

Timing of recurrent placental abruption relative to the previous episode and implications for subsequent pregnancy management

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Abstract

Purpose

Placental abruption has a high recurrence risk, but the timing of recurrence relative to the previous episode remains unclear. This study evaluated recurrence timing and compared recurrent and first-time placental abruption in multiparous women.

Methods

This retrospective multicenter cohort study included 239 women with placental abruption managed at nine perinatal centers in northern Japan between 2003 and 2024. Clinical characteristics and pregnancy outcomes were compared between multiparous women with recurrent placental abruption ($n = 10$) and multiparous women with first-time placental abruption and no previous history of placental abruption ($n = 134$). To assess recurrence timing, we also examined the gestational age at placental abruption in the previous and current pregnancies among women with recurrent placental abruption.

Results

Among the 239 women with placental abruption, 10 (4.2%) had recurrent placental abruption. Maternal age was significantly higher in the recurrent group, whereas BMI, smoking status, conception by assisted reproductive technology, and hypertensive disorders of pregnancy were similar between groups. Most clinical features and maternal and neonatal outcomes did not differ significantly, although birth weight was significantly higher in the recurrent group. Among the 10 women with recurrent placental abruption, 11 recurrent events were identified; 6 (54.5%) occurred within ± 1 week and 8 (72.7%) within ± 2 weeks of the gestational age at the previous episode. Pathology reports in the recurrent group suggested maternal vascular malperfusion in 7 of 10 cases.

Conclusion

Recurrent placental abruption tended to occur near the gestational age of the previous episode. The gestational age at the previous abruption may serve as a practical anchor for surveillance planning in subsequent pregnancies, although management should remain individualized. These findings should be interpreted cautiously because of the small number of recurrent cases.

What does this study adds to the clinical work

Recurrent placental abruption tended to occur near the gestational age of the previous episode, with 72.7% of recurrent events occurring within ± 2 weeks.

In a subsequent pregnancy after placental abruption, the gestational age of the previous episode may serve as a practical anchor for planning intensified surveillance, although management should remain individualized.

Introduction

Placental abruption is a serious obstetric emergency characterized by the premature detachment of a normally implanted placenta before delivery [1, 2]. This condition poses severe risks to both the mother and the fetus; in mothers, it may cause hemorrhagic shock, coagulopathy, and organ dysfunction due to massive bleeding, while in fetuses and neonates, it may lead to preterm birth, low birth weight, hypoxic injury, intrauterine fetal death, and neonatal death [1–3]. Although its incidence is relatively low, placental abruption is of major clinical importance because of its rapid progression and strong association with adverse maternal and neonatal outcomes [1, 3, 4].

Reported risk factors for placental abruption include hypertensive disorders of pregnancy, trauma, smoking, premature rupture of membranes, advanced maternal age, multiple pregnancy, and conception by assisted reproductive technology [1–8]. In clinical practice, however, placental abruption often develops unpredictably even in women without these typical risk factors, which limits the ability to stratify risk before onset [1, 2, 9]. In particular, a history of placental abruption is known to markedly increase the risk of recurrence in a subsequent pregnancy, making it one of the most important clinical indicators of future risk [1, 2, 4, 10, 11].

Despite its clinical importance, there is still insufficient evidence regarding the specific gestational age at which women with a history of placental abruption should commence high-risk management in a subsequent pregnancy [1, 2, 12, 13]. Although major guidelines emphasize the need for careful follow-up, there is a lack of concrete guidance for clinicians regarding when to intensify surveillance, how frequently women should be reviewed, whether planned admission is warranted, and how delivery timing should be determined [1, 12, 13]. As a result, management in daily practice often relies on empirical judgment, and clinicians must individually balance the risk of recurrence against the burden of intervention, such as frequent visits and prolonged hospitalization [1, 2, 12, 13].

In this context, we retrospectively analyzed cases of placental abruption managed at nine perinatal care centers in northern Japan, with a specific focus on recurrent episodes. The aims of this study were to compare the clinical characteristics of recurrent cases with those of first-time cases in multiparous women, to characterize the temporal distribution of recurrence in relation to the gestational age of the previous episode, and to provide clinically relevant evidence regarding the timing of intensified surveillance and high-risk obstetric management in subsequent pregnancies among women with a history of placental abruption.

Methods

Study design and population

We conducted a retrospective multicenter cohort study of women with placental abruption managed at nine perinatal care centers in northern Japan between January 2003 and December 2024. The study was approved by the Institutional Review Board of Hirosaki University Graduate School of Medicine (No. 2022 – 119). The requirement for informed consent was waived due to the retrospective nature of the study, and an opt-out approach was used to allow eligible women to decline participation.

Data collection and definitions

A total of 239 women diagnosed with placental abruption were identified from medical records. Placental abruption was diagnosed primarily on clinical grounds, based on a combination of classic symptoms (including vaginal bleeding, abdominal pain, and uterine tenderness), retroplacental hematoma confirmed at delivery, and, when available, histopathological findings. For the comparative analysis, multiparous women were categorized into two groups: (1) the recurrent placental abruption group ($n = 10$), consisting of women with placental abruption in the index pregnancy and a history of placental abruption in at least one previous pregnancy, and (2) the first-time placental abruption group ($n = 134$), consisting of multiparous women experiencing placental abruption in the index pregnancy with no prior history of placental abruption. Nulliparous women were excluded from this comparative analysis. To evaluate recurrence timing, we reviewed the gestational age at placental abruption in both the previous and current pregnancies among women in the recurrent group. Gestational age at onset was defined as the gestational age at the first maternal symptoms or clinical findings that led to the diagnosis of placental abruption, as documented in the medical record. Because one woman had two previous pregnancies complicated by placental abruption, 11 recurrent events were identified among 10 women.

Clinical outcomes and pathological evaluation

Maternal and neonatal characteristics were extracted, including maternal age, body mass index (BMI), presence of hypertensive disorders of pregnancy (HDP), gestational age at delivery, and neonatal birth weight. Clinical presentation, ultrasonographic findings, pregnancy course, mode of delivery, maternal outcomes, and neonatal outcomes were also collected from the medical records. Furthermore, we examined the gestational age at onset for both the current and previous pregnancies in the recurrent group to determine the temporal distribution of recurrence. Placental pathology was evaluated according to the Amsterdam Placental Workshop Group Consensus Statement, with a focus on findings suggestive of maternal vascular malperfusion (MVM). Placental pathological findings were reviewed from the original pathology reports and, when available, from archived histological slides.

Statistical analysis

Continuous variables are expressed as medians with interquartile ranges (IQR) and were compared using the Mann–Whitney U test. Categorical variables are presented as numbers and percentages and were analyzed using Fisher’s exact test. Parity was compared using the Fisher–Freeman–Halton exact test. The temporal relationship between the gestational ages at previous and subsequent placental abruption episodes was examined descriptively. All statistical analyses were performed using R statistical software (version 4.2.2). A p-value of < 0.05 was considered statistically significant. Because of the small number of recurrent cases, the analyses were exploratory and no multivariable adjustment was performed. Missing data were not imputed, and analyses were performed using available data for each variable.

Ethical considerations

This retrospective observational study was approved by the Ethics Committee of Hirosaki University Graduate School of Medicine (approval number: 2022 – 119; approval date: February 17, 2023). Necessary ethical review and institutional procedures were also completed at each participating institution. Given the retrospective nature of the study, informed consent was waived or addressed by an opt-out procedure in accordance with the ethical policies of each institution.

Results

Study population and baseline characteristics

During the study period, 239 cases of placental abruption were identified. The baseline characteristics of the overall cohort are shown in Table 1. The median maternal age was 33.0 years, and the median pre-pregnancy BMI was 21.0 kg/m². Of the total cohort, 10 women (4.2%) had recurrent placental abruption, while 134 women (56.1%) were multiparous women experiencing their first placental abruption episode.

Table 1
Baseline characteristics of the overall placental abruption cohort (n = 239)

1. Maternal characteristics	
Maternal age, years	33.0 (19–45)
Advanced maternal age (≥ 35 years), n (%)	87 (36.4)
Pre-pregnancy body mass index, kg/m ^{2a}	21.0 (15.0–38.1)
Smoking during pregnancy, n (%)	10 (4.2)
Conception by assisted reproductive technology, n (%)	9 (3.8)
2. Parity	
Nulliparous, n (%)	95 (39.7)
Multiparous, n (%)	144 (60.3)
3. Preexisting medical conditions	
Chronic hypertension, n (%)	3 (1.3)
Preexisting diabetes mellitus, n (%)	3 (1.3)
Thyroid disease, n (%)	6 (2.5)
Systemic autoimmune disease, n (%)	2 (0.8)
Renal disease, n (%)	2 (0.8)
4. Pregnancy characteristics in the index pregnancy	
Hypertensive disorders of pregnancy, n (%)	44 (18.4)
Fetal growth restriction, n (%)	27 (11.3)
Multiple pregnancy, n (%)	2 (0.8)
Premature rupture of membranes, n (%)	21 (8.8)
Abdominal trauma during pregnancy, n (%)	4 (1.7)
Data are presented as n (%) or median (range).	
ART, assisted reproductive technology.	
a Pre-pregnancy BMI was available for 177/239 women.	
Thyroid disease included Graves' disease (n = 1), Hashimoto's disease (n = 1), hypothyroidism (n = 2), hyperthyroidism (n = 1), and thyroid cancer (n = 1).	
Systemic autoimmune disease included ulcerative colitis (n = 1) and autoimmune hepatitis (n = 1).	
Renal disease included IgA nephropathy (n = 2).	

1. Maternal characteristics	
5. Recurrence status	
Recurrent placental abruption, n (%)	10 (4.2)
First-time placental abruption in multiparous women, n (%)	134 (56.1)
Data are presented as n (%) or median (range).	
ART, assisted reproductive technology.	
a Pre-pregnancy BMI was available for 177/239 women.	
Thyroid disease included Graves' disease (n = 1), Hashimoto's disease (n = 1), hypothyroidism (n = 2), hyperthyroidism (n = 1), and thyroid cancer (n = 1).	
Systemic autoimmune disease included ulcerative colitis (n = 1) and autoimmune hepatitis (n = 1).	
Renal disease included IgA nephropathy (n = 2).	

Comparison between recurrent and first-time placental abruption

Table 2 compares the maternal characteristics of the recurrent placental abruption group (n = 10) and the first-time placental abruption group (n = 134). Maternal age was significantly higher in the recurrent placental abruption group than in the first-time placental abruption group (35.5 [34.0-40.5] vs. 34.0 [30.0–37.0] years, $p = 0.039$). No significant differences were observed in BMI, smoking status, conception by assisted reproductive technology, obstetric history, or hypertensive disorders of pregnancy. Other baseline maternal characteristics and pregnancy-related factors were also similar between the two groups (Table 2).

Table 2

Maternal characteristics and obstetric history of multiparous women with first-time versus recurrent placental abruption

1. Maternal characteristics	Multiparous women without previous placental abruption (n = 134)	Multiparous women with recurrent placental abruption (n = 10)	P-value
Maternal age, years	34.0 (30.0–37.0)	35.5 (34.0–40.5)	0.039
Advanced maternal age ($\geq$ 35 years), n (%)	55 (41.0)	5 (50.0)	0.742
Pre-pregnancy BMI, kg/m ^{2a}	20.9 (19.3–24.1)	22.3 (21.1–23.2)	0.405
Smoking during pregnancy, n (%)	9 (6.7)	0 (0.0)	1.000
Conception by ART, n (%)	5 (3.7)	0 (0.0)	1.000
2. Obstetric history			
Parity, n (%)			
1	82 (61.2)	4 (40.0)	0.130
2	34 (25.4)	5 (50.0)	
3	14 (10.4)	0 (0.0)	
≥ 4	4 (3.0)	1 (10.0)	
Previous cesarean delivery, n (%)	19 (14.2)	1 (10.0)	1.000
Previous preterm birth, n (%)	12 (9.0)	1 (10.0)	1.000
Previous hypertensive disorders of pregnancy, n (%)	9 (6.7)	1 (10.0)	0.525
Data are presented as n (%) or median (IQR).			
Continuous variables were compared using the Mann–Whitney U test.			
Categorical variables were compared using Fisher's exact test.			
Parity was compared using the Fisher–Freeman–Halton exact test.			
a Pre-pregnancy BMI was available for 96/134 women without previous placental abruption and 6/10 women with recurrent placental abruption.			
ART, assisted reproductive technology.			

1. Maternal characteristics	Multiparous women without previous placental abruption (n = 134)	Multiparous women with recurrent placental abruption (n = 10)	P-value
Previous fetal growth restriction, n (%)	3 (2.2)	1 (10.0)	0.253
3. Preexisting medical conditions			
Chronic hypertension, n (%)	3 (2.2)	0 (0.0)	1.000
Preexisting diabetes mellitus, n (%)	3 (2.2)	0 (0.0)	1.000
4. Pregnancy characteristics in the index pregnancy			
Hypertensive disorders of pregnancy, n (%)	24 (17.9)	1 (10.0)	1.000
Fetal growth restriction, n (%)	17 (12.7)	1 (10.0)	1.000
Multiple pregnancy, n (%)	1 (0.7)	0 (0.0)	1.000
Premature rupture of membranes, n (%)	10 (7.5)	0 (0.0)	1.000
Abdominal trauma during pregnancy, n (%)	3 (2.2)	0 (0.0)	1.000
Data are presented as n (%) or median (IQR).			
Continuous variables were compared using the Mann–Whitney U test.			
Categorical variables were compared using Fisher’s exact test.			
Parity was compared using the Fisher–Freeman–Halton exact test.			
a Pre-pregnancy BMI was available for 96/134 women without previous placental abruption and 6/10 women with recurrent placental abruption.			
ART, assisted reproductive technology.			

Most clinical findings and maternal and neonatal outcomes were also comparable between groups (Table 3). Birth weight was significantly higher in the recurrent group (2600 [2287–2888] vs. 2146 [1543–2560] g, $p = 0.011$), whereas gestational age at diagnosis and delivery did not differ significantly. No significant between-group differences were observed in subjective symptoms, ultrasonographic

findings, abnormal fetal heart rate tracing, mode of delivery, estimated blood loss, obstetric disseminated intravascular coagulation, blood transfusion, umbilical artery pH, intrauterine fetal death, or neonatal death.

Table 3

Clinical presentation, pregnancy course, and maternal and neonatal outcomes among multiparous women with first-time versus recurrent placental abruption

1. Clinical presentation (symptoms)	Multiparous women without previous placental abruption (n = 134)	Multiparous women with recurrent placental abruption (n = 10)	P-value
Any subjective symptom, n (%)	121 (90.3)	10 (100.0)	0.600
Vaginal bleeding, n (%)	87 (64.9)	7 (70.0)	1.000
Abdominal pain, n (%)	37 (27.6)	5 (50.0)	0.156
Uterine contractions, n (%)	37 (27.6)	2 (20.0)	0.729
Leakage of fluid / suspected PROM, n (%)	11 (8.2)	1 (10.0)	0.593
Decreased fetal movement, n (%)	8 (6.0)	0 (0.0)	1.000
Back pain, n (%)	3 (2.2)	1 (10.0)	0.253
2. Clinical findings at presentation			
Any abnormal ultrasound finding, n (%)	89 (66.4)	4 (40.0)	0.166
Retroplacental hematoma, n (%)	59 (44.0)	2 (20.0)	0.191
Placental thickening, n (%)	26 (19.4)	0 (0.0)	0.209
Increased placental echogenicity or heterogeneous placental echotexture, n (%)	7 (5.2)	1 (10.0)	0.446
Sonographic evidence of placental separation, n (%)	8 (6.0)	0 (0.0)	1.000
Abnormal fetal heart rate tracing, n (%)	59 (44.0)	3 (30.0)	0.515
3. Pregnancy course and delivery			
Data are presented as n (%) or median (IQR).			
Categorical variables were compared using Fisher's exact test.			
Continuous variables were compared using the Mann–Whitney U test.			
a Umbilical artery pH was available for 94/134 women without previous placental abruption and 7/10 women with recurrent placental abruption.			

1. Clinical presentation (symptoms)	Multiparous women without previous placental abruption (n = 134)	Multiparous women with recurrent placental abruption (n = 10)	P-value
Gestational age at diagnosis, weeks	34.0 (32.0–37.0)	36.0 (34.3–37.0)	0.172
Gestational age at delivery, weeks	35.0 (32.0–37.0)	36.5 (35.3–37.0)	0.092
Mode of delivery			
Spontaneous vaginal delivery, n (%)	21 (15.7)	0 (0.0)	0.358
Vacuum-assisted vaginal delivery, n (%)	3 (2.2)	0 (0.0)	1.000
Cesarean delivery, n (%)	110 (82.1)	10 (100.0)	0.214
4. Maternal outcomes			
Estimated blood loss, mL	890 (608–1328)	845 (706–934)	0.568
Obstetric disseminated intravascular coagulation, n (%)	20 (14.9)	0 (0.0)	0.358
Blood transfusion, n (%)	32 (23.9)	1 (10.0)	0.455
5. Neonatal outcomes			
Birth weight, g	2146 (1543–2560)	2600 (2287–2888)	0.011
Umbilical artery pH ^a	7.266 (7.098–7.322)	7.330 (7.229–7.348)	0.192
Intrauterine fetal death, n (%)	19 (14.2)	0 (0.0)	0.359
Neonatal death, n (%)	2 (1.5)	1 (10.0)	0.195
Data are presented as n (%) or median (IQR).			
Categorical variables were compared using Fisher's exact test.			
Continuous variables were compared using the Mann–Whitney U test.			
^a Umbilical artery pH was available for 94/134 women without previous placental abruption and 7/10 women with recurrent placental abruption.			

Timing of recurrence

The relationship between gestational age (GA) at onset in the previous and current pregnancies was analyzed for 11 recurrent events in 10 women (Fig. 1). One woman contributed two recurrent events

because she had two previous pregnancies complicated by placental abruption. Recurrent events tended to occur close to the gestational age at the previous episode. The median difference in GA between the previous and subsequent episodes was 0.0 weeks (IQR: -1.0 to + 1.4 weeks). Specifically, 54.5% (6/11) of recurrences occurred within ± 1 week, and 72.7% (8/11) occurred within ± 2 weeks of the GA at the previous episode.

Placental pathology in recurrent cases

Histopathological evaluation of the placentas from previous pregnancies in the recurrent group revealed findings suggestive of maternal vascular malperfusion (MVM) in 7 of 10 cases. Representative findings included extensive villous infarction and decidual vasculopathy (Fig. 2), even in cases where the mother did not manifest HDP. These findings suggest that underlying vascular pathology may contribute to recurrence in at least some cases.

Discussion

This retrospective study included 239 cases of placental abruption from nine institutions in northern Japan and compared recurrent cases in multiparous women ($n = 10$) with multiparous first-time cases ($n = 134$), while also examining the distribution of recurrence timing in recurrent cases. The principal finding of this study was that recurrent events tended to cluster near the gestational age at onset of the previous episode. Approximately half of recurrent events occurred within ± 1 week of the gestational age at the previous episode, and approximately three-quarters occurred within ± 2 weeks. These findings suggest that the gestational age at the previous episode may serve as a useful temporal anchor when planning surveillance in a subsequent pregnancy among women with a history of placental abruption.

Although known risk factors for placental abruption include hypertensive disorders of pregnancy, chronic hypertension, smoking, premature rupture of membranes, trauma, and conception by assisted reproductive technology, onset can also occur in women without these risk factors, limiting the ability to predict placental abruption in advance [1–3, 9]. In the present study, maternal age was higher in the recurrent group, whereas the frequency of advanced maternal age itself was not significantly different. Likewise, no clear between-group differences were observed in the frequencies of previously reported clinical risk factors, including smoking, conception by assisted reproductive technology, previous cesarean delivery, previous preterm birth, previous hypertensive disorders of pregnancy, chronic hypertension, preexisting diabetes mellitus, hypertensive disorders of pregnancy in the index pregnancy, and fetal growth restriction. However, because our comparison was restricted to women with placental abruption in the index pregnancy, this analysis was not designed to identify independent risk factors for recurrence. Accordingly, the absence of significant between-group differences should not be interpreted as evidence that these factors are unrelated to recurrent placental abruption.

The fact that recurrence could not be adequately explained by conventional clinical factors alone suggests that placental abruption may involve underlying pathophysiology that is not readily captured by routine clinical indicators. Recent work has suggested that both inflammatory pathways related to

infection and chronic ischemic pathways related to impaired uteroplacental circulation may contribute to the pathogenesis of placental abruption [1, 14, 15]. In addition, ischemic placental disease, a concept that encompasses preeclampsia, fetal growth restriction, and placental abruption, has been proposed, with maternal vascular malperfusion (MVM) regarded as one of its characteristic pathological patterns [1, 16–18]. In the present study, pathology reports suggested MVM in 7 of the 10 recurrent cases. Moreover, in one case in which pathology slides from the previous episode were available for review, the placenta from the previous pregnancy showed findings consistent with MVM. These observations support the possibility that, at least in some recurrent cases, chronic uteroplacental circulatory insufficiency may represent an underlying pathophysiological mechanism. However, the pathological findings in this study should be regarded as exploratory because they were based on a small number of cases and were not derived from a centralized pathology review. Accordingly, these findings cannot be considered direct predictors of recurrence, although pathological evaluation of a previous placenta may potentially provide supplementary information for future risk stratification.

When clinical presentation and outcomes were compared, no significant differences were found between recurrent cases and multiparous first-time cases for many variables, including subjective symptoms, abnormal ultrasonographic findings, abnormal fetal heart rate tracing, blood loss, obstetric disseminated intravascular coagulation, blood transfusion, umbilical artery pH, intrauterine fetal death, and neonatal death. All recurrent cases were delivered by cesarean delivery, but the difference in cesarean delivery rate was not statistically significant. Birth weight was significantly higher in the recurrent group; however, gestational age at diagnosis and gestational age at delivery were only numerically higher and did not differ significantly. Therefore, the higher birth weight in the recurrent group may partly reflect later gestational timing rather than a clearly different clinical phenotype. Rather, the findings suggest that, aside from a history of placental abruption, the acute clinical presentation of recurrent cases largely overlapped with that of first-time cases in multiparous women.

With respect to recurrence timing, the most important finding of this study was that recurrent episodes were centered around the gestational age at the previous episode. In clinical practice, there is often concern that recurrence may occur substantially earlier than the prior episode; however, in this cohort, most recurrent events occurred within ± 2 weeks of the gestational age at the previous episode. At the same time, not all cases fell within this range, and a subset recurred at gestational ages more distant from the previous episode. Thus, while the gestational age at the previous episode may be a useful guide for management in a subsequent pregnancy, it cannot fully account for all cases, and individualized care remains necessary with awareness that some recurrent cases may occur earlier than expected.

Although the increased recurrence risk associated with a history of placental abruption has been consistently reported, high-level evidence remains limited regarding when to begin intensified surveillance, when inpatient management is appropriate, and when delivery intervention should be considered in a subsequent pregnancy [1, 2, 10, 12, 13]. Previous reports have suggested the need for special surveillance beginning well before the gestational age at the prior episode and have also raised the possibility of delivery intervention at around 37 weeks when the previous abruption occurred at term

[1, 2, 10, 12]. At the same time, available data remain insufficient to guide the choice between inpatient and outpatient management for chronic abruption and the optimal timing of delivery [1, 13]. Taken together, the present study does not establish a uniform management protocol, but it supports the use of the gestational age at the previous episode as a pragmatic reference point for individualized surveillance planning in a subsequent pregnancy. Because approximately three-quarters of recurrent events in this study occurred within ± 2 weeks of the previous episode, enhanced observation beginning about 2 weeks before the gestational age of the prior episode may be a reasonable exploratory approach. However, this 2-week window should be considered hypothesis-generating rather than prescriptive, and management should be individualized according to institutional resources, travel time to the hospital, severity of the previous episode, coexisting hypertensive disorders of pregnancy or fetal growth restriction, and patient behavior at symptom onset [1, 2, 20, 21].

The fact that all recurrent cases in this cohort were delivered by cesarean delivery is a feature of this series, but it should not be generalized to suggest that the threshold for cesarean delivery should be lowered in women with a history of placental abruption. Actual delivery management depends on multiple factors, including fetal condition, the degree of suspicion of placental abruption, gestational age, cervical status, and institutional capacity, and should therefore be determined on an individual basis [2, 20].

This study has several limitations. First, as a retrospective study based on medical record review, information bias cannot be fully excluded. Second, because cases were collected over a long period across nine institutions, interinstitutional variation in diagnosis and management may have been present. Third, recurrent placental abruption is rare, and the number of recurrent cases was limited, restricting the ability to perform multivariable adjustment for confounding and more detailed stratified analyses. Fourth, the initiation of intensified surveillance and inpatient management was not based on a uniform protocol but on clinical judgment; therefore, the present data cannot directly evaluate the effectiveness of specific interventions. Fifth, the absence of significant differences in many variables between recurrent and multiparous first-time cases may reflect not only true similarity but also limited statistical power due to the small number of recurrent cases. Sixth, because this was a case-only comparison within a cohort of women with placental abruption, the study was not designed to estimate recurrence risk in the overall obstetric population or to determine independent predictors of recurrence.

In summary, recurrence timing in recurrent placental abruption tended to cluster near the gestational age at the previous episode. These findings support the use of the gestational age at the previous episode as a temporal anchor for surveillance planning in subsequent pregnancies among women with a history of placental abruption. At the same time, recurrent cases did not show a clearly distinct clinical phenotype apart from their history, and neither gestational age at diagnosis nor gestational age at delivery differed significantly. Therefore, the present study cannot be used to define fixed timing for hospitalization or delivery, but intensified surveillance from about 2 weeks before the gestational age of the previous episode may be considered as an exploratory practical option. This threshold should remain a guide rather than a fixed rule, and individualized management remains necessary in light of patient-specific

factors, including delayed access to care among women living far from medical facilities. Further accumulation of cases is needed to validate individualized management strategies, including those for early recurrence.

Declarations

Author Contributions

Nakamura: Data collection or management, Data analysis, Manuscript writing/editing.

Iino: Protocol/project development, Data collection or management, Data analysis, Manuscript writing/editing, Other (supervision).

Ozaki, Sato, Osawa, Tanaka, Takeda, Takahashi, Taniguchi, and Ito: Data collection or management, Manuscript writing/editing.

Yokoyama: Manuscript writing/editing, Other (supervision).

All authors read and approved the final manuscript.

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Competing Interests

The authors have no relevant financial or non-financial interests to disclose.

Ethics approval

This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of Hirosaki University Graduate School of Medicine (February 17, 2023/No. 2022-119). Necessary institutional procedures were also completed at each participating institution.

Consent to participate

Informed consent was waived because of the retrospective nature of the study, and an opt-out approach was used in accordance with institutional policy.

Consent to publish

Not applicable.

Data Availability

The datasets generated and/or analyzed during the current study are not publicly available because they contain information that could compromise participant privacy but are available from the corresponding author on reasonable request and subject to approval by the participating institutions.

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Figures

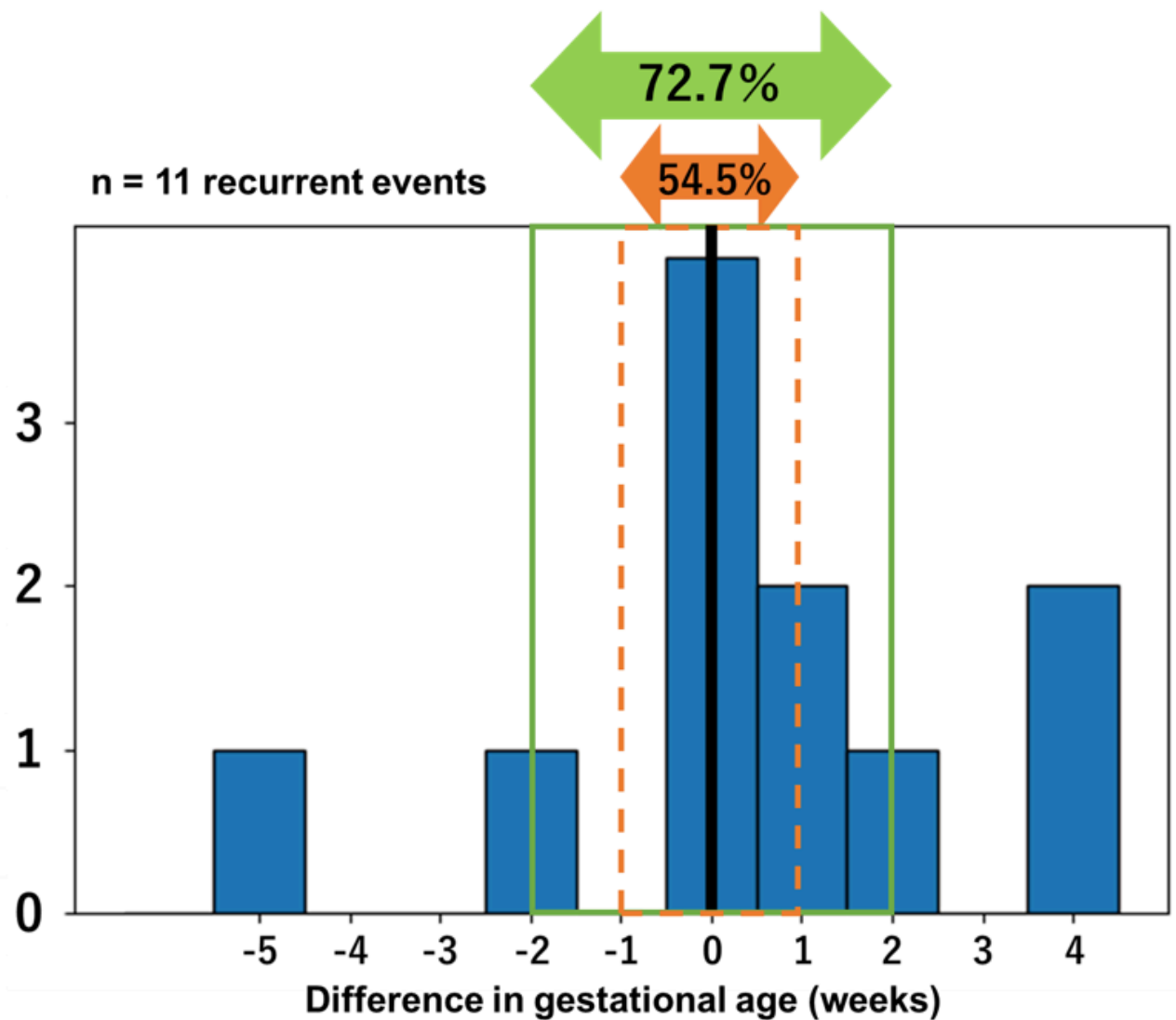


Figure 1

Timing of recurrent placental abruption relative to the previous episode. Differences in gestational age at placental abruption onset (current pregnancy minus previous pregnancy) are shown for 11 recurrent events in 10 pregnancies. One woman had two prior placental abruptions and therefore contributed two recurrent events. Six of 11 events (54.5%) occurred within ± 1 week, and 8 of 11 events (72.7%) occurred within ± 2 weeks of the gestational age at the previous episode.

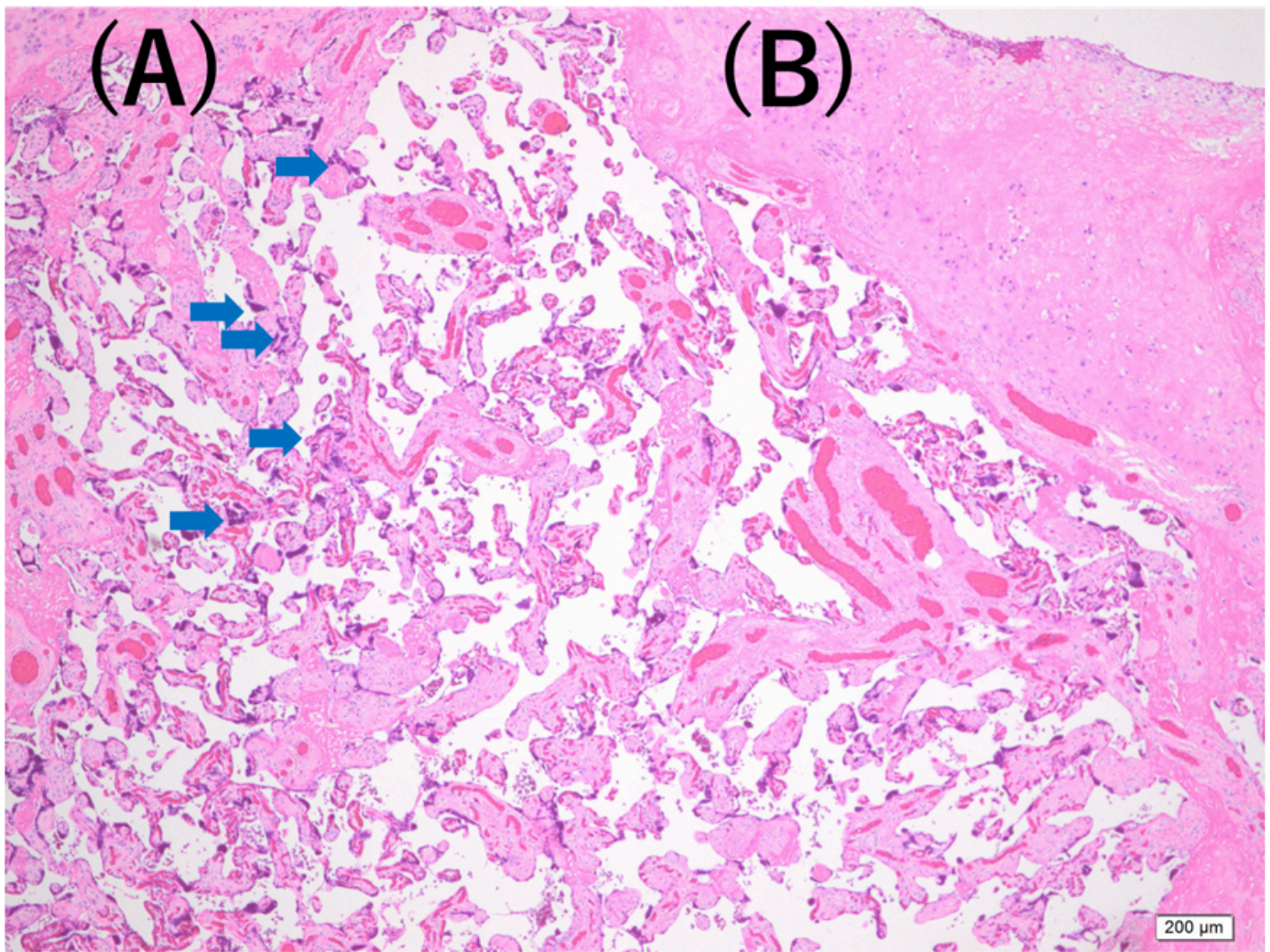


Figure 2

Representative placental pathology findings in the previous pregnancy of a recurrent placental abruption case. Findings suggestive of maternal vascular malperfusion in the placenta from the previous pregnancy are shown. (a) Increased syncytial knots (arrows) on hematoxylin and eosin staining. (b) Placental infarction on hematoxylin and eosin staining. Scale bar = 200 µm.