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Retrospective Analysis of Eighty-Nine Caesarean Section Cases with Abnormal Placental Invasion

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Abstract

Objective: Abnormal placental invasion (API) is defined as an abnormal adherence of the placenta to the underlying uterine wall. Undiagnosed API may result in catastrophic maternal haemorrhage during delivery. In the present retrospective analysis, anaesthetic and surgical records were evaluated in patients with API who had undergone caesarean delivery (CD).

Methods: Clinical records of 89 patients with API who had undergone CD were retrospectively reviewed in our clinic between April 2010 and February 2017.

Results: Amongst the patients, 87 (97.8%) had a history of previous CD and 68 (76.4%) had placenta previa. In regression analysis, weak positive correlation was found between an increase in packed red blood cell (PRBC) (r=0.420, p=0.001) and fresh frozen plasma (FFP) (r=0.476, p=0.022) transfusions and time of hospital stay. PRBC and FFP consumptions were significantly greater in intensive care unit (ICU) patients than in non-ICU patients (p<0.001). ICU requirement were significantly greater in patients who had more than average crystalloid (p=0.004) and colloid (p<0.001) infusions. Elective CD was performed in 81 (91%) patients and emergency CD in 8 (9%). PRBC transfusions were 7±4.3 U in patients undergoing emergency CD and 3.85±3 U in patients undergoing elective CD (p=0.034). The number of patients requiring care in ICU was 4 (50%), who underwent emergency CD and 12 (14%) who underwent elective CD, (p=0.032).

Conclusion: It is crucial that the anaesthesiologist should be familiar with the risk factors and diagnosis of API because of the potential risk of massive haemorrhage. Multidisciplinary approach with surgery and blood bank decreases the amount of bleeding, blood transfusion requirement, ICU and hospital stay in patients with API.

Keywords: Abnormal placental invasion, placenta accreta, caesarean section, transfusion

Introduction

The pathological attachment of the placenta to the myometrium is called abnormally invasive placenta (AIP). AIP can be divided into 3 types, according to the depth of invasion: placenta accreta (PA; placental villi are in direct contact with the myometrium); placenta increta (PI; placental villi invade into the myometrium) and placenta percreta (PP; placenta tissue passes the serosa and penetrates the adjacent structures, including the bowel and bladder) (1). PA is more common than PI and percreta. There are 2 major risk factors for the development of abnormal invasive placentation, and these are a previous caesarean section and placenta previa (PPrev) (2).

The incidence of AIP gradually increases with the incidence of caesarean section, and the anomalies occurring during the implantation and the separation process of the placenta may result in catastrophic haemorrhages. In the case of AIP, the blood loss can reach high levels that will disrupt haemodynamics, and it often requires massive blood transfusions (1-4). In AIP cases, many complications such as massive blood transfusions; uterus rupture; surgical

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trauma in the bowel, bladder and ureter; infection; postoperative intensive care unit (ICU) requirement and multi-organ failure may occur, and AIP constitutes the most common cause of peripartum hysterectomies (5).

Although developments in obstetric care have led to significant improvements in AIP-associated clinical outcomes, the maternal mortality, which is usually caused by bleeding, is still high at 7% (6). In these patients, careful multidisciplinary planning is essential in prenatal and peripartum periods to prevent complications (7).

In this study, we aimed to retrospectively investigate the anaesthetic and surgical data of the patients diagnosed with AIP in the preoperative or intraoperative period for developing our intraoperative anaesthesia management and obtaining information about postoperative complications, as well as to evaluate the perioperative need for blood and blood product, peripartum hysterectomy rate, postoperative intensive care need, neonatal Apgar scores, maternal complications and the length of hospital stay.

Methods

After receiving an approval of the Çukurova University Medical Faculty Clinical Research Ethics Committee (Date: 03.02.2018, decision no. 47), the files and anaesthesia records of 89 patients who underwent caesarean section between April 2010 and February 2017 and who were diagnosed with AIP in the preoperative or intraoperative period were reviewed retrospectively.

Demographic features, comorbidities and preoperative haemoglobin (Hb) and haematocrit (Htc) values were recorded from the preoperative records. The intraoperative records were reviewed, and the type of monitoring, anaesthesia technique, duration of operation, the type and amount of fluid that was given, blood and blood products that were transfused, intraoperative complications and Apgar scores of newborns at the 1st and 5th minutes were recorded.

The number of patients taken to the ICU and the length of stay, duration of hospitalisation and postoperative maternal complications were examined from the postoperative records.

It was found that the preoperative anamnesis and physical examination (airway, cardiovascular and respiratory evaluation), complete blood count and biochemical parameters of the patients were examined in the preoperative evaluation at the outpatient anaesthesiology clinic.

Although there is no particular classification used for the risk assessment in our hospital, the pre-diagnosis of AIP is established through certain ultrasonography (USG) findings, such as the absence of a normal retroplacental hypoechoic region, thinning of the hyperechoic area between the uterine serosa and bladder, intraplacental vascular spaces and loss of a normal venous flow pattern in the peripheral placental region. The final diagnosis and the determination of the depth of the invasion are established by intraoperative observation and a histopathological examination of the uterus. The risk of massive haemorrhage should be considered in the presence of USG findings suggesting AIP and a history of more than 2 previous caesarean sections (2, 4). Based on the USG findings in the preoperative preparation period, crossmatching is performed for 4 units (U), and a total of 8 U of packed red blood cell (PRBC) and 4 U of fresh frozen plasma (FFP) are prepared for patients who have AIP and no risk of massive haemorrhage, and 10 U PRBC, additionally 10 U FFP and 5 U of thrombocyte suspension (TS) are prepared for those with the risk of massive haemorrhage. For the cases included in the definition of massive haemorrhage, a routine complete blood count, fibrinogen and D-dimer levels are requested in the intraoperative period and a replacement therapy (platelet, cryoprecipitate and anti-fibrinolytic agent) is given if necessary.

In our hospital, caesarean section is planned under elective conditions in the 34th week in patients with suspected AIP upon an USG examination by the Department of Obstetrics and Gynaecology (OG). The patients that have vaginal haemorrhage and acute foetal distress or whose labour has begun are operated under emergency conditions.

In our patients undergoing surgery, with the pre-diagnosis of abnormal invasive placentation, electrocardiography (ECG), peripheral oxygen saturation ($Sp0_2$) and noninvasive blood pressure are routinely monitored. As an anaesthetic technique in selected cases with uncomplicated minimally invasive placentation, while regional anaesthesia can be administered after consulting with the surgical team, general anaesthesia is preferred in most cases. The patients are established 3 wide (one 20 gauge and two 18 gauge) peripheral venous vascular accesses, and they are subjected to invasive arterial blood pressure monitoring and blood gas monitoring. A central venous catheter (CVC) is not inserted during routine monitoring. In patients who are in need of vasopressor or inotropic therapy or who have a risk of massive haemorrhage (considering the USG data), CVC is inserted in the preoperative period following intubation, and central venous pressure monitoring is performed.

In the intraoperative period, the amount of bleeding at the surgical site is monitored by the number of sponges, the amount of bleeding in the drapes, the amount of blood in the aspirator and a Hb and Htc follow-up and the hourly urine output is routinely monitored. For postoperative anal-

gesia, a personalised multimodal analgesia protocol (such as morphine, non-steroidal anti-inflammatory agents and paracetamol) is applied to each case.

In the postoperative period, patients with an adequate spontaneous breathing effort (SpO_2>94%) and stable haemodynamics after general anaesthesia are extubated at the operation table and sent to the OG service. Patients undergoing a massive blood transfusion (≥4U in 1 hour) and who have an inadequate respiratory effort or unstable haemodynamics are taken to the ICU intubated.

Statistical analysis

The IBM SPSS Statistics Version 20.0 (IBM Statistical Package for the Social Sciences Corp.; Armonk, NY, USA) software was used for statistical analysis of the data. Categorical measurements were presented as the number and percentage and numerical measurements were presented as the mean and standard deviation (median and minimum–maximum value where necessary). In the data analysis, the patients with and without AIP were separated during the preoperative period. In the intraoperative period, the PRBC, FFP, crystalloid and colloid fluid consumption and duration of hospitalisation were compared using the Mann–Whitney U test, and the need for postoperative intensive care was evaluated using the chi-squared test.

In the same manner, in the patients with and without the PPrev diagnosis in the preoperative period, PRBC, FFP, crystalloid and colloid fluid consumption and hospital stay were compared with the Mann–Whitney U test, and the postoperative intensive care requirement was compared with the chi-squared test. In the patients undergoing emergency and elective surgeries, the correlation between the crystalloid and colloid fluid consumption and the need for PRBC and FFP were analysed using the Spearman's correlation coefficient. A logistic regression analysis was used to determine the measurements affecting the postoperative ICU need. A p-value <0.05 was considered to be statistically significant in all tests.

Table 1. Demographic data of the patients

	n (%)	Mean±SD	Min–Max
Age (year)		32.21±4.45	19–45
Weight (kg)		75.25±11.35	49–121
Gravidity		3.80±1.58	1–8
Parity		2.18±1.17	1–7
Gestational age (week)		33.4±3.77	14–38
Number of previous caesarean sections			
0	2 (2.25)		
1	30 (33.7)		
2	44 (49.4)		
≥3	13 (14.6)		
Number of previous uterine curettage			
1	18 (20.22)		
≥2	8 (8.98)		
Placenta previa	68 (76.4)		
Placenta accreta	85 (95.5)		
Placenta percreta	4 (4.49)		
Preoperative haematocrit (%)		33.21±3.84	20–43.5
Preoperative haemoglobin (g dL^{-1})		10.98±1.4	7–15

Data n (%) are presented as the mean±SD or median (min–max). Min–max: minimum–maximum; SD: standard deviation

Results

The files of the patients who underwent caesarean section due to AIP were examined in our study, and demographic data (age, gender, body weight, gravidity and parity), comorbid diseases and preoperative Hb and htc values are presented in Table 1. All patients had at least one of the risk factors determined for AIP.

It was found that only USG was used for early AIP diagnosis in all patients. In the preoperative period, the presence of AIP was detected in 8 patients (8.99%) without AIP, but it was diagnosed as PPrev. Considering preoperative USG findings, intraoperative monitorisation and postoperative histopathological examination, it was found that 85 (95.5%) of patients diagnosed with AIP had PA, and 4 (4.49%) had PP. There were no PI cases seen.

While 62 (69.6%) pregnant women were followed up in the OG clinic of our hospital during their pregnancy, 27 (30.3%) pregnant women were referred to our hospital with the pre-diagnosis of AIP by OG specialists from another health centre. Of the referred patients, 22 were admitted to our hospital before the 34th gestational week and underwent caesarean section under elective conditions. It was detected that 5 patients were operated under emergency conditions.

The distribution of anaesthetic techniques used in this study is presented in Table 2. The patients who were taken to the operating room to undergo caesarean section underwent rapid induction with IV propofol or thiopental, rocuronium or vecuronium as a muscle relaxant and sevoflurane or desflurane as an inhalation agent in 40%/60% O_2/N_2O in the administration of general anaesthesia. It was detected that spinal anaesthesia was applied to 4 patients without the AIP

Table 2. Anaesthesia method, intraoperative management and postoperative findings

	n (%)	Mean±SD	Min–Max
Anaesthesia method			
General anaesthesia	84 (94.4)		
Spinal anaesthesia	2 (2.2)		
Combined spinal-epidural	1 (1.1)		
Spinal and general anaesthesia	2 (2.2)		
Duration of operation (min)		133.93±54.66	45–300
Crystalloid (mL)		2848.3±1752.7	1000–9500
Colloid (mL)		1289.6±865.5	500–4500
Packed red blood cells (U)		4.22±3.31	1–15
Fresh frozen plasma (U)		4.39±3.04	2–14
Thrombocyte suspension (U)		2	1–3
Postoperative haemoglobin (g dL^{-1})		10.02±1.29	6.6–13.8
Postoperative haematocrit (%)		30.02±3.92	21.3–41.1
Newborn weight (gram)		2368.2±686.77	100–3910
Newborn Apgar scores			
1. min Apgar		6.15±1.89	0–9
5. min Apgar		7.87±1.84	0–10
Hysterectomy	57 (64)		
Bladder repair	13 (14.6)		
Intestinal repair	1 (1.1)		
Ureteroneocystostomy	1 (1.1)		
Bilateral ureteral stent	1 (1.1)		
Bilateral hypogastric artery ligation	9 (10.1)		
Relaparotomy	3 (3.4)		
Duration of stay in ICU (day)		1.54±0.78	1–3
Duration of hospitalisation (day)		4.13±3	2–16

Data n (%) are presented as the mean±SD or median (min–max).

ICU: intensive care unit; U: unit; min–max: minimum–maximum; SD: standard deviation

Table 3. Intraoperative blood and fluid consumption of patients taken and not taken to ICU in the postoperative period

	Patients taken to ICU	Patients not taken to ICU	p
PRBC consumption (U)	8 (2–15)	3 (1–10)	<0.001
FFP consumption (U)	6.5 (2–14)	2 (2-4)	<0.001
Crystalloid consumption (mL)	3500 (1000–9500)	2500 (1000–5800)	0.004
Colloid consumption (mL)	2000 (500–4500)	1000 (500–4500)	<0.001

Data are presented as median (min–max). ICU: intensive care unit; U: unit; PRBC: pacekd red blood cells; FFP: fresh frozen plasma

diagnosis, and combined spinal-epidural (CSE) anaesthesia was applied to 1 patient diagnosed with AIP in the preoperative period (Table 2). The combination of bupivacaine and fentanyl was used in regional anaesthesia. It was determined that while administrating CSE and spinal anaesthesia, it was entered from the L4–5 interval and the epidural catheter was removed after 24 hours. However, it was determined that spinal anaesthesia was switched to general anaesthesia in 2 cases because of a prolonged operation time and decreased patient comfort at the intraoperative 2nd hour. In

these 2 cases, thiopental and rocuronium were used in induction for general anaesthesia, and desflurane was used for the maintenance of anaesthesia.

The PRBC and FFP application, ICU requirement and duration of hospitalisation were similar among the patients with the diagnosis of AIP in the preoperative period and those without the preoperative diagnosis but who were intraoperatively found to have AIP, and the difference was not statistically significant. Of the 89 patients who had AIP, 59 (66.3%) required blood transfusion, 43 (48.3%) of these patients were applied PRBC transfusion under 5 U, but 16 (18%) were given PRBC 5 U and above.

Thirteen patients (14.6%) without an adequate respiratory effort or without stable haemodynamics in the postoperative period were found to be followed up in the ICU. One of these patients was applied dopamine infusion intraoperatively, and 2 were administered dopamine and noradrenaline infusions.

The intraoperative blood and fluid consumptions of the patients taken and not taken to the ICU in the postoperative period are shown in Table 3. It was determined that the amount of PRBC given to the patients admitted to the ICU was significantly higher compared to that given to the patients not taken to the ICU ($p<0.001$; Table 3).

While 7% of the patients who were applied PRBC transfusion under 5U PRBC were transferred to the ICU, 62.5% of those who received 5 or more were taken to the ICU (95% Confidence Interval [CI]; 4.72–104.65; $p<0.001$). While 60% of patients who intraoperatively received 3 U FFP and over were taken to ICU, 12.5% of patients who were given less than 3 U FFP needed ICU (95% CI; 4.72–104.65, $p=0.032$). In the regression analysis, there was a weak positive correlation between an increased consumption of PRBC ($r=0.420$, $p=0.001$) and FFP ($r=0.476$, $p=0.022$) and hospital stay. It was determined that only 6 patients received less than 4 U TS due to low (<50.000) platelet levels. Because of low fibrinogen levels and high D-dimer levels, 6 patients were applied tranexamic acid (1 g), and 2 patients were applied cryoprecipitate (10 U).

It was detected that 81 patients (91%) were operated under elective conditions, and 8 patients (9%) were operated under emergency conditions and without initial preparations. One patient underwent an emergency operation due to uterine rupture. While the mean PRBC consumption was 7±4.3 U in patients undergoing emergency surgery, it was 3.85±3 U in patients undergoing elective surgery ($p=0.034$). It was determined that 4 patients (50%) who underwent emergency surgery required ICU in the postoperative period, and only 12 (14.8%) of 81 patients who were operated under elective conditions needed ICU ($p=0.032$). The risk of being taken to the ICU was 5.75 times higher in emergency cases than in elective cases (95% CI; 1.26–26.17).

Preoperative PPrev was diagnosed in 68 patients. Among the patients with and without the PPrev diagnosis, PRBC ($p=0.910$) and FFP consumption, the ICU requirement and length of hospital stay were similar, and no statistically significant difference was found. Fifty-seven patients (64.04%) underwent hysterectomy after caesarean section. In 32 patients (35.9%) who did not undergo hysterectomy, it was determined that the placenta could be removed due to minimal placental invasion, and bleeding control was provided intraoperatively.

The Apgar scores of new-borns and mean birth weights are shown in Table 2. Intrauterine foetal loss was detected in 3 patients at the 14th, 17th and 22nd gestational weeks. In 52 of the new-borns (58.4%), the birth weight was below 2500 g and 20 new-borns were admitted to the ICU.

Discussion

In this retrospective study examining patients who underwent caesarean section due to abnormal invasive placentation, intraoperative findings contradicted the preliminary diagnosis in 9% of AIP cases. Regional anaesthesia was applied to 4 (4.5%) of these patients without the AIP diagnosis; however, while adequate anaesthesia was provided in 2 patients, spinal anaesthesia was switched to general anaesthesia in 2 patients. Of the 89 (100%) patients with AIP, 81 (91%) were diagnosed preoperatively, and their preoperative pre-diagnoses were confirmed. In the intraoperative period, 66.3% of our patients were treated with PRBC, 25.8% with FFP and 6.7% with TS. Moreover, 4.5% were performed at least one surgical procedure in addition to caesarean section. Postoperatively, 16 (18%) patients (12 elective and 4 emergency surgical procedures) were taken to the ICU.

Abnormal invasive placentation coexists with complications such as haemorrhage and massive transfusion, coagulopathy, bladder and ureter injuries, reoperation, more frequent ICU placement, a prolonged hospital stay and preterm delivery (7). Most of the pregnant women with AIP do not have any problems during pregnancy. Therefore, identification of known risk factors is very important in terms of an early detection (8). A history of a previous caesarean section in the presence of PPrev is a major risk factor, and it displays a positive correlation with the number of previous caesarean sections (9).

In the observational study by Stotler et al. (10), it was stated that 63 of 66 patients with AIP needed blood transfusion (95%). Of these patients, 26 (39%) were applied blood transfusion of 10 U, and 7 (11%) were given more than 20 U blood transfusion. In the study of Kalelioglu et al. (11), in which

they examined 85 patients with AIP who underwent hysterectomy, it was reported that 72 (84.7%) patients underwent blood product transfusion in the intraoperative period, 50 (58.8%) patients underwent a blood product transfusion in the postoperative period and 17 (20%) patients developed dilutional thrombocytopenia due to massive transfusion. In our study, 59 (66.3%) patients received blood and blood product transfusion in the intraoperative period, 16 (18%) patients underwent massive transfusion due to the development of severe bleeding and 6 (6.7%) patients were applied TS. In patients with AIP, prenatal diagnosis, multidisciplinary approach and coordination with the blood bank have been reported to reduce the number of complications of unplanned caesarean section and hysterectomy and the need for transfusion (12). This approach is particularly recommended in more aggressive invasions such as PI and PP (13, 14). In our study, while the mean PRBC consumption was 7±4.3 U in 8 (9%) patients who were operated under emergency conditions, it was 3.85±3 U in 81 patients (91%) in those operated under elective conditions (p=0.034). In our clinic, blood and blood product preparation protocol, which we mentioned in the section of methods, was applied to AIP patients with and without the risk of massive haemorrhage in the preoperative preparation period based on the USG data. Blood and blood product demand is expanded considering the severity of bleeding and haematocrit levels in the management of patients who have not been diagnosed, have been operated under emergency conditions or have had more blood loss than expected. Patients who are considered to have AIP according to clinical and ultrasonographic data in the preoperative period should be followed up and treated by an experienced team in centres where there is a blood bank is located and where a multidisciplinary approach can be provided (11).

When anaesthetic techniques (general and regional) for caesarean section were compared in the studies, general anaesthesia complications (failed endotracheal intubation, gastric aspiration, hypoxia) were reported to be 17 times higher than regional anaesthesia, and maternal mortality rate was 1.7 times higher (15). However, due to the possibility of hypotension and coagulopathy following massive haemorrhage and hysterectomy, it was stated that general anaesthesia might be preferred initially to prevent conversion to general anaesthesia in patients with AIP (16). Regional anaesthesia is a risk factor particularly for patients with haemodynamic instability due to hypotension caused by sympathetic blockade, and it should not be preferred (17). However, it has been reported that regional anaesthesia can be used in selected patients who have minimally invasive placentation or who are at risk for general anaesthesia (16). In our clinic, general anaesthesia is preferred for AIP cases, except for the selected cases with the uncomplicated minimally invasive placentation. In our study, the CSE anaesthesia was administered in 1 patient, and spinal anaesthesia was applied in 4 patients without the preoperative AIP diagnosis. It was found that spinal anaesthesia was switched to general anaesthesia in 2 patients due to decreased patient comfort and a prolonged operation time (2 hours).

While the PA risk is 24% in patients with a history of a previous caesarean section and accompanying PPrev diagnosis, this rate reaches 67% after the 4th caesarean section (3). However, in those cases of PPrev who did not undergo a previous caesarean section, the PA development rate was only 5% (3). In our study, 68 (76.4%) of 89 patients were diagnosed with PPrev, and only 1 of them had the first pregnancy. Five patients who were operated under emergency conditions and who were diagnosed with PPrev were referred to our centre from an external centre.

During pregnancy, the blood flow in each uterine artery increases from 100 mL min^{-1} to 350 mL min^{-1} (18). Caesarean section and hysterectomy in cases with AIP differ from those in cases with persistent uterine atony or rupture due to an invasion to the surrounding tissue and a fragile vascular structure (7). In the retrospective study by Seyhan et al. (19), in patients with AIP who were applied PRBC transfusion of more than 5 U in the intraoperative period, the duration of operation was longer, peroperative hypotension was more frequent, blood product and fluid requirement were higher and bladder repair was more frequent. In our study, there was a weak positive correlation between an increased PRBC and FFP consumption and duration of hospital stay. In addition, it was detected that postoperative ICU requirement increased in parallel with increased intraoperative PRBC, FFP, crystalloid and colloid fluid consumption.

The transfusion limit for acute anaemia in postpartum haemorrhage has not been established, but the current guidelines suggest a 7–8 g dL^{-1} Hb concentration as the lower limit for the transfusion threshold, and these values are applied in our clinic (20). However, it should be taken into account that there may be a significant haemoconcentration in the early stages of bleeding. Hb, Htc and blood gas monitoring should be carefully evaluated in the case of a massive haemorrhage and should often be repeated depending on the clinical picture.

Haemorrhagic shock occurs in about half of emergency postpartum hysterectomy cases, and coagulopathy or disseminated intravascular coagulation (DIC) can occur in 25% of patients (21). In our study, the mean transfused PRBC was 4.22±3.31 U, and it was determined that 16 patients were applied massive transfusion (4U and above). It was found that 10 patients undergoing massive transfusion were admitted to the ICU in the postoperative period, but no complications due to massive transfusion (coagulopathy, DIC, acute lung injury, acute respiratory distress syndrome) were observed in

these patients. In our study, the AIP diagnosis in the prepartum period, an early detection of risky patients, the presence of experienced surgical team, preparation of blood and blood products, strict haemodynamic follow-up, not allowing hypotension and acidosis, keeping Hb values within safe limits, not forgetting FFP and platelet replacement and multidisciplinary approach play an important role in obtaining these results.

Although early diagnosis allows an early birth planning in patients with abnormal invasive placentation, it is not a guide to predict blood loss or transfusion planning. In 2 previous retrospective studies, it was reported that massive bleeding is predictable when AIP is defined, but the necessary transfusion support should be prepared regardless of the degree of placental invasion (10, 22). Therefore, all AIP cases should be considered as high-risk cases requiring massive transfusion support, and preoperative blood and blood product preparation should be made. In our study, there was no difference between the patients who were and were not diagnosed with AIP in the preoperative period in terms of the PRBC and FFP consumption, intensive care requirement and duration of hospital stay. It was thought that the absence of any difference between these 2 groups might have been associated with the low number of cases in the second group, the rapid access to blood and blood products and an experienced surgical team.

Another important factor is that the operation of patients with suspected AIP in the antenatal period should be performed in units that can provide the necessary components (ES, FFP and platelet) for transfusion or that have a blood centre. In the preoperative period, blood centre should be warned and blood products should be provided on time when transfusion is needed (22). There is no consensus on the transfusion rate of blood components in obstetric patients. In studies performed in trauma patients, better transfusion results were obtained with the 1:1 ratio of PRBC and FFP. The use of PRBC and FFP at the same rate in a massive postpartum haemorrhage has been shown to prevent dilution and consumption coagulopathy (23). In our clinic, PRBC and FFP are used at the rates between 1:1 and 1:2 (16).

The use of cryoprecipitate or fibrinogen should be considered during ongoing bleeding for the treatment of coagulopathy in patients with AIP. In severe postpartum haemorrhages, it has been reported that the fibrinogen level decreases at an early stage, and it should definitely be kept above 2 g L^{-1} in cases with bleeding expectancy (24). Since there was no fibrinogen extract in our hospital, cryoprecipitate was used in 2 cases due to low fibrinogen levels (10 U).

Since interventional radiological procedures such as intravascular balloon occlusion or uterine artery embolisation, which are used to prevent postpartum haemorrhage (PPH) in abnormal invasive placentation cases, have not been performed in our hospital yet, these interventions were not encountered in our cases. However, uterotonics are routinely used in all caesarean section cases for prophylaxis of PPH in our clinic. After 5 U oxytocin is applied intravenously (iv) as an induction dose for the PPH prophylaxis, its maintenance is provided as 5–10 U iv per hour. If the uterine tonus is found to be insufficient, methylergonovine maleate 0.2 mg is administered intramuscularly, and 800 µg sublingual misoprostol is used if there is insufficient tonus in any way. The fact that we did not study data on uterotonic use in our study is the first limitation of this study. In addition, preoperative USG findings of our patients undergoing and not undergoing hysterectomy were not compared, which is the second limitation of our study.

Conclusion

Considering the risk factors such as recurrent caesarean section or PPrev, massive haemorrhage should be foreseen in cases diagnosed with AIP, and massive transfusion preparation (10 U PRBC, 10 U FFP, 5 U TS) should be performed. We think that establishing of a massive haemorrhage protocol in clinics would be very useful to reduce maternal and foetal morbidity and mortality, particularly in patients to be operated under emergency conditions because of a greater need for transfusions, ICU follow-up and treatment and longer hospital stays.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Cukurova University School of Medicine (Date: 02.03.2018, Decision No: 75).

Informed Consent: Due to the retrospective design of the study, informed consent was not taken.

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