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Placenta previa with early opening of the uterine isthmus is associated with high risk of bleeding during pregnancy, and massive haemorrhage during caesarean delivery

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ABSTRACT

Objective: To demonstrate the relationship between the timing of opening of the uterine isthmus and bleeding during pregnancy and caesarean section in patients with placenta previa.
Methods: A prospective observational study was conducted at a single perinatal centre. All patients with placenta previa, diagnosed between 20 and 22 weeks of gestation, who were followed up at the study hospital and underwent caesarean section were enrolled.

The condition of the uterine isthmus was examined every 2 weeks. The timing (in gestational weeks) of complete opening of the uterine isthmus was determined. Patients were divided into two groups: patients in whom the uterine isthmus opened before 25 weeks of gestation (EO-previa), and patients in whom the uterine isthmus opened after 25 weeks of gestation (LO-previa). The frequency of bleeding during pregnancy and the amount of intra-operative bleeding were compared between the two groups.
Results: Forty-four cases of EO-previa and 55 cases of LO-previa were analysed. Complete placenta previa at delivery was observed more frequently in the EO-previa group than in the LO-previa group (88.6% vs 47.3%, $p < 0.001$). An emergency caesarean section due to active bleeding was performed more frequently in the EO-previa group (48%) than in the LO-previa group (25%) ($p = 0.021$). The frequency of massive haemorrage (>2500 ml) during caesarean section was higher in the EO-previa group than in the LO-previa group (25% vs 9%, $p = 0.033$).
Conclusion: Placenta previa was associated with a high risk of bleeding leading to emergency caesarean section during pregnancy, and massive haemorrhage during caesarean section in patients in whom the uterine isthmus opened before 25 weeks of gestation.

Introduction

Placenta previa is a major cause of massive haemorrhage during pregnancy and delivery. However, massive haemorrhage does not occur in all cases of placenta previa, and the prediction of cases that are at high risk for massive haemorrhage is important for management of the condition. As such, there has been a great deal of discussion regarding the prediction of cases at high risk of placenta previa through sonographic evaluation. Short cervical length [1], placenta lacunae, sponge-like echo in the cervix, and the lack of a clear zone [2,3] are currently considered to be sonographic risk factors for massive bleeding.

The uterine isthmus is usually closed during early pregnancy, but opens with advancing gestation. This phenomenon also occurs in patients with placenta previa. Consequently, it was hypothesized that patients with placenta previa in whom the uterine isthmus opens earlier are more likely to experience complications, such as sudden bleeding during pregnancy and massive haemorrhage during caesarean section, because changes in the lower part of the uterus that occur during slight contractions may lead to separation of the placenta and the decidua during pregnancy, and because atonic bleeding may occur frequently when the uterine isthmus is dilated and expanded for a long period of time (from earlier gestation to delivery by caesarean section).

This study distinguished the uterine isthmus from the uterine cervix by precise ultrasound examinations. The aim of this study was to demonstrate the relationship between the timing of

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opening of the uterine isthmus and bleeding during pregnancy and caesarean section in patients with placenta previa.

Materials and methods

A prospective cohort study was performed at Showa University Hospital, Tokyo, Japan between 2009 and 2014. The study population included all patients with placenta previa, diagnosed between 20 and 22 weeks of gestation, who were followed up at the study hospital and underwent caesarean section.

Placenta previa was diagnosed by experienced obstetricians based on a transvaginal ultrasonic finding of placental tissue covering the lowest ostium of the uterine cavity (amniotic cavity) between 20 and 22 weeks of gestation. During the ultrasound examination, the pregnant patients were placed in a supine position after urination. Ultrasound examination was taken when uterine contraction was not investigated. The uterine cervix was defined as same as the endocervical mucosa (cervical gland), which was usually visualized as a leaf-like echo area with low echogenicity compared with the surrounding tissues. The uterine isthmus was defined as the region from the highest point of the cervical gland to the lowest point of the internal ostium of uterine cavity.

Following a diagnosis of placenta previa, the uterine isthmus, the uterine cervix and the location of the placenta were observed by transvaginal ultrasound every 2 weeks. As the uterine isthmus opens with advancing gestation, the timing (in gestational weeks) of opening was detected and recorded. An open isthmus was defined as a completely opened isthmus (i.e. an isthmus region was undetectable); if this condition was not met, the isthmus was considered to be closed (Figs. 1 and 2).

The subjects were divided into two groups: those in whom the uterine isthmus opened before 25 weeks of gestation (early opening isthmus; EO-previa) and those in whom the uterine isthmus opened after 25 weeks of gestation (late opening isthmus; LO-previa). The frequency of bleeding during pregnancy, and the amount of bleeding during caesarean section were compared between the two groups. Three authors (M.G., T.A. and H.T.) used ultrasound images to determine if the isthmus was open. When one author reported a different diagnosis from the other two authors, the diagnosis made by the two authors was taken.

When a hysterectomy was performed following a caesarean section, the amount of bleeding during the hysterectomy was included. In the present study, massive haemorrhage was defined as more than 2500 ml during surgery.

Elective caesarean sections were planned between 36 and 37 weeks of gestation. Emergency caesarean sections were performed before planned caesarean sections in the case of more than 100 ml of bleeding, uncontrollable uterine contractions or premature rupture of membranes.

All statistical analyses were performed using Statistical Package for Social Science Version 20.0J (IBM Corp., Armonk, NY, USA). Continuous variables were reported as median (range) and compared using the Mann–Whitney *U*-test. Categorical variables were reported as percentages and compared using Fisher's exact test. Significant variables associated with EO-previa on univariate analysis, including complete placenta previa, were used in the multivariable analysis. $p < 0.05$ was considered to indicate statistical significance.

This study was approved by the hospital ethics committee. Informed consent was obtained in writing from all patients before they underwent ultrasound scans.

Results

Two hundred and ninety cases of suspected placenta previa were identified between 20 and 22 weeks of gestation. The suspected placenta previa resolved at delivery in 189 cases, so this study included 101 patients with placenta previa. Two cases were excluded: one case in which intra-uterine fetal death occurred due to another perinatal complication, and one case of a twin pregnancy. Thus, 99 cases were classified into two groups based

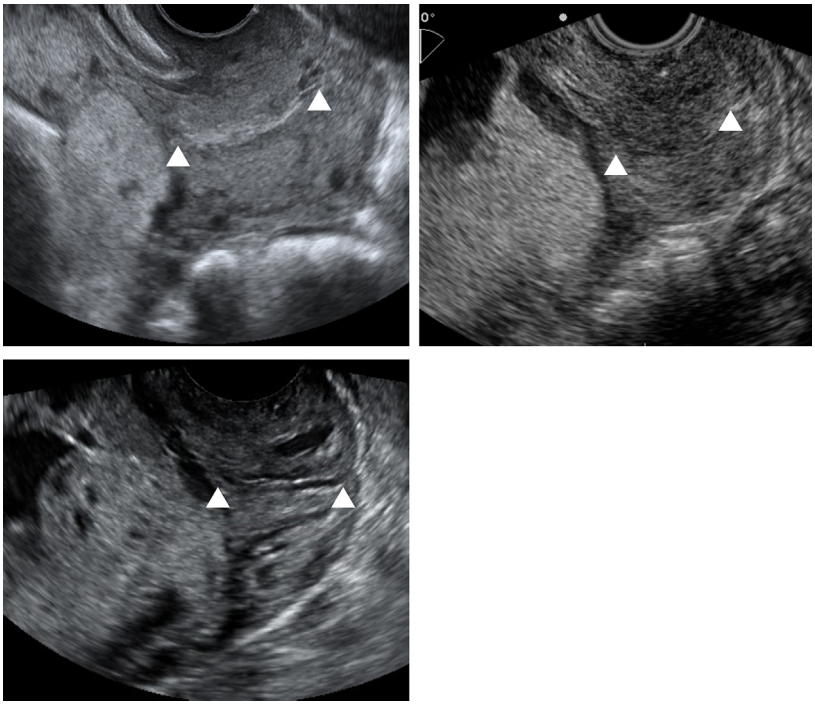

Fig. 1. Placenta previa with open isthmus. The uterine cervix was defined as same as the endocervical mucosa (cervical gland ▲–▲), which was usually visualized as a leaf-like echo area with low echogenicity compared with the surrounding tissues.