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