Objective: Placental abruption is an extremely critical complication in pregnant women because it can result in poor maternal and neonatal outcomes. The exact criteria or obvious prognostic factors to diagnose and predict the outcome have not been determined. This study aimed to evaluate the clinical significance of initial findings of patients with placental abruption.

Methods: Fifty-six women with placental abruption who delivered at our hospital between January, 2007 and December, 2017 were enrolled in this retrospective study. We reviewed medical records and analyzed the relationship between variable clinical factors and pregnancy outcomes.

Results: Patients with unfavorable outcomes (intrauterine fetal death or use of neonatal ventilator) showed a high tendency of having both abdominal pain and vaginal bleeding, or abdominal pain. Neonates delivered in the abdominal pain group showed a significantly lower Apgar score, larger dimensions of placental abruption and higher frequencies of ventilator use than the other group. The results of multivariate logistic regression showed poor prognostic factors of placenta abruption: abdominal pain (odds ratio [OR]=43.3; 95% confidence interval [CI]=1.9-968.9) and vaginal bleeding (OR=23.1; 95% CI=1.7-305.9).

Conclusion: Patients with placental abruption showed statistically significant tendencies of having abdominal pain and vaginal bleeding as initial symptoms. Especially, abdominal pain was associated with the poorest outcome. Therefore, obstetricians should make more rapid decisions and carefully monitor patients for improving the outcome of placental abruption when patients have obvious abdominal pain and vaginal bleeding.

Key Words: Abruptio placentae, Diagnostic clue, Prognosis, Signs and symptoms

Introduction

Placental abruption is the partial or complete separation of the placenta from the decidua basalis before delivery of the fetus. The incidence of placental abruption has been reported to be approximately 0.5–1%. Several risk factors, such as older age, multiparity, hypertensive disease, preterm premature rupture of membrane, smoking, and polyhydramnios increase the occurrence of placental abruption.1–3 Placental abruption is a critical complication in pregnant women because it can result in massive postpartum bleeding, disseminated intravascular coagulation (DIC), acute kidney injury, and poor neonatal outcome.4,5 However, there is no definitive criteria or laboratory examination to diagnose placental abruption. Placenta abruption is difficult to diagnose with ultrasonography (USG). Furthermore, laboratory findings, such as D–dimer and fibrinogen levels, only reflect the severity of DIC and are not helpful for the exact diagnosis of placental abruption. Therefore, obstetricians are limited in their ability to diagnose placental abruption early and usually depend on patients’ symptoms, such as vaginal bleeding, uterine hypertonicity, and abdominal pain. However, such “typical symptoms of placental abruption” can also be confused with preterm labor pain and subsequent vaginal bleeding from cervical efface-
This study aimed to evaluate significant initial clinical findings and their correlation with pregnancy outcome of patients with placental abruption based on experiences in our hospital.

Methods

Fifty-six women with placental abruption, who delivered at our hospital between January, 2007 and December, 2017, were enrolled in this retrospective study. Pregnant women who were diagnosed with placental abruption were defined as having one or more clinical findings (abdominal pain [AP], vaginal bleeding [VB], abnormal fetal heart rate [FHR] patterns, and retroplacental hematoma in USG amongst others) and blood clots in the retroplacental area on postpartum gross examination of the placenta. Data regarding basal characteristics, initial clinical findings, maternal and neonatal outcomes were retrospectively obtained from medical records. We regarded AP, VB and other atypical symptoms (premature rupture of membrane, regular uterine contraction with cervical shortening, epigastric pain, or decreased fetal movement) as initial symptoms of placental abruption. We classified the patients into four categories based on initial symptoms, which were both abdominal pain and vaginal bleeding (AP & VB), vaginal bleeding with or without other symptoms (VB), abdominal pain with or without other symptoms (AP), and patients who had atypical symptoms. We differentiated AP from labor pain, which has a cyclic contraction pattern. In our study, AP indicated continuous and dull pain or with focal tenderness.

The FHR category was divided into two groups based on the National Institute of Child Health and Human Development (NICHD) criteria. We considered category 1 as one group, and categories 2 and 3 as another group based on the NICHD criteria. At postpartum, we grossly examined the abruption suspected lesion (the region where a dark blood color or large amount of clot was observed, compared with the fresh blood red color of normal placenta), and measured its size to determine the dimensions of the placental abruption. Women with placenta previa, multiple pregnancies, or major fetal anomalies were excluded.

We divided patients into favorable and unfavorable outcome groups for analysis. We defined unfavorable outcome groups as patients that used neonatal ventilators or occurrence of intrapar-terine fetal death (IUFD) upon arrival at the hospital. Neonates received artificial ventilation in the presence of respiratory distress syndrome, neonatal acidemia (cord blood pH <7.1), or suspected neonatal asphyxia after birth. Therefore, we considered IUFD and use of artificial ventilation as unfavorable outcomes. We analyzed the neonatal characteristics of live neonates. We defined the use of ventilators and IUFD as composite morbidities.

Our data were analyzed using IBM SPSS statistics version 25.0 (IBM Corp., Armonk, NY, USA). Comparison of categorical variables was based on the Chi-squared and Fisher’s exact tests. Comparison of continuous variables was based on the Mann-Whitney U test. Multivariable analysis was based on logistic regression. P-values were the result of a two-sided test, and P<0.05 was considered statistically significant. This retrospective study was approved by the Ethics Committee (CR-19-062) of our institute. All procedures performed in studies involving human participants were in accordance with the ethical standards of the Institutional and/or National Research Committee, the 1964 Helsinki Declaration and its later amendments, or comparable ethical standards.

Results

We divided the patients into favorable and unfavorable outcome groups, and summarized their obstetric characteristics (Table 1). Statistically significant differences were found in the age of patients, number of gestational weeks, birth weight, and required number of transfusion units (packed red blood cells or platelets) between the two groups. When comparing the initial symptoms, patients in unfavorable groups showed a tendency of having both AP & VB, or AP more frequently (P=0.045 for AP & VB; P=0.021 for AP). The presence of retroplacental hematoma on USG and abnormal FHR patterns were not significantly different between groups. Therefore, we analyzed the clinical characteristics of patients with initial symptoms of AP & VB (Table 2), and AP (Table 3) in detail.

Among the 56 patients, only nine (16.1%) had both AP & VB initially (Table 2). In patients with AP & VB, the placental abruption dimensions were larger (P=0.033). Neonates delivered in this group showed longer neonatal intensive care unit (NICU)
admission periods (P=0.03), higher frequencies of ventilator use (P=0.038), and higher proportions of composite morbidities than the other group (P=0.045). Other factors did not show a statistical difference, probably because of the small number of cases.

As shown in Table 3, the mean gestational age of the patients in the AP group was lower than that in the other group (P=0.008). Incidence of Apgar score ≥7 at 1 and 5 minutes was lower in the AP group (P=0.016 and 0.041, respectively). In patients with AP, the placental abruption dimensions were larger (P=0.048), neonates delivered in this group showed higher frequencies of ventilator use (P=0.023) and higher proportions of composite morbidity than the other group (P=0.021).

The results of the multivariate logistic regression analyses are presented in Table 4. The following characteristics were entered into multivariate regression analysis: abdominal pain,
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vaginal bleeding (OR=23.1; 95% CI=1.7–305.9). However, there was no significant association between the presence of a retroplacental hematoma on USG and abnormal FHR patterns.

**Discussion**

Placental abruption is a critical obstetric complication that can lead to poor prognosis in pregnant women and neonates; therefore, it usually requires prompt attention and aggressive management. However, patients with placental abruption have variable initial clinical findings based on the severity of disease when they arrive at the hospital. Hence, obstetricians may have difficulty in diagnosing and predicting the outcomes of patients and neonates.

Patients suspected of having placental abruption show various findings that can be mistaken as preterm labor pain or other diseases. Although USG is undergoing continuous advancements, accurate diagnosis by USG is still difficult and dependent on both the timing of the abruption and the skill of the examiner. Fetal electronic monitoring also cannot accurately reflect fetal and placental statuses during the early abruption period. Furthermore, when abnormal findings appear, the fetus may already have a certain degree of organ damage and require urgent management. Laboratory examinations are time-consuming and not helpful in diagnosing placental abruption and predicting prognoses.

Therefore, among the initial clinical findings, identifying the specific findings that reflect patient prognosis is important. In this regard, our center analyzed the significance of each clinical finding and their roles as predictive markers of placental abruption prognosis.

In our study, neonatal outcome was significantly associated with abdominal pain (odds ratio [OR]=43.3; 95% confidence interval [CI]=1.9–968.9) and vaginal bleeding (OR=23.1; 95% CI=1.7–305.9). However, the presence of a retroplacental hematoma on USG and abnormal FHR patterns were not significantly related to increased risk.
with initial symptoms of both AP & VB and AP. AP & VB were known as the most typical symptoms of placental abruption. In patients with AP & VB, the dimensions of the placental abruptions were larger, their neonates had longer NICU admission periods, and there were higher frequencies of ventilator use and higher proportions of composite morbidities. However, the number of patients was too small (only nine) to show statistical significance for other factors (Table 2). Furthermore, the small number of patients with AP & VB indicates its limited usefulness as a clinical marker of placental abruption, unlikely to previous acquaintance.\(^1\)

Patients with AP as an initial symptom showed lower incidence of Apgar score \(\geq 7\) at 1 and 5 minutes and larger dimensions of placental abruption. Their neonates had higher frequencies of ventilator use and higher proportions of composite morbidity. The occurrence of AP in placental abruption arises from the increased intrauterine pressure of the enlarged hematoma.\(^1\) Retroplacental hematoma on USG can usually be confirmed after the hematoma enlarges to a certain extent. In the case of a uterine posterior wall-implanted placenta, it may be more difficult to confirm by USG due to concealment by the fetus even after hematoma enlargement.\(^1,13\) Subsequently, increased blood loss and intrauterine pressure interfere with oxygen delivery to the fetus, thus causing multiorgan dysfunction which can lead to neonatal asphyxia or acidemia.\(^15,16\) Depending on the extent of such dysfunction, intrauterine fetal death may occur or may necessitate the use of a ventilator after birth. Especially in case of concealed hemorrhage, the risk of DIC is expected to increase and abdominal pain will increase due to the pressure effect. We suggest that larger placental abruptions cause more maternal hemorrhage and also increase the necessity of transfusions.

The results of the multivariate logistic regression presented in Table 4 compared the important clinical findings and poor neonatal outcomes. It is well known that gestational age and birth weight are closely related to neonatal prognosis. However, these factors are not significantly associated with severity of disease in placental abruption. In the case of severe placental abruption, the likelihood of fetal death increases, even if the fetus is a full-term fetus with an appropriate weight for the gestational age. For IUFD fetuses included in this study, the average gestational weeks at delivery was 32\(\pm\)5 weeks. The earliest gestational age of IUFD was 30 gestational weeks and the latest was 38 gestational weeks. Based on the recent medical technology, the possibility of death is extremely low unless there is severe degree of placenta abruption. The purpose of this study was to clarify the relationships between initial clinical findings and neonatal outcomes. Therefore, we did not evaluate the association between outcome and gestational age in our analysis. Instead, we analyzed the association of neonatal prognosis and categorized initial clinical findings that obstetricians commonly use to diagnose placental abruption. Based on these results, patients with placental abruption had the highest risk of poor neonatal outcome when accompanied by AP as the initial clinical finding (OR=43.3). The results of this study are consistent with the results of Kasai et al.\(^17\) Moreover, this study provides evidence for the relevance of adverse pregnancy outcomes to AP by measuring dimension of placental abruption as percentage.

Our study has some limitations. First, this was a retrospective study with a small sample size. Second, selection bias could have occurred because the study was conducted at a tertiary medical center and does not represent the whole population. Therefore, large-scale multicenter studies should be conducted.

Patients suspected of having placental abruption show various symptoms that can be mistaken for other diseases. Obstetricians usually regard initial symptoms, USG findings or abnormal FHR patterns, as indicators of placental abruption. However, accurate diagnosis and detection of severity is still difficult before delivery. Therefore, from the aspect of ‘prognosis evaluable clinical variables before delivery’, we suggest that AP is the most significant clinical finding that reflects the prognosis of neonates.

In conclusion, our study showed that AP is a useful predictive marker of the neonatal outcome of placental abruption. Obstetricians should make more rapid decisions and carefully monitor patients for improving the outcome of placental abruption when patients have obvious AP.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.
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