Aegean Journal of Obstetrics and Gynecology 1/1 (2019) 13-16

Aegean Journal of Obstetrics and Gynecology

Original Article

Radiological evaluation of placental invasion anomalies: single center data

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A B S T R A C T

Placenta previa totalis refers to the placenta lying over the lower uterine segment and completely covering the internal cervical os. The aim of this study was to predict the complications that may develop in cases with placenta previa totalis and most importantly, to decrease maternal morbidity and mortality rates.

A total of 185 patients, who were diagnosed with placenta previa totalis in our clinic between January 2011 and December 2015 and underwent cesarean section, were included in the present study. Patients with placenta previa partialis, placenta previa marginalis, lower placenta pre-diagnosis, and placenta previa less than 24 weeks of gestation were excluded. Demographic data, gynecological and obstetric histories, type of surgical incision, placental adhesion anomalies, laboratory parameters, and blood transfusions of the patients were examined. Patients' type of application to our clinic, gestational week, birth weight, sex of the newborn, Apgar score of the first and fifth minutes, additional surgical interventions and complications developed were evaluated. The data were obtained using PROBEL Hospital Information Management System, which is the hospital electronic archive database.

It was observed that a total of 60039 babies were delivered (29894 vaginal deliveries, 30145 cesarean sections) in our hospital during the study period. The frequency of the five-year placental invasion anomaly was found to be six in 10000 births. There was a statistically significant increase in the number of previous cesarean sections and invasion formation ($p<0.05$).

Early diagnosis and adequate preoperative preparation are of great importance particularly in cases with placenta previa totalis who are thought to have an invasion. Patients should be referred to tertiary centers with high-quality blood bank unit, adult intensive care unit and neonatal intensive care unit, where a multidisciplinary approach can be offered. We believe that the elective operation of the cases is an important factor in reducing or preventing maternal morbidity and mortality.

Keywords: Placenta previa; placenta accrete; obstetric hemorrhages; cesarean section; hysterectomy

A R T I C L E I N F O

Article history:
Received: 01 December 2019
Revision received 29 December 2019
Accepted 30 December 2019

Introduction

The placenta is an organ belonging to the basic fetus, which provides fertilized ovum to develop and mature and allows the fetus to develop in the prenatal period. The human placenta is a villous hemochorial type placenta and its most prominent feature is that the maternal circulation is separated from the fetal circulation (1). The placenta is formed by trophoblasts, the outer cell group in the morula phase, which occurs on the third day following fertilization. In the second week after the fertilization, endometrial invasion formed by syncytiotrophoblasts is completed (1,2). A study from Turkey has reported that the placenta is mostly located anteriorly, posteriorly, and fundal, respectively, and is low-lying more rarely (3). Placenta previa occurs when the placenta lies over the lower uterine segment after the 20th gestational week and partially or completely covers the internal cervical os (4). Placenta previa cases are classified according to the anatomical relationship of the placenta and uterine cervix. If the placenta completely covers the uterine cervix, it is called placenta previa totalis (PPT). Its incidence has been reported to be one in 300 people. Morbidity and mortality rates are likely to increase if there is a delay in diagnosis or the diagnosis cannot be made (5–8).

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Clinical suspicion should arise in the presence of painless, non-excessive and repetitive vaginal bleeding, usually seen at the end of the second trimester or third trimester. Radiological imaging methods are used in its diagnosis and it is recommended to avoid digital examination in the presence of bleeding (9). Complications that can lead to impaired endometrial integrity such as increased parity, advanced maternal age, multiple pregnancies, congenital uterine anomalies, smoking, infertility treatment, previous cesarean delivery, and recurrent miscarriage can be considered as risk factors for placenta previa (8). Another placental pregnancy complication that can coexist with placenta previa is placental invasion anomalies (PIA). They are classified depending on the depth of invasion (10). If the villi have progressed to the muscle layer but not entered into the muscle due to the insufficient development of the decidua where the villi are implanted, it is called placenta accreta; if the villi have entered into the muscle layer, it is called placenta increta; and if the villi have advanced to serosa and surrounding tissues, it is called as placenta percreta. Its incidence has been reported as one in 2500 births and the mortality rate is around 7% (10,11).

The primary aim of this study was to investigate the role of radiological methods in the evaluation of PIA in cases with PPT. The secondary aim of this study was to investigate the effect of PIAs on pregnancy outcomes.

Materials and methods

This study included pregnant women who applied to our clinic between January 2011 and December 2015, were diagnosed with PPT by transabdominal or transvaginal ultrasonography (USG) or magnetic resonance imaging (MRI) and underwent cesarean section. The study was designed as a retrospective case-control study. Tepecik Training and Research Hospital Ethics Committee Approval was obtained prior to the study.

Pregnant women, who were followed in our clinic during their pregnancy, who were found to have PPT placement anomalies during pregnancy follow-ups, whose pregnancy was terminated in our clinic and newborn examinations of whom were performed in our clinic, were included. Pregnancies terminated at 24 weeks gestation or under 500 grams and pregnant women who were hospitalized in our clinic with a preliminary diagnosis of placental location anomaly but whose pregnancy was not terminated were excluded.

The study group consisted of pregnant women who received a preliminary diagnosis of PPT and also had PIA. Pregnant women without invasion anomalies were included in the control group.

Demographic data of the patients, preoperative and postoperative laboratory parameters (routine whole blood, biochemistry, coagulation parameters), presence of placental invasion, blood transfusions performed intraoperatively or postoperatively, complications and surgical interventions during or after the operation, the fifth minute Apgar scores, stillbirth rate, weight, gender, and intensive care admission requirements of newborns were retrospectively scanned from the hospital information system, operating notes and delivery room records.

As a routine approach in our clinic, all pregnant women with painless bleeding in the second trimester are evaluated via transabdominal ultrasonography (USG) by gynecologists and obstetricians experienced in terms of placental pathologies. Pregnant women with placental pathology are examined via transvaginal USG or MRI for invasion and location, if needed. However, the final diagnosis is made during the operation with difficulty in removing the placenta and with macroscopic monitoring and histopathological examination of the placenta or hysterectomy material.

Statistical analysis

Descriptive statistics of continuous variables were expressed as minimum, maximum, mean and median values. Discrete variables were transformed into cross tables and analyzed with Fisher's Exact and Pearson's Chi-Square test. Kolmogorov-Smirnov test was used to determine whether the data followed a normal distribution. Mann-Whitney U test was used to compare independent groups that did not follow normal distribution. Independent Sample t-test was used in groups with normal distribution. Independent risk factors were determined via logistic regression analysis. Hypotheses were bidirectional and a p value of <0.05 was considered statistically significant. Statistical analyses were performed using SPSS 21.0 version 64 bit for Windows (SPSS Inc., Chicago, IL, USA).

Results

A total of 185 pregnant women with a preliminary diagnosis of PPT were included in the study. The participants were divided into two groups as the study group involving 36 pregnant women with placental invasion anomalies (Group 1) and control group involving 149 pregnant women (Group 2).

Table 1. Demographic information of pregnant women included in the study

	Group 1 (n=36)	Group 2 (n=149)	p value
Age, mean±SD	32±6 (20–43)	31±6 (18–47)	0.166
Gravida, median (min-max)	3 (1–6)	2 (1–9)	0.020
Number of previous cesarean sections, median (min-max)	2 (0–3)	1 (0–3)	<0.001
Number of abortion, median (min-max)	1 (0–4)	1 (0–5)	0.159
Gestational week, mean±SD	36.2±2.3	35.9±3.3	0.785
Birth weight (g), mean±SD	2840.3±643.8	2680±762	0.470
Operation Time (min), mean±SD	76.4±39.5	41.4±18.8	< 0.001
Preoperative Hb (g/dL), mean±SD	10.7±1.2	11.4±1.2	0.002
Postoperative Hb (g/dL), mean±SD	8.4±1.5	9.6±1.4	< 0.001
ERS Replacement (U), median (min-max)	5 (0–13)	2 (0–13)	< 0.001
TDP Replacement (U), median (min-max)	3 (0–13)	1 (0–11)	< 0.001
Fibrinogen Replacement (g), median (min-max)	0.9±1.5	0.1±0.5	< 0.001

There was no statistically significant difference between the two groups in terms of the number of abortions, age, gestational week or birth weight.

Table 2. Neonatal results of pregnant women included in the study

	Group 1 (n=36)	Group 2 (n=149)	p value
Fifth-minute Apgar Score	7 (0–9)	7 (5–10)	0.898
Fetal sex Female Male	 16 (44.5%) 20 (55.5%)	 71 (47.4%) 79 (52.6%)	0.729
Stillbirth	2 (5.5%)	/	0.001

In Group 1, the preoperative and postoperative hemoglobin values of the pregnant women were found to be statistically lower and the rate of gravida, previous cesarean section and blood product replacement was found to be significantly higher than the other group. The findings are summarized in Table 1.

There was no statistically significant difference between the two groups in terms of placental locations.

The neonatal results of the pregnant women included in the study are summarized in Table 2. There was no significant difference in the fifth minute Apgar score and fetal gender in both groups, but the stillbirth rate was higher in Group 1 (p 0.001).

Table 3. Operative and postoperative results of pregnant women included in the study

	Group 1 (n=36)	Group 2 (n=149)	p value
Hysterectomy	11 (30.6%)	1 (0.7%)	<0.001
Compression suture	19 (52.8%)	3 (2%)	<0.001
Uterine artery ligation	9 (25%)	4 (2.7%)	<0.001
Hypogastric artery ligation	15 (41.4%)	6 (4%)	<0.001
Operative complications	10 (27.8%)	1 (0.7%)	<0.001
Maternal intensive care need	14 (38.6%)	63 (42.3%)	0.711

The operative and postoperative results of the pregnant women included in the study are summarized in Table 3. Almost all operative and postoperative complications were statistically significantly higher in Group 1 ($p<0.001$). However, the need for maternal intensive care was found to be similar in both groups (p 0.711).

Table 4. The success of radiological imaging methods in predicting invasion anomaly

	Specificity	Sensitivity	PPV	NPV	p value
USG	19.4% (8.19%–6.02%)	100% (97.5%–100%)	100%	83.7% (81.4%–85.7%)	0.003
MRI	64.2% (35.1%–87.4%)	78.2% (56.3%–2.5%)	64.2% (43.4%–1.09%)	78.2% (63.32%–8.2%)	0.013
USG: ultrasonography, MRI: magnetic resonance imaging PPV: positive predictive value, NPV: negative predictive value					

Table 4 summarizes the success of radiological imaging methods in predicting PIA. The sensitivity and PPV values of USG were found to be 100%, while its specificity was 19.4% (p 0.003). On the other hand, specificity and PPV values of MRI were 64.2% and its sensitivity and NPV values were 78.2%(p0.013).

Discussion

Despite the advancements in medicine, obstetric hemorrhages are the most important cause of maternal death alone throughout the world. Placental location and invasion anomalies are also some of the most important causes of obstetric hemorrhages (12,13). In the present study, it has been seen that almost all invasion anomalies can be easily identified with USG to be made in addition to clinical suspicion although clinical suspicion has great importance in the identification of placental anomalies (sensitivity 100%, PPV 100%, p 0.003) and that an advanced radiological imaging method, such as MRI, should be used only in cases where it is necessary (sensitivity 78.2%, PPV 64.2%, p 0.013).

In parallel with the increasing rate of cesarean delivery in recent years, the incidence of placement and invasion anomalies of the placenta has also increased (5). In the present study, the incidence of PPT was about one in 216 deliveries whereas the incidence of PIA was one in 1660 births. The high incidence of PPT and PIA in the present study, compared to the literature, might be due to the fact that our hospital is a hospital with a high capacity that provides service in the Aegean region in Turkey and receives a large number of patient referrals (10,14). Compatible with the literature, the number of previous cesarean sections and pregnancies, which is accepted as the risk factors for PIA, was found to be higher in pregnant women with PIA in the present study (15,16). However, the rate of previous abortion, which is also considered as one of the risk factors, was not found as a risk factor in our study (15,16).

This may be due to the fact that the pregnant women included in the study refuse an abortion in relation to their socio-cultural level and want to give birth regardless of the result. As in the present study, pregnancies with PPT or PIA are terminated by cesarean section at the 37th week of gestation at the latest throughout the world (17). It is noteworthy that the weeks in which pregnancy is terminated become smaller particularly with the widespread use of corticosteroids (18). As can be expected, the operation time was longer and the blood loss and replacement of blood and blood products were higher in pregnant women with PIA in our study. The stillbirth rate was higher in the group with PIA, compatible with the literature.

It is recommended to perform a hysterectomy by leaving the placenta in place if bleeding cannot be controlled or in the presence of PIA since placental pathologies will cause obstetric hemorrhages that are difficult to prevent (4,19,20). In our study, hysterectomy was found to be performed more and uterine protective operative techniques were needed more in the group with PIA compared to the group without PIA.

The retrospective design of our study is its limitation. However, in order to prevent this limitation, patient selection criteria were kept strict and only cases with PPT were included to prevent biases due to possible misdiagnosis.

In cases where PPT or PIA are predicted, it will be appropriate to refer the patients to hospitals, in which experienced surgeons are employed, the intensive care needs can be met, and blood and blood products are available. Although clinical suspicion is the most important factor for placental pathologies, USG is often found to be an initial and adequate radiological imaging method. We believe that multicenter prospective studies to be carried out in this regard are important for early diagnosis of placental pathologies, which are one of the important causes of obstetric hemorrhages, and will decrease the maternal mortality rates.

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