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Incidence of Obstetric Massive Blood Transfusion and Clinicial Features: Hospital-Based Study

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Abstract: To determine the incidence of obstetric massive blood transfusion in a tertiary center, to determine the characteristics of massive blood transfusion, its main causes and adverse outcomes in obstetric cases, thus trying to contribute to the creation of obstetric emergency plans. The results of 39 cases who underwent massive blood transfusion for obstetric indications were reviewed retrospectively. Demographic data of the cases (age, gravida, parity, body mass index), indications for hospitalization, vital signs during hospitalization, shock index, hemogram values and international normalized ratio (INR) values, massive transfusion indications, transfused blood products (and in intensive care/intensive care units) from patient medical files. Length of hospital stay, reactions and complications related to massive transfusion were recorded. The cases who underwent obstetric massive blood transfusion were divided into 2 groups as low-risk pregnancy and high-risk pregnancy. The data were also compared between the 2 groups. The rate of massive blood transfusion was found to be 26 (12/4607) in 10000 pregnancies in low-risk pregnancies and 1.2% (27/2269) in high-risk pregnancies. Transfusion was started in 21 of 33 cases who underwent cesarean section due to massive bleeding that occurred intraoperatively. The time between the decision of transfusion due to obstetric hemorrhage and initiation of transfusion, and the vital signs and shock indices of the cases at the time of initiation of transfusion were similar between the groups ($p>0.05$). However, while the hemoglobine and hemotocrit levels were statistically lower in the low-risk group at the time of initiation of transfusion, the INR value was statistically higher in the high-risk group. In massive obstetric hemorrhages, which is one of the most important causes of maternal mortality, performing procedures such as blood transfusion and hysterectomy without delay is life-saving. ©2023 NTMS.

Keywords: Massive Transfusion; Obstetrics; Morbidity; Mortality.

1. Introduction

Obstetric hemorrhage remains a common obstetric emergency and is similarly still the leading cause of maternal mortality in Turkey. There are many definitions of massive bleeding in the obstetric literature. Recommended values to consider massive bleeding are, >10 units over 24 h, four units of red

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blood cells (RBCs) transfused within 4 h with active major bleeding of more than 150 mL/min, >8 units of RBCs within 24 h of delivery, Three units RBCs administered over 60 min or postpartum hemorrhage >1500 mL with clinical signs or symptoms of anemia or hemodynamic decompensation [1, 2].

Massive blood transfusion occurs as a 'life-threatening' event when large volumes of blood products are administered over a short period of time, indicates major obstetric bleeding and requires extensive coordination of obstetric, anesthesia and blood bank teams. The incidence of massive blood transfusions related to labor or postpartum hemorrhage (PPH) has been reported to be 0.23-1 per 1000 mothers in high-resource countries [3].

In this study, our aim is to determine the incidence of obstetric massive blood transfusion in our hospital, which is a tertiary center, to determine the characteristics of massive blood transfusion, its main causes and negative outcomes in obstetric cases, thus to contribute to the creation of obstetric emergency plans.

2. Material and Methods

In this descriptive epidemiological study, the results of 39 cases who underwent massive blood transfusion for obstetric indications between 01.10.2022 and 31.05.2023 in our hospital, which is a multidisciplinary 3rd level center, were retrospectively analyzed. Approval was obtained from the Local Ethics Committee for this study (Ethics Committee Approval Number: EK1-2023-297).

The criteria for massive blood transfusion were >10 U within 24 hours or 4 U of Erythrocyte suspension (ES) replacement within 4 hours with active bleeding. Demographic data (age, gravida, parity, body mass index(BMI)), hospitalization indications, vital signs during hospitalization, shock index, hemogram values and international normalized ratio (INR) values, massive transfusion indications, transfused blood products (erythrocyte suspension, fresh blood, frozen plasma, pooled platelet suspension, cryoprecipitate, fibrinogen) and length of stay in the intensive care unit and hospitalization, as well as reactions and complications related to massive transfusion were recorded.

The cases who underwent obstetric massive blood transfusion were divided into 2 groups as low-risk pregnancy and high-risk pregnancy. The following characteristics were used to identify pregnancies as low risk: maternal age 20–39 years, gestational age at delivery 37-42 weeks, BMI <30 kg/m^2, singleton pregnancy, and cephalic presentation. Pregnancies with any evidence of prepregnancy diabetes, gestational diabetes, hypertension, history of preterm birth, poor pregnancy outcome, cervical cerclage, premature rupture of membranes, congenital anomalies (including anencephaly, meningomyelocele/spina bifida, congenital diaphragmatic hernia, omphalocele, gastroschisis, limb reduction defect, cleft lip with or without cleft palate, cleft palate alone, and Down syndrome) accepted as high- risk pregnancy.

2.2.3. Statistical analysis

Statistical analyzes were performed using IBM SPSS 23.0 software. Descriptive and categorical data were expressed as numbers (n) and percentages (%). The results of the continuous data were given as Mean±SD, median, and minimum-maximum values. The mean values of the data according to the groups were calculated using the Independent Sample-T test, and the median values were calculated using the Mann-Whitney test. A p value of <0.05 was considered statistically significant.

3. Results

39 of 6876 deliveries were analyzed in the Obstetrics Unit and Perinatology departments of our hospital during the 8-month period in which cases who underwent massive blood transfusion for critical bleeding due to obstetrics were examined. The need for massive blood transfusion due to obstetrical bleeding was calculated as 5.7 per 1000. While 12 (30.8%) of the cases whose data were analyzed in our study were low-risk pregnancies, 27 (29.2%) were in the high-risk pregnancy category. Thus, the rate of massive blood transfusion was found to be 2.6 (12/4607) in 1000 pregnancies in low-risk pregnancies, and 0.12 in 1000 cases (27/2269) in high-risk pregnancies.

Demographic and clinical data of 39 cases whose data were analyzed in the study are shown in Table 1. When the indications for hospitalization of these cases during the period of obstetric bleeding were examined, the most common indication in the low-risk pregnancy group was a history of previous cesarean section with an uneventful pregnancy (Table 2). In the high-risk pregnancy group, the most common indication for hospitalization was the presence of placenta previa (n=16). 5 of the cases were primigravid (13.2%), 10 of them were primiparous (26.3%), 21 of them were multiparous (52.6%), and 3 of them were grandmultiparous (7.8%). While 8 of 34 cases with a previous delivery history had a vaginal delivery, 10 had a previous cesarean section and 16 had more than one previous cesarean section. While obstetric hemorrhage requiring massive blood transfusion occurred in the third trimester in 25 cases and in the second trimester in 12 cases, it occurred during the first trimester of pregnancy in only 1 case. In one case, it occurred after 24 hours postpartum.

The number of anemic cases (hemoglobine (Hb) <10 g/dl) at hospitalization was 14 (36.8%). In 3 patients, the Hb value was <7 g/dl at the time of admission to the hospital with vaginal or abdominal bleeding.

Table 1: Characteristics of cases who underwent massive transfusion (n=39).

		Mean ±SD	Median (Minimum-Maximum)
Age		32.2±5.2	31.5 (18-42)
BMI (kg/m ^{2})		28.3±4.5	27.7 (17.2-39.4)
Number of pregnancies (n)		3.6±1.9	3.0 (1-9)
Number of births (n)		2.1±1.6	2.0 (0-7)
Week of pregnancy at which bleeding occurs		31.1±7.4	33.2 (13.4-39.6)
Hospitalization	**Hb level (g/dl)**	10.5±2.1	10.5 (5.1-14.0)
	HTC level (%)	32.4±5.7	31.9 (19.8-43.4
	Platelet count (x10 ^{3})	218±72	202 (48-396)
	INR level	1.12±0.42	1.01 (0.90-3.51)
The time between decision of transfusion and starting the transfusion (min)		88±118	37 (7-517)
Total transfusion time (hours)		4.6±1.4	5.3 (1.8- 6.4)
When the transfusion is started	**Systolic BP (mmHg)**	102±19	103 (50-146)
	Diastolic BP (mmHg)	61±14	61 (31-95)
	Heart rate (/min)	107±21	110 (71-80)
	Shock index*	1.1±0.5	1.0 (0.7-2.8)
	Hb level (g/dl)	8.5±1.9	8.3 (4.7-12.1)
	HTC level (%)	26.2±5.4	26.3 (13.9-35.2)
	Platelet count (x10 ^{3})	181±81	173 (18-333)
	INR level	1.13±0.19	1.10 (0.90-1.82)
During obstetric bleeding	**Lowest Hb level (g/dl)**	6.9±1.2	7.0 (3.3-10.0)
	Lowest HTC level (%)	21.5±3.7	21.4 (9.2-30.1)
	Lowest platelet count (x10 ^{3})	114±52	113 (18-249)
	Highest INR level	1.30±0.46	1.20 (0.90-3.51)
On discharge	**Hb level (g/dl)**	10.3±1.4	10.2 (7.6-13.9)
	HTC level (%)	31.7±4.3	31.8 (23.5-42.5)
	Platelet count (x10 ^{3})	294±130	238 (128-752)
	INR level	1.03±0.11	1.00 (0.90-1.39)
Length of stay in intensive care (days)		3.6±3.7	2.0 (1-15)
Length of stay in hospital (days)		13.5±13.2	9.5 (2-65)

*Pulse rate/systolic BP. BMI: Body mass index, Hb: Hemoglobin, HTC: Hemotocrit.

When the demographic data of the cases and clinical findings were compared during the massive blood transfusion process were compared according to the risk status of the pregnant women (low-risk pregnancy group (n=12) and high-risk pregnancy group (n=27) (Table 3). The mean age was significantly higher in the high-risk group as expected (29.0±6.1 versus 33.3±4.7, p=0.023). Body mass indexes were similar in both groups (p= 0.128). The median number of pregnancies in low-risk pregnancies is 3.0 (1-5), median parity is 2.0 (1-4), and in high-risk pregnancies these numbers are 4.0 (2-9) and 2.0 (1-7), respectively (p-value p=0.178 and p=0.178, respectively). p=0.254). While obstetric hemorrhage occurred at 35.2±8.0 (median 38) weeks of gestation in the low-risk pregnancy group, the mean gestational week was 29.4±6.7 (median 28.5) (p=0.035) in the high-risk pregnancy group. The mean Hb, hemotocrit (Htc) levels and INR values at hospitalization were similar between the groups (p>0.05).

Obstetric massive bleeding started during pregnancy in 4 (10.3%) cases, intrapartum in 18 (46.2%) cases, all during cesarean section, and in 17 (43.6%) cases in the postpartum period. The causes of obstetric hemorrhage requiring massive blood transfusion are shown in Figure 1 in detail. While bleeding occurred after vaginal delivery in 5 of the cases with postpartum bleeding, massive bleeding started after cesarean section in 12 cases.

Table 2: Hospitalization diagnoses of patients who received massive blood transfusion (n=39).

	n %
Low-risk pregnancies (n=12)	**30.8**
History of caserean section	**5**
Fetal indications (fetal distress, tachycardia, malpresentation/malposition)	**3**
Oligohydramnios	**1**
Rest placenta	**1**
Pregnancy+anemia	**1**
Early membrane rupture	**1**
High-risk pregnancies (n=27)	**69.2**
Placenta previa	**12**
Placental abruption+intrauterine ex fetus	**3**
Hypertension of pregnancy, severe preeclampsia/Eclampsia/(HELLP) syndrome	**2**
Placenta previa+Placenta accreta spectrum	**2**
Multiple pregnancy	**2**
PPROM	**1**
Placenta previa+Uterine rupture	**1**
Twin pregnancy+Placenta previa	**1**
13 weeks pregnant+acute abdomen	**1**
24 weeks pregnant+acute abdomen	**1**
Pregnancy+Hemophilia C	**1**

Hemorrhage that required massive blood transfusion occurred in the postpartum period in 75% (n=9) of low-risk pregnancies, while 59.3% (n=16) of massive bleeding in high-risk pregnancies was intraoperative (because all were delivered by cesarean section). occurred (p=0.027) (Table 4). The mean time between the decision to transfusion due to obstetric hemorrhage and initiation of transfusion was 88±118 minutes. When the transfusion was started, the mean systolic blood pressure of the cases was 102±19 mmHg, diastolic blood pressure was 61±14, heart rate was 107±21 /min, and the shock index was 1.1±0.5 (median 1.0 median. Shock index was <0.9 in 10 (26.3%) cases, in 18 cases. Transfusion was initiated when it was above the value of 0.9-1.2, and in 11 cases, when the value was higher than 1.2. The time between making the decision to transfusion due to obstetric hemorrhage and starting transfusion and the vital signs and shock indexes of the cases at the time of initiation of transfusion were similar between the groups (p>0.05). While Htc levels were statistically lower in the low-risk group, the INR value was statistically higher in the high-risk group (Table 3).

When the blood groups of the cases were examined, the number of A (+) blood group cases was 18 (47.4%), O (+) n=8, 21.1%, B (+) n=6, 15.8%, AB (+) n=4 (10.4%), A (-) and B (-) are 1 case each. There was no case with O (-) and AB (-) blood groups. When the replaced blood products were examined, similar amounts of ES, Fresh frozen plasma (FFP) and fibrinogen were given to both groups (p>0.05) (Table 5). The median amount of ES given to the low-risk group was 6 (4-10), the median value of FFP was 4 (1-9), the median amount of ES in high-risk pregnancies was 7 (4-15), FFP 4 (2-9) units. (p -value is 0.065 and 0.327, respectively). In low-risk pregnancies, 1 unit of pooled thrombocyte suspension was administered to 2 cases, and 3 units of pooled thrombocyte suspension was administered to only 1 case in high-risk pregnancies. In cryoprecipitate, 10 units were given to 2 cases (3 U in one, 10 U in the other) in low-risk pregnancies and 10 units in 2 cases in high-risk pregnancies. FFP was also given to all patients who were given cryoprecipitate. Fibrinogen (1 g in 2 cases, 2 g in 21 cases, ≥3 g in 9 patients) was given to 32 cases. When the surgical procedures performed in addition to blood transfusion in cases with massive bleeding were examined, the diagnosis was made in 4 cases whose obstetric bleeding started during pregnancy at 13 weeks of gestation. Total hysterectomy was performed directly on the case with uterine rupture before the pregnancy was terminated. Peripartum hysterectomy was performed after cesarean section in 3 cases whose bleeding started during pregnancy. Peripartum hysterectomy was performed in 9 and postpartum hysterectomy was performed in 1 of 18 patients who started perioperative bleeding during cesarean section.

Laparotomy was performed in only 1 of 5 cases with postpartum bleeding after vaginal delivery and hysterectomy was not required in any case. Relaparotomy was performed in 10 of 12 cases with postpartum bleeding after cesarean delivery. While postpartum hysterectomy was performed in 3 of these cases, bleeding was controlled with uterus-sparing surgical procedures in the remaining cases. Transfusion was started in 21 of 33 cases who underwent cesarean section due to massive bleeding that occurred intraoperatively. In 9 of these cases (42.9%; 9/21), bleeding was stopped perioperatively without the need for additional surgical intervention, but postoperative relaparotomy was performed in one of them and hysterectomy was performed. However, peripartum hysterectomy was performed in all 12 cases with perioperative bleeding (Figure 1).

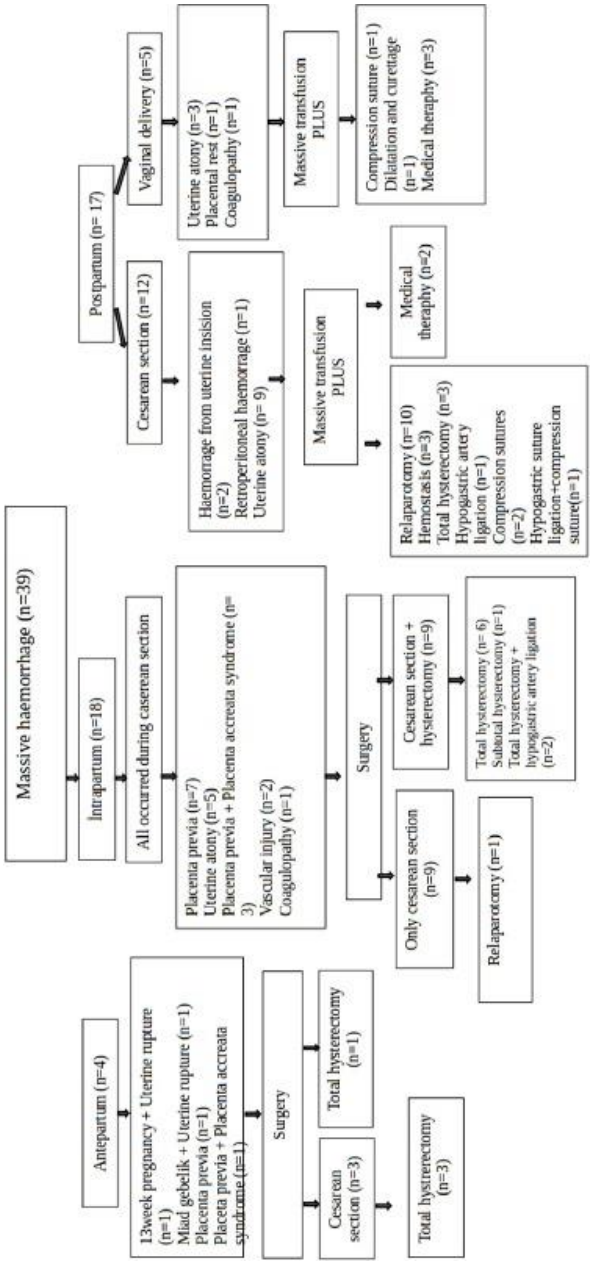

Figure 1: Management chart of cases who had massive blood transfusion and delivered by cesarean section.

Transfusion-related allergic reaction was observed in 7 (17.9%) of the patients who received massive blood transfusion. Febrile nonhemolytic transfusion reaction (high fever; >38 ºC) occurred in 5 of them, acute hemolytic transfusion reaction occurred in 1 case (fever, chills, chest and back/low back pain), and allergic reaction (dyspnea, urticaria) occurred in 1 case. In these cases, transfusion was temporarily suspended and continued after medication. No anaphylactic reaction was observed in any case severe enough to cause the termination of transfusion. In one case in the high-risk pregnancy group, a diagnosis of Transfusion-related acute lung injury (TRALI) was made and treated based on the examination of the development of respiratory distress, hypoxia and hypotension during transfusion and the findings of abnormal chest X-ray.

When the duration of intensive care and hospitalization of the cases were examined, it was observed that the length of stay in the intensive care unit was similar in the two groups (median 1.0 (1-4) days in the low-risk group, 2.5 (1-15) days in the high-risk group, p=0.182). The total length of hospital stay was statistically significantly longer in the high-risk group (median 5.0 (2-21) days in the low-risk group, 10.0 (4-65) in the high-risk group, p=0.044). No maternal death was noted in any of the cases.

4. Discussion

In this study, the incidence of massive blood transfusion due to obstetric hemorrhage in a tertiary center was found to be 5.7 per 1000. This rate was found to be 0.12 per 1000 in high-risk pregnancies. It is noteworthy that 66.7% of the cases who underwent massive blood transfusion due to obstetric hemorrhage had at least one previous cesarean delivery history.

In the literature, many different definitions have been made the definitions of massive bleeding regarding and massive blood replacement. These are usually the definitions made on the unit of blood products. In the Patient Blood Management Guide published by the Ministry of Health of our country, massive transfusion for adults is considered if more than half of the blood volume is transfused within 4 hours or more than the total blood volume (approximately 70 ml/kg of blood volume in adults) within 24 hours [2]. Although this definition is better to eliminate the heterogeneity between the body mass indexes of individuals and to provide standardization, we preferred to use the definitions made by using the unit since our study only used the data of pregnant women and made a retrospective analysis. When pregnancy and delivery are included, the need for blood and blood products transfusion varies between 0.03-0.6 per 1000 cases [3-5]. Common risk factors have been found in many studies that lead to the need for blood product transfusion during pregnancy and labor [5, 6]. These factors include placental pathologies (placenta previa, insertion anomaly, abruption, rest placenta), anemia, excessive uterine distension (multiple pregnancy, polyhydramnios), preeclampsia/eclampsia, preterm labor, induction of labor, trauma, emergency cesarean section and operative delivery.[7] Postpartum hemorrhages are one of the most important risk factors for blood transfusions, as demonstrated in etiological studies on obstetric transfusions [6, 7].

Table 3: Comparison of demographic data and clinical findings by groups.

		Low risk pregnancy (n=12)	High-risk pregnancy (n=27)	p
		Mean±SD (min-max)		
Age		29.0±6.1 (18-37)	33.±4.7 (26-42	**0.023**
BMI (kg/m2)		30.1±3.8 (23.9-35.8)	27.7±4.7 (17.2-39.4)	0.128
Number of pregnancies (n)		2.8±1.5 (1-5)	3.9±2.1 (1-9)	0.136
Number of births (n)		1.8±0.9 (1-4)	2.6±1.6 (1-7)	0.191
Gestational week at the time of bleeding		35.2±8.0 (13-39)	29.±6.7 (17-38)	**0.035**
Hospitalization	Hb level (g/dl)	9.9±2.8 (5.1-13.1)	10.6±1.9 (7.1-14.0)	0.351
	HTC level (%)	31.4±6.9 (19.8-39.2)	32.3±5.6 (20.8-43.4)	0.665
	INR level	1.1±0.1 (0.9-3.5)	1.2±0.7 (0.9-1.4)	0.298
	Platelet count (x10 ^{3})	231±65 (131-332)	212±74 (48-396)	0.450
Duration between the decision of transfusion and starting the transfusion (min)		98±110 (8-373)	8±122 (7-517)	0.785
Total transfusion time (hours)		4.6±1.3 (2.3-6.0)	4.7±1.4 (1.8-5.8)	0.797
When the transfusion is started	Systolic BP (mmHg)	101±16 (70-128)	102±21 (50-146)	0.895
	Diastolic BP (mmHg)	61±13 (40-88)	61±15 (31-95)	0.961
	heart rate (/min)	111±16 (82-138)	105±22 (71-180)	0.408
	Shock index*	1.1±0.3 (0.7-1.8)	1.1±0.5 (0.5-2.8)	0.862
	Hb level (g/dl)	7.4 ±1.2 (5.5-9.0)	8.9±2.0 (4.7-12.1)	**0.022**
	HTC level (%)	23.6±3.7 (18.7-28.7)	27.1±5.8 (13.9-35.2)	0.033
	Platelet count (x10 ^{3})	200±77 (68-330)	174±82 (18-333)	0.366
	INR level	1.0±0.1 (0.9-1.2)	1.2±0.2 (0.9-1.8)	**0.034**
Obstetric bleeding	Lowest Hb level (g/dl)	6.3±0.8 (5.1-7.6)	7.2±1.3 (3.3-10.0)	0.040
	Lowest HTC level (%)	20.3±2.0 (17.2-24.0)	21.9±4.1 (9.2-30.1)	0.227
	Lowest platelet count (x10 ^{3})	134±56 (68-249)	107±49 (18-234)	0.139
	Highest INR level	1.4±0.7 (0.9-3.5)	1.3 ±0.3 (0.9-2.1)	0.508
On discharge	Hb level (g/dl)	9.7±1.1 (7.6 – 11.1)	10.6±1.5 (8.1-13.9)	0.070
	HTC level (%)	30.6±3.4 (23.5-35.9)	32.2±4.6 (24.6-42.5)	0.284
	Platelet count (x10 ^{3})	297±116 (128-478)	287±137 (131-752)	0.841
	INR level	1.0±0.1 (0.9-1.2)	1.0±0.1 (0.9-1.4)	0.495
Length of stay in intensive care (days)		1.8±1.5 (1-4)	4.1±4.0 (1-15)	0.277
Length of stay in hospital (days)		8.5±6.2 (2-21)	15.4±14.7 (4-65)	**0.047**

*Pulse rate/systolic BP. BMI: Body mass index, Hb: Hemoglobin, HTC: Hemotocrit.

Table 4: Period in which massive bleeding occurs according to pregnancy risk groups.

	During pregnancy (n=4)	Intrapartum/Intraoperative (n=18)	Postpartum (n=17)
Low risk pregnancy (n=12)	1 (25.0%)	2 (16.7%)	9 (75.0%)
High-risk pregnancy (n=27)	3 (11.1%)	16 (59.3%)	8 (29.6%)

Table 5: Amount of transfused blood products.

	All cases (n=39)	Low risk pregnancy (n=12)	High-risk pregnancy (n=27)	p
	Mean±SD (Median; Min-Max)	Mean±SD (Min-Max)		
Erythrocyte suspension (U)	7.2±2.7 (6.5; 4-15)	5.9±2.1 (4-10)	7.6±2.8 (4-15)	0.073
Fresh frozen plasma (U)	4.9±2.5 (4.0; 2-11)	4.3±2.4 (1-9)	5.1±2.4 (2-11)	0.361
Fibrinogen (g)	2.1±1.3 (2.0; 0-6)	2.4±0.9 (1-4)	2.5±1.0 (1-6)	0.801

In massive blood transfusion protocols, it is generally recommended to replace blood products as 1 U ES/1 U FFP/1 U pooled platelet suspension [8, 9]. However, in our study, it is seen that the recommendation of 1/1/1 was not fully met in both the low-risk pregnancy group and the high-risk pregnancy group. It is seen that the amount of replaced ES is approximately 2.3 U more than the FFP. Cryoprecipitate replacements were also made in 4 cases who had already been given FFP. Platelet replacement was performed in only 3 cases whose platelet count fell below 50 thousand during surgery. Since there was no maternal mortality despite this practice and all our patients were discharged, it may be considered to review the 1:1:1 recommendation for massive transfusion and to decide on the number of routine applications of platelet replacement. Although the retrospective nature of our study limits its value in this respect, our proposal needs to be supported by prospective and population-based studies.

Another conclusion that can be drawn from this study is the importance of starting blood transfusion when the mother's compensation mechanisms are still active. In the cases in our study, when transfusion was started, mean systolic BP was 102±19 mmHg, diastolic BP was 61±14, heart rate was 107±21/min, and shock index was 1.1±0.5 (median 1.0). It was initiated when the shock index was below 1.2 in 72% of the cases. In massive hemorrhages, while compensation mechanisms are still in effect, it is life-saving to decide on transfusion in a timely manner before hypovolemia symptoms worsen and the severity of coagulopathy does not increase.

Transfusion is a life-saving procedure in the prevention of maternal mortality and morbidity [10, 11]. However, approximately 1% of all transfusions may cause sudden onset or delayed reactions despite the measures taken to reduce the risks [12]. Allergic reactions, hemolytic reactions, blood-transmitted infections, transfusion-related acute lung injury, electrolyte disturbances (hypocalcemia, hypomagnesemia, hyperkalemia), massive transfusion-related complications (hypothermia, metabolic acidosis, and coagulation disorders) limit the clinician in random use of blood products. necessary complications [13- 15]. Considering the risks of blood transfusion, in most clinics, blood transfusion is primarily planned in symptomatic patients with Htc <20%, but in hemodynamically stable and asymptomatic patients with Hb below 7 g/dl, an individualized treatment with oral antianemic or intravenous iron therapy can be used as an alternative to transfusion [16- 18].

The incidence of obstetric massive blood transfusion is increasing, but the rate of hysterectomy and bleeding disorders is decreasing among women undergoing it [19, 20]. In order to minimize the incidence of obstetric massive transfusion, more importance should be given to education on the importance of antenatal visits, evidence-based transfusion practices, multiparous women in advanced age, uterine atony, severe anemia and placenta previa. Appropriate blood transfusion preparations and antenatal early detection for high-risk pregnant women can improve outcomes and reduce adverse outcomes.

5. Conclusions

In massive obstetric hemorrhages, which is one of the most important causes of maternal mortality, application of surgical procedures (compression sutures, arter ligation or hysterectomy) combined with massive blood transfusion is life-saving.

Limitations of the Study

Several limitations to this pilot study need to be acknowledged. These findings are limited by the use of a observational design. The lack of larger sample size adds further caution regarding the generalisability of these findings.

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Conflict of Interests

No conflict of interest was declared by the authors.

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Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version. Conception-İ.Ö.; Design-İ.Ö.; Supervision-H.L.K.; Funding-İ.Ö.; Materials-İ.Ö.; Data collection and analysis-H.L.K; Analysis and interpretation- İ.Ö., H.L.K.; Literature review-İ.Ö.; Writing-İ.Ö.; Critical review-İ.Ö., H.L.K.

Ethical Approval

The study was carried out with the permission of Ethical Committee of Ankara Etlik City Hospital (Decision no: EK1-2023-482).

Data sharing statement

All data relevant to the study are included in the article.

Consent to participate and Informed Statement

Because the study was designed retrospectively, no written informed consent form was obtained from patients.

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