Özgün Araştırma / Original Article

Jinekoloji - Obstetrik ve Neonatoloji Tıp Dergisi
The Journal of Gynecology - Obstetrics and Neonatology

DOI: 10.38136/jgon.772048

Plasenta previa ve invazyon anomalileri; üçüncü basamak obstetrik merkezdeki vakaların retrospektif analizi

Placenta previa and invasion anomalies; a retrospective analysis of cases in a tertiarty obstetric care center

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ÖZ

Amaç: İnvazyon anomalisi olan ve olmayan plasenta previa vakalarında risk faktörlerinin belirlenmesi, yönetim şekillerinin, maternal ve yeni doğan sonuçlarının karşılaştırılmasıdır.

Gereç ve Yöntemler: 2014-2019 yılları arasında hastanemizde doğum yapan 34199 hastanın dosyası retrospektif olarak tarandı. İnvazyon anomalisi olan ve olmayan tüm plasenta previa vakalarının bilgilerine ulaşıldı.

Bulgular: 34199 hastanın 15'inde invazyon anomalisi olan (%0,04) ve 85'inde invazyon anomalisi olmayan (%0,24) toplamda 100 tane plasenta previa vakası (%0,29) saptanmıştır. Her iki grup arasında; anne yaş ortalaması, geçirilmiş küretaj, abortus öyküsü, IVF gebeliği, GDM, IUGR ve HT ile ilişkili hastalık açısından bir fark yoktu. Gravida ve parite sayısı ile geçirilmiş sezaryen doğum öyküsü invazyonu olan grupta anlamlı oranda fazlaydı (sırasıyla p=0,005, p=0,01 ve p<0,0001). Vakaların yönetiminde; uterin arter ligasyonu, kompresyon sütürü ve bakri balon uygulanması açısından iki grup arasında fark yoktu ancak histerektomi ve hipogastrik arter ligasyonu invazyonu olan grupta anlamlı oranda fazlaydı (sırası ile p<0,0001, p<0,0001). Postoperatif hastanede kalış süresi, hemogram ve hematokrit düzeylerindeki düşüş miktarı, kan transfüzyonu gereksinimi invazyonu olan grupta anlamlı oranda fazlaydı (sırasıyla p=0,001, p=0,007, p=0,007, p<0,0001). Her iki grup arasında yeni doğanların doğum haftası, kilosu, cinsiyeti, 5. dakika apgar skoru ortalaması ve yoğun bakım gereksinimi açısından anlamlı bir fark yokken 1. dakika apgar skoru ortalaması invazyonu olan grupta anlamlı oranda daha düşüktü (p=0,021).

Sonuç: Gravida ve paritenin yüksek, geçirilmiş sezaryen sayısının fazla olması plasenta invazyon anomalisi riskini belirgin olarak arttırmaktadır. Plasenta invazyon anomalilerine bağlı maternal ve perinatal morbididenin azaltılması için sezaryan sayılarındaki artış önlenmeli ve bu vakaların doğumu deneyimli bir ekibin olduğu multidisipliner bir merkezde gerçekleştirilmelidir.

Anahtar Kelimeler: plasenta previa, plasenta invazyon anomalisi, akreata, prekreata, inkreata.

ABSTRACT

Objective: The aim of this study is to determine the risk factors in placenta previa cases with and without invasion anomalies, and to compare management patterns and perinatal outcomes.

Materials and Methods: The files of 34199 patients who gave birth in our clinic between the years 2014-2019 were scanned retrospectively. Demographic characteristics of the cases, number of previous cesarean sections, placental invasion anomaly types, interventions to stop bleeding, blood and blood products transfusions and newborn results were recorded.

Results: A total of 100 placenta previa cases in 34199 patients (0.29%) were detected, in which 15 of them were with invasion anomaly (0.04%) and 85 of them were without invasion anomaly (0.24%). The history of cesarean delivery, along with gravidity and parity count, was found significantly higher in the group with invasion anomaly (p = 0.005, p = 0.01 and p <0.0001, respectively). Regarding the management of cases; there was no difference between the two groups in terms of uterine artery ligation, compression suture, and Bakri balloon administration, but hysterectomy and hypogastric artery ligation were found to be significantly higher in the invasion anomaly group (respectively p <0.0001, p <0.0001). Postoperative hospitalization periods, decreases in hemogram and hematocrit levels, and blood transfusion requirements were found significantly higher in the group with invasion anomalies (p = 0.001, p = 0.007, p = 0.007, p <0.0001, respectively). While there was no significant difference between the two groups in terms of delivery week, birth weight, gender, mean of the 5th minute apgar score and need for intensive care unit, the mean 1 minute apgar score was found significantly lower in the group with invasion anomaly (p = 0.021).

Conclusion: The high number of caesarean sections, along with high gravidity and parity, significantly increases the risk of placental invasion anomaly. In order to reduce maternal and perinatal morbidity due to placental invasion anomalies, the increase in cesarean sections should be prevented and the birth of these cases should be performed in a multidisciplinary center with an experienced team.

Keywords: placenta previa, placental invasion anomaly, accreata, percreata, increata.

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Başvuru tarihi : 21.07.2020
Kabul tarihi : 20.10.2020

INTRODUCTION

Placenta previa is the placement of the placenta in the lower uterine segment, completely or partially covering the internal cervical os. Traditionally, placenta previa is divided into three groups, in accordance with the relationship of the placenta with the cervix. The complete closure of the internal cervical os by the placenta is called previa totalis, while the partial closure of the internal cervical os by the placenta is called previa partialis, and if the lower end of the placenta reaches the internal cervical os, but does not cover the cervical os, it is called previa marginalis. The condition where the placenta settles in the lower uterine segment but ends at a distance of 2 cm before it arrives at the internal cervical os, is called a low-lying placenta. In 2013, Fetal Imaging Workshop evaluated the placenta previa in two groups; with one being "Placenta previa including total and partial placenta previa cases", and the other being "Low-lying placenta". The Workshop, in addition, proposed not to use the term placenta previa marginalis (1).

Two possible mechanisms are thought to play a role in the formation of placental invasion anomalies. The first mechanism is thought to occur due to the damage of decidua basalis as a result of uterine surgeries such as curettage, cesarean or myomectomy, loss of barrier function and thus, resulting in the invasion of myometrium by trophoblasts. The second mechanism is thought to be due to over-expression of CD44 receptors, changes in angiogenesis factor and trophoblast growth factor, and a series of genetic changes and interactions at the cytokine level, including altered adrenomullin gene expression and mitechondral DNA mutations (2). Placental invasion anomalies seen with placenta previa are classified into three groups, aptly named as acreata, increata and percreata. The type of chorionic villi that adhere to the myometrial surface but do not infiltrate the myometrium is called accreata, while the type of chorionic villi that infiltrates into myometrium is called increata, and the type in which the chorionic villi infiltrates the serosa and sometimes the bladder by passing through the myometrium, is called percreata. Placenta invasion anomalies are also named as placenta accreta spectrum or morbid adherent placenta (3).Risk factors for placenta previa and placenta invasion anomalies are reported as such; advanced maternal age, increased parity, low socioeconomic level, previous infertility treatment, previous cesarean, myomectomy and curettage history, and smoking (4). Placental invasion anomalies may both increase the risks of maternal morbidity such as massive antepartum and intrapartum hemorrhage, cesarean hysterectomy, blood transfusion, and need for intensive care, and it may also cause complications related to preterm delivery. While the most common cause for peripartum hysterectomy was uterine atony due to postpartum bleeding in times past, placental invasion anomalies have risen up to the most common cause today (3,5).

In this study, we aimed to determine the risk factors, management methods and perinatal outcomes in placenta previa cases with and without placenta invasion anomaly in our clinic between 2014 and 2019.

MATERIAL AND METHODS

The files of 34199 patients, who delivered at our clinic within the 6-year period between 2014-2019 were scanned retrospectively from the records of our hospital. A total of 100 placenta previa patients were detected. Certain findings, parameters and informations of these patients, such as; prenatal ultrasound and MRI information, maternal age, gestational history, previous uterine surgery history, invitro fertilization history, pregestational diabetes mellutis, gestational diabetes mellitus (GDM), intrauterine growth retardation (IUGR), pregnancy-related hypertensive disease, type of delivery, type of anesthesia, type of abdominal incision, decrease in hemogram and hematocrit values due to peripartum bleeding, blood transfusion requirement, type of treatment for peripartum hemorrhage, organ injury related to surgical treatment, need for intensive care unit, duration of hospital stay, wound site infection, delivery week, birth weight, gender of newborn,1st and 5th minute apgar scores, intensive care requirement of the newborn, postpartum newborn loss have all been reviewed. Planned cases which were interred during working hours with blood and blood products prepared beforehand were considered elective, while other cases were considered urgent.

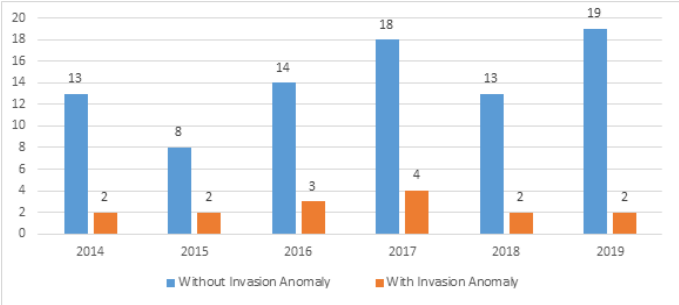
This study complies in accordance with the ethical rules of the Helsinki Declaration of World Medical Association. This study has been approved by the Local Ethics Committee of Umraniye Training and Research Hospital (No: B.10.1.TKH.4.34.H. GP.0.01/199).

Statistical evaluation was analyzed using SPSS 25.0 package program. The distribution of data was seen as not normal with the Kolmogorov Smirnov test. While evaluating the study data, Fischer's Exact test and Mann Whitney U test were used for non-parametric data along with descriptive statistical methods (Mean, Standard deviation, Frequency).

RESULTS

Among 34199 patients who delivered at our clinic between 2014-2019, 100 (0.29%) placenta previa cases were detected. All patients were having a single pregnancy. Among these placenta previa cases, 65 of the patients were total, while 1 was partial and 19 were marginal, summing up to a total of 85 cases without invasion anomalies. There were also placenta invasion anomalies in 15 patients, 8 of which were acreata, 2 were increata and 5 were percreata. During this 6-year period, the incidence of placenta previa with and without invasion anomalies has been 0.04% and 0.24%, respectively. The distribution of the number of placenta previa cases in terms of years is shown in Chart 1.,

Chart 1. The distribution of the number of placenta previa cases in terms of years



Between the groups, there was no statistically significant difference in terms of maternal age, previous curettage, abortion history, IVF pregnancy, GDM, IUGR and HT related diseases. All cases were multiparous in the placenta previa group with invasion anomaly; gravidity count, parity count and previous cesarean history were statistically higher in this group (p = 0.005, p = 0.01 and p <0.0001, respectively) (Table 1). These patients neither had a history of smoking, nor a history of placenta previa.

Table 1. Dermographic data of placenta previa groups with and without invasion anomalies.

	Placenta previa without invasion anomaly (n=85)		Placenta previa with invasion anomaly (n=15)		
	n	**%**	**n**	**%**	**p value**
Maternal Age (years)	31,33 ± 6,14		32,20 ± 3,00		0,680
Gravida	2,52±1,47		3,27±0,88		**0,005**
Parity	1,20±1,19		1,87±0,91		**0,01**
History of Curettage					
Existing	5	83,3	1	16,7	0,633
Non-existing	80	85,1	14	14,9	
History of Abortion					
Existing	17	89,5	2	10,5	0,729
Non-existing	68	84	13	16	
Previous Cesarean History					
Existing	18	58,1	13	41,9	**p<0,0001**
Non-existing	67	97,1	2	2,9	
Current IVF Pregnancy					
Existing	6	100	0	0	0,587
Non-existing	79	84	15	16	
GDM					
Existing	4	80	1	20	0,564
Non-existing	81	85,3	14	14,7	
IUGR					
Existing	7	87,5	1	12,5	1,00
Non-existing	78	84,8	14	15,2	
HT Related Diseases					
Existing	0	0	1	100	0,150
Non-existing	85	85,9	14	14,1	

Only 2 patients had a history of uterine surgery other than cesarean section. Both of the patients' surgeries were myomectomies, and both patients were placenta previa cases without invasion anomalies. All cases were diagnosed prenatally with ultrasound, except for 2 of the accreata cases, in which MRI was used in addition to ultrasound for diagnosis. All patients were delivered via cesarean section. 31 of 100 placenta previa cases had a previous cesarean delivery history (31%). 17 of the patients had a history of cesarean delivery once, while 11 of the patients had twice and 3 of the patients had thrice. Placenta previa with invasion anomaly was detected in 2 patients, even though they had no previous cesarean section or other uterine surgical history. The relationship between the number of previous cesarean sections and the incidence of placental invasion anomaly in placenta previa cases, is shown in Table 2.

Table 2. The relationship between the number of previous cesarean sections and the incidence of placental invasion anomalies in placenta previa cases.

Number of Previous Cesarean Sections	Placenta Previa With Invasion Anomaly.	
	n/N	(%)
0	2/69	(%2,9)
1	6/17	(%35,3)
2	4/11	(%36,4)
3	3/3	(%100)

The management of placenta previa cases with and without invasion anomalies and maternal complications are shown in Table 3.

Table 3. Management of placenta previa cases with and without invasion anomaly and maternal complications.

	Placenta Previa Without Invasion Anomaly (n=85)		Placenta Previa With Invasion Anomaly (n=15)		
	n	**%**	**n**	**%**	**p-value**
Surgery Time (minutes)	43,7 ± 16,3		93,6 ± 27,5		**p<0,0001**
Additional intervention requirement to stop intrapartum bleeding					
Existing	30	66,7	15	33,3	**p<0,0001**
Non-existing	55	100	0	0	
Cesarean Hysterectomy					
Existing	1	10	9	10	**p<0,0001**
Non-existing	84	93,3	6	6,7	
Hypogastric Artery Ligation					
Existing	3	30	7	70	**p<0,0001**
Non-existing	82	91,1	8	8,9	
Uterine Artery Ligation					
Existing	4	80	1	10	0,564
Non-existing	81	85,3	14	14,3	
Bakri Balloon Tamponade					
Existing	25	86,2	4	13,8	1,00
Non-existing	60	84,5	11	15,5	
Square Compression Suture					
Existing	6	75	2	25	0,344
Non-existing	79	85,9	13	14,1	
Segmental Resection					
Existing	0	0	2	100	0,021
Non-existing	85	86,7	13	13,3	
Bladder Injury					
Existing	1	33,3	2	66,7	0,058
Non-existing	84	82,5	13	13,4	
Wound Infection					
Existing	2	100	0	0	1,00
Non-existing	83	84,7	15	15,3	
Maternal Intensive Care Unite Requirement					
Existing	0	0	2	100	0,021
Non-existing	85	86,7	13	13,3	
Duration of Hospitalization (day)	2,49 ± 0,781		3,13 ± 0,743		**0,001**
Haemogram Difference Before and After Surgery (g/dL)	1,83 ± 1,27		3,03 ± 1,72		**0,007**
Hematocrit Difference Before and After Surgery (%)	5,44 ± 3,80		9,36 ± 5,64		**0,007**
Fresh Frozen Plasma Transfusion					
Existing	21	61,8	13	38,2	**p<0,0001**
Non-existing	64	97	2	3	
Erythrocyte Suspension Transfusion					
Existing	26	66,7	13	33,3	**p<0,0001**
Non-existing	59	96,7	2	3,3	

Of the 100 previa cases, 67 (67%) were taken to cesarean delivery under emergency conditions due to bleeding. This rate was 60% in the group with invasion and 68% in the group without. In the group with invasion, all patients underwent general anesthesia, while in the non-invasive group, 3 of the patients received spinal and 82 of the patients received general anesthesia. During the attempt to enter into the abdomen at the time of the cesarean surgery; pfannenstiel incision was preferred in 6 of the patients (40%) and sub-navel median incision was preferred in 9 of the patients (60%) within the group with invasion, while pfannenstiel incision was preferred in 82 patients (96.5%) and sub-navel median incision was preferred in 3 of the patients (3.5%) within the group without invasion. The operation time of the group with invasion was statistically longer than the group without invasion (p <0.0001).

All of the 15 patients in the group with invasion underwent additional intervention to stop peripartum bleeding. In the group without invasion, additional intervention was required for 30 patients (35%). Among the interventions to stop peripartum bleeding; cesarean hysterectomy, and hypogastric artery ligation were higher in statistical significance in the group with invasion (p <0.0001, p <0.0001, respectively). There was no difference between the two groups in terms of uterine artery ligation, square compression suture, and bakri balloon tamponade. Segmental resection was applied only to two patients in the group with invasion. Relaparotomy was required only in 1 patient, who was in the group without invasion. No maternal loss associated

with placenta previa was detected during the 6 years of study.

During the operation of placenta previa cases, none of the patients had bowel or ureter injuries. 3 patients had bladder injuries, while postoperative intensive care was required for 2 patients and wound infections had occured in 2 patients. In terms of these complications, there was no statistically significant difference between the two groups.

Duration of postoperative hospitalization, decreases in postoperative hemogram and hematocrit levels, and requirement of erythrocyte suspension and fresh frozen plasma transfusions were statistically higher in the group with invasion anomaly (p = 0.001, p = 0.007, p = 0.007, p <0.0001 and p <0.0001, respectively).

There was no statistically significant difference between the placenta previa groups with and without invasion anomalies in terms of delivery week, birth weight, gender and neonatal intensive care unite requirement and postpartum newborn loss. The mean 1st and 5th minute apgar score of the newborns was lower in the group with invasion anomaly. While the decrease in the average of the 1st minute apgar score was statistically significant (p = 0.021), the decrease in the average of the 5th minute apgar score was not (p = 0.085) (Table4).

Table 4. Newborn outcomes of placenta previa cases with and without invasion anomaly

	Placenta previa without invasion anomaly (n=85)		Placenta previa with invasion anomaly (n=15)		
	n	**%**	**n**	**%**	**p value**
Delivery Week	35,48 ± 3,10		34,67 ± 3,39		0,312
Birth Weight	2714,9 ± 687,4		2647,2 ± 700,1		0,772
Newborn Gender					
Male	46	88,5	6	11,5	0,404
Female	39	81,3	9	18,8	
1st Min. Apgar	7,89 ± 1,79		6,66 ± 2,12		**0,021**
5th Min. Apgar	9,18 ± 1,38		8,20 ± 2,04		0,085
Newborn need of intensive care unit					
Existing	23	76,7	7	23,3	0,138
Non-existing	62	88,6	8	11,4	
Postpartum newborn exitus					
Existing	3	100	0	0	1,00
Non-existing	82	84,5	15	15,5	

When newborns of all cases were grouped by gender; the mean of delivery week, birth weight, 1st and 5th minutes apgar score of the male newborns were lower than the girls but these were not statistically significant (p = 0.161, p = 0.418, p = 0.636, p = 0.625, respectively). While 34% of male newborns needed newborn intensive care unit, this rate was 25% for female newborns. There was also no statistically significant difference between the two groups in terms of newborn intensive care unit requirement (p = 0.383) (Table 5).

Table 5. Comparison of newborn results by gender

	Male	Female	
	Avr ± Std	**Avr ± Std**	**p value**
Delivery Week	34,94 ± 3,36	35,81 ± 2,84	0,161
Birth Weight	2614,08 ± 750,40	2803,1 ± 601,52	0,418
1st Min. Apgar Score	7,5 ± 2,17	7,938 ± 1,50	0,636
5th Min. Apgar Score	8,904 ± 1,68	9,188 ± 1,34	0,625
Newborn need of intensive care unit			
Existing	18(%60)	12(%40)	0,383
Non-existing	34(%48,6)	36(%51,4)	

DISCUSSION

In the literature, the incidence of placenta previa is generally reported as 0.5% (1,2). It was stated that the incidence of placenta previa with invasion anomaly increased from 0.025% in 1970s to 0.04% in 1980s and finally, to 0.13-0.18% due to the increasing cesarean rates in recent years (3). In our study, we found the incidence of placenta previa with and without invasion anomaly as 0.04% and 0.24%, respectively.

While advanced maternal age, increased parity, previous curettage and uterine surgeries, smoking and even in vitro fertilization are shown as risk factors for placenta previa; previous cesarean delivery history has also been reported to increase the risk of invasion anomaly in pregnancies complicated by placenta previa (3,6). Many studies have reported that advanced maternal age is associated with placenta previa and placental invasion anomalies (7–9). However, in a multicenter study including 73247 pregnant women, 196 of whom were complicated with placenta accreta, which followed a multivariate analysis including previous cesarean deliveries and placenta previa status in current pregnancy, it was concluded that advanced maternal age is not an independent risk factor for placental invasion anomalies(10). Also in another study in our country, 387 placenta previa cases, 48 of which were complicated with accreta, were examined, no relationship was found between maternal age and placenta previa and accopanying placenta

acreata spectrum. (11). Although it is not fully understood which mechanism of advanced maternal age causes placenta praevia, sclerotic changes occurring in the arteries in the myometrium layer with the age and the consequent decrease in blood flow to the placenta have been held responsible in the literature (12). In our study, the mean age of the previa group with and without invasion anomaly was found to be 32.20 ± 3.00 and 31.33 ± 6.14 respectively, and there was no statistically significant difference in the mean age in both groups.

It is known that as the number of previous cesarean sections increases, the risk of placental invasion anomaly increases. Kılıçcı et al stated that two or more previous cesarean sections were statistically significant risk factor for the development of placenta accreta spectrum and increased the risk 9.74 folds (11). In an article published in 2019; the incidence of invasion anomaly in pregnancies complicated with placenta previa was reported as 11%, 40% and 61%, respectively, in the previous 1, 2, and 3 cesarean births (3). In a study conducted in our country; the incidence of previa with invasion anomaly has been reported as 2.2% in those who have never had a cesarean delivery before, 35.7% in those with one cesarean delivery and 37.5% in those with two cesarean deliveries (6). Similarly, in our study, we found that the incidence of invasion anomaly in pregnancies complicated with placenta previa was 2.9% in those who had no previous cesarean delivery, 35.3% in those who had one cesarean delivery and 35.6% in those who had two cesarean deliveries and 100% in those who had three cesarean births previously.

In the literature, it was reported that ultrasonography and MRI performed in the 2nd or 3rd trimester in diagnosis of placenta previa cases with invasion were similar with 80% sensitivity and 90% specificity, but MRI was more useful in evaluating posterior placenta previa and bladder wall invasion (3). The diagnosis of placenta previa was made by ultrasound in all of our patients, and only in 2 cases of accreata, MRI was used to demonstrate invasion in the myometrium in addition to ultrasound.

An important challenge in the management of placenta previa cases is the proper timing of birth. In order to reduce the complications of prematurity that may occur due to preterm birth, keeping the cases waiting until the term birth time causes an increase in maternal morbidity with peripartum and intrapartum bleeding (13). ACOG suggests the time of birth to be at 34 - 35 + 6 weeks in placenta previa cases with invasion anomaly and 36 - 37 + 6 weeks in cases without an invasion anomaly (14). In our study, the mean week of birth was found to be 34.67 ± 3.39 in the previa group with invasion anomaly and 35.48 ± 3.10 in the group without invasion anomaly. There was no statistically significant difference in terms of birth week between the two groups.

When the two groups were compared in terms of operation time, the average operation time was significantly longer in the group with invasion than the group without invasion (p <0.0001). Kılıçcı et al stated that; the presence of invasion anomaly increased the risk of bleeding more than 1000 cc by 4.280 times, the need for bilateral hypogastric artery ligation by 35.426 times and the need for total abdominal hysterectomy by 1625 times compared to placenta previa without invasion. (11). In our study, all patients in the group with invasion had been performed additional intervention to stop intrapartum bleeding, and the need for additional intervention was found to be 35% in the group without invasion (p <0.0001). Among these interventions, while cesarean hysterectomy and hypogastric artery ligation was more in statistical significance in the group with invasion (p <0.0001, p <0.0001, respectively), there was no significant difference between the two groups in terms of uterine artery ligation, segmental resection, compression suture application and bakri balloon tamponade treatment.

In our study hypogastric artery ligation was performed in 10 patients in total in order to stop bleeding and hysterectomy was performed upon 4 of them after hypogastric artery ligation failed. These four failed cases were previa cases with invasion anomaly. In our study, the success rate of hypogastric artery ligation applied in intrapartum bleeding in placenta previa cases was determined as 60%. In the literature, the success rates of hypogastric artery ligation applied to stop postpartum bleeding in a heterogeneous group due to uterine atony, uterine rupture, detachment, coagulopathy and placenta previa, are reported between 81 and 96% (15,16). The low success rate of hypogastric artery ligation in placenta previa cases in our clinic, compared to the literature, may be related to the low number of patients in the study group, or the heterogeneity of the study group in the literature.

In this study, uterine artery ligation was performed in 5 patients after placenta removal to stop intrapartum bleeding. Since the bleeding continued afterwards, 3 of these patients had additional bakri balloon tamponade application, and compression sutures for one of the patients, and hypogastric artery ligation and hysterectomy to another one of the patients. In a study published in 2019, it has been stated that bilateral uterine artery ligation before the placenta removal in placenta acreata cases,

reduces the amount of bleeding, the need for blood transfusion and prevents the need of caesarean hysterectomy (17).

In our study, a total of 29 patients were treated with bakri balloon tamponade. While postpartum hemorrhage was taken under control in 18 patients who were treated with bakri balloon tamponade; compression sutures were performed in 3 of the patients who continued to bleed, 3 of the patients underwent uterine artery ligation, 4 of the patients underwent hypogastric artery ligation, and 1 of the patients underwent hysterectomy. In our study, the success rate in the treatment of bakri balloon tamponade in postpartum bleeding due to placenta previa was determined as 62%. In a study evaluating prophylactic bakri balloon application in placenta previa cases without invasion anomaly; the success rate was reported as 87% and the most important reason for failure was shown as the prolapse of the Bakri balloon (18). In another study, it was shown that; balloon prolapse developed in 5 of the 50 placenta previa patients whom bakri balloon was applied, and bleeding could be brought under control in these 5 patients by replacing the balloon (19). In our own retrospective study, we could not find the cause of failure from the records in 11 patients whose Bakri balloon tamponade treatment failed.

Different compression suture techniques to control postpartum bleeding related to placenta previa have been described in the literature. In a study published in 2019, it was stated that parallel vertical compression suture application, together with Foley catheter applied inside the uterine cavity, was 98% successful in placenta previa-related postpartum bleeding (20). Success was reported as 97% in the technique of 'Nausicaa', a technique which was defined by Shih et al. and consisted of compression sutures that were laid horizontally parallel to the uterus anterior and posterior walls (21). In another study published in 2015, it was stated that the '&' suture technique successfully stopped bleeding in all 9 patients with postpartum hemorrhage including placenta accreta (22). In a review published in 2019 regarding uterine compression sutures, the success rate of different compression suture techniques in postpartum bleeding was reported between 36% and 98%. In the same review, since there hadn't been any randomized controlled studies comparing suture techniques in the literature, it was suggested that suture technique selection should be made according to the surgeon's knowledge and experience regarding the case (23). In our study, 8 of the patients were applied with square sutures as uterus compression sutures in intrapartum hemorrhage due to placenta previa, and square sutures were sufficient alone in bleeding control in 4 of the patients. For the rest of 4 patients, additional methods were required to stop bleeding. In our clinic, our success rate of the square compression suture technique in placenta previa cases is 50%.

None of the patients in our study had any ureteral or intestinal injuries related to the surgical procedures. 3 of the patients had bladder injury, 2 of the patients required postoperative intensive care and 2 of the patients had postoperative wound infection. In terms of these complications, there was no statistically significant difference between the group with invasion and the group without. Postoperative hospitalization time was significantly longer in the group with invasion ($p = 0.001$). The hemogram and hematocrit differences before and after surgery were significantly higher in the group with invasion ($p = 0.007$). Accordingly, the need for erythrocyte suspension and fresh frozen plasma transfusion was also statistically higher in the group with invasion ($p = p < 0.0001$).

In a study evaluating placenta previa cases with and without invasion anomalies; while preterm delivery before 36 weeks, birth weight less than 2500 grams, and need for newborn intensive care unit was found as significantly higher in the group with invasion ($p = 0.029$, $p = 0.038$, and $p = 0.023$), no significant difference was found between the two groups in terms of newborn apgar scores and newborn loss (6). In our study, delivery week, birth weight and 5th minute apgar score was lower in the previa group with invasion, but this was not statistically significant. There was no difference between the two groups in terms of newborn gender, newborn intensive care unit requirement and postpartum newborn loss. The 1-minute apgar score of the newborns in the group with invasion was significantly lower than the group without invasion ($p = 0.021$).

Interestingly, in a study published in 1999, the male/female ratio was found to be statistically and significantly higher regarding the sex of newborn babies in the group with placenta previa compared to the group without placenta previa (1.19 and 1.05, $p < 0.001$, respectively) (24). Furthermore, in a different study published in 2000, the male/female ratio was found to be statistically higher in the group with placenta previa than the group without placenta previa (1.19 and 1.04, $p < 0.02$, respectively) (25). In a study conducted by Köstü et al. in 2015, the ratio of male/female in newborn genders was found to be 2.6 in total placenta previa cases, and this difference in the number of male and female newborns was statistically significant ($p < 0.001$). According to the same study, it has been reported that male fetus increased poor perinatal outcomes in cases of

placenta previa totalis (26). In our own study, the male/female ratio was determined as 0.67 in the group with invasion, 1.17 in the group without invasion, and 1.08 in all previa cases. When all placenta previa cases are evaluated accordingly in terms of male and female newborns; we did not find a significant difference between the two genders in terms of delivery week, birth weight, apgar scores and neonatal intensive care unit recquirement.

Restrictive features of our study are; its retrospective nature, the choice of intervention in the management of cases being at the initiative of the obstetrician at work on that day, diagnosis of other invasion anomalies other than hysterectomy specimens sent to pathology being made through prenatal ultrasound informations and the obstetrician who entered the operation.

In conclusion, in accordance with the literature in our study, we found out that increased cesarean birth history, along with increased gravidity and parity, is an important risk factor for placenta previa with invasion anomaly, and surgical interventions such as hypogastric artery ligation and hysterectomy are frequently required in these cases to control postpartum bleeding. Decreases in hemogram and hematocrit levels due to bleeding and need for blood transfusion increased significantly, especially in the previa group with invasion. Increase in cesarean counts should be prevented in order to reduce perinatal complications due to placental invasion anomalies. Performing the delivery of placenta previa cases who were diagnosed at the prenatal period, or suspected of invasion anomaly, in a multidisciplinary center with a blood center, a newborn intensive care unit and a team experienced in this field, would reduce maternal and newborn complications.

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