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Adherent basal plate myometrial fibers in the delivered placenta as a risk factor for development of subsequent placenta accreta

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ABSTRACT

Background: Placenta accreta is implantation of chorionic tissue directly upon the myometrium without normal intervening decidua. The clinical significance of myometrial fibers attached to the basal plate (BPMYO) has yet to be fully elucidated.
Objective: To determine the importance of depth and quantity of BPMYO in predicting subsequent accreta in the next pregnancy.
Method: Women with placentas from two successive pregnancies submitted for pathologic evaluation were included. 50 cases had clinical and/or pathologic diagnosis of accreta in an index pregnancy. 100 controls had no evidence of accreta in an index pregnancy. H&E slides were re-reviewed and stage of accreta/BPMYO was determined. The stages were defined as: Stage 0-no BPMYO; Stage 1-BPMYO with intervening decidua; Stage 2 < 2 decidual cells separating myometrium from chorionic tissue; Stage 3-accreta; Stage 4-increta; Stage 5-percreta. The amount of BPMYO for each placenta was quantified.
Results: Prior placentas of cases were twice as likely to have BPMYO compared to controls (84%vs42%, $P < 0.001$). The frequency of stage 1 BPMYO was not significantly different between the two groups (46% v40%, $P = 0.489$), but cases were more likely to have higher stages of BPMYO (stage 2–3) in a prior placenta (38%vs2%, $P < 0.001$). A significantly higher number of BPMYO foci and a larger proportion of BPMYO on the basal plate (6.2%vs0.7%, $P < 0.001$) in cases compared to controls.
Conclusions: Small amounts and low stage BPMYO (stage 1) may be common; however, higher stages of BPMYO (stage 2–3) and greater quantities of BPMYO in a delivered placenta are significantly associated with the subsequent development of accreta.

1. Introduction

Placenta accreta is an important cause of maternal morbidity and mortality secondary to postpartum hemorrhage with an increased risk of massive blood transfusion, disseminated intravascular coagulation, uterine rupture, and even maternal death [1–3]. Hysterectomy is often required, with accreta now being the most common indication for cesarean hysterectomy [2,4,5]. The incidence of placenta accreta has increased 10-fold over the past 50 years in parallel with the increase in delivery via cesarean, a known risk factor for the development of subsequent placenta accreta [1,6,7]. Other known risk factors include advanced maternal age, placenta previa or low-lying placenta, prior dilation and curettage (D&C), dilation and evacuation (D&E), myomectomy, multiparity, and even prior placenta accreta [2,3,6,7]. Many hypothesize that these risk factors have a potential to lead to disruption of the decidua basalis with subsequent defective or absent decidualization at the future implantation site. This allows for abnormally deep implantation of the chorionic villi directly upon the myometrium manifested clinically by the inability to separate the placenta from the uterine wall at the time of delivery or placenta accreta [7–9].

The term accreta, as it is used in the literature, encompasses a range of abnormalities based on the depth of placental implantation or invasion and is sub classified as accreta (chorionic villi directly on the superficial myometrium), increta (chorionic villi invade or extend into the myometrium) and percreta (complete penetration of the myometrium and serosa with or without

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penetration of adjacent organs) [7,8]. However, this classification system is imprecise, depending greatly on the pathologist's interpretation, specimen received and sections taken. It also excludes milder forms of placental adherence such as myometrial fibers attached to the basal plate, which we have dubbed "BPMYO" (b-p-míuo). BPMYO is typically not recognized grossly, but is often identified histologically in the delivered placenta as longitudinally-arranged or cross sections of smooth muscle fibers adherent to the basal plate with an intact intervening decidual layer present between the anchoring villi/Rohr's fibrin and the myometrium.

BPMYO is not a rare finding; as Benirschke noted, it is "not unusual to find a few myometrial fibers in [the] basal plate of delivered placentas near spiral arteries" [10]. Despite this, the literature regarding BPMYO is extremely limited and its significance has yet to be elucidated. While BPMYO does not meet the strict histologic definition of accreta, it likely indicates abnormal separation of the placenta from the uterine wall and may represent, just like accreta, abnormally deep placental penetration [11]. Sherer et al. suggested that focal decidual defects could be generated when a placenta is delivered with BPMYO, potentially leading to abnormal trophoblast–uterine interactions at the implantation site in a later pregnancy [11]. We have shown in a previous cohort of patients meeting the pathologic and clinical criteria for abnormal placental adherence that the presence of myometrial fibers attached to the basal plate is associated with an increased risk for placenta accreta in a subsequent pregnancy [12]. The aim of this study was to expand on that previous study in a larger cohort of patients, and to determine the importance of location (depth of myometrial invasion) and quantity of the myometrial fibers in predicting subsequent accreta in the next pregnancy.

2. Methods

This retrospective case-control study was carried out using clinical and pathologic material collected from Prentice Women's Hospital in Chicago, Illinois. Institutional Review Board approval was obtained prior to the start of this study.

2.1. Selection of subjects

Through a search of our Cerner Pathology Database combined with records obtained from our collaborators in the Obstetrics and Anesthesiology Departments, we identified 417 patients who were admitted to Prentice Women's Hospital between January 2008 to September 2013 with a clinical suspicion and/or pathologic diagnosis of "accreta", "increta", or "percreta" in any pregnancy. The patients were included only if they had a placenta and/or uterus submitted to pathology. Fifty three (53) of these patients were also found to have had a prior placenta submitted for pathologic examination. Of those, 50 had hematoxylin and eosin-stained (H&E) slides available for both index and prior pregnancy, with adequate basal plate for histologic review. These 50 patients represented the case group for our study with data collected from two pregnancies: the index pregnancy with clinical and/or pathologic diagnosis of accreta and the prior pregnancy.

One hundred (100) control or non-accreta patients were consecutively identified within the same time period who had no clinical suspicion or pathologic diagnosis of accreta and had two placentas submitted to surgical pathology (index and prior) for pathologic examination with H&E slides available in the Pathology archives.

2.2. Collection of clinical and demographic data

Clinical characteristics of each of the patients were collected from the available medical records including maternal age at index pregnancy, maternal race/ethnicity, gravidity, parity, number of previous cesareans, history of uterine instrumentation (i.e., D&E, D&C), history of maternal disease (e.g., chronic hypertension, gestational hypertension, preeclampsia, pre-gestational diabetes, or gestational diabetes). Clinical characteristics for each pregnancy included gestational age, birth weight, fetal gender, multiple gestation, placental weight, route of delivery (e.g., vaginal, operative vaginal, cesarean section), estimated blood loss, placenta previa, and any intervention required to complete the third stage of labor.

2.3. Review of pathologic material

For all cases and controls, the H&E slides of the placenta and/or hysterectomy specimen from the index and prior pregnancies were pulled from the Pathology archives and reviewed by two pathologists. Since 2008, a standard sampling of the placenta has been performed including one slide with "maternal surface biopsies," which consists of three rectangular samples of the maternal surface containing basal plate along the long axis of the section. These sections are typically taken at or near the center of the basal plate. In addition, at least two full thickness samples of the placenta were taken, with most of these samples containing some basal plate. Additional tissue samples were taken from any gross lesion, if present.

A pathologic staging system was developed *a priori* that characterized the spectrum of findings from normal to BPMYO to placenta percreta (Figs. 1 and 2). For all cases and controls, a pathologic stage was assigned to both the index and prior pregnancy. Placenta specimens without an accompanying hysterectomy specimen were assigned no greater than stage 3 (accreta). For those assigned stage 4 (increta), the depth percentage was determined by comparing the deepest section histologically consistent with increta to an adjacent section of normal, uninvolved myometrium. The depth % was then assigned a letter (i.e. 4A < 25%, 4B = 25–50%, 4C = 50–75%, and 4D = 75–100%). Placenta percretas were separated in to those with no involvement of adjacent organs (Stage 5) and those with invasion or attachment of adjacent organs (stage 6). Two pathologists independently reviewed the slides and any disagreements were settled by joint review and consensus.

2.4. Quantification of BPMYO

For all placentas that were assigned BPMYO stages 0 through 3, the number of pieces of basal plate examined and number of foci of BPMYO were quantified. The total length of basal plate, largest fragment of BPMYO, and total length of BPMYO were also measured in greatest dimension using an ocular micrometer. For those placentas with quantified BPMYO, the proportion or percentage of BPMYO was calculated by dividing the total length of BPMYO identified by the total length of the measured basal plate.

A validation study was also performed in order to determine if the BPMYO identified within the diagnostic sampling was proportional to the 'true' amount present along the entire basal plate. Three placentas were identified with BPMYO non-diagnostic for accreta via routine diagnostic sampling in September 2013. The quantity of BPMYO in these diagnostic sections was determined by morphologic measurements as described above. The formalin fixed placenta specimen was then retrieved from specimen storage and sampling of the remaining placental basal plate was performed with submission of the entire remainder of the basal plate (between 51 and 80 cassettes each). The quantity of BPMYO of the entire basal plate was determined by morphologic measurements as described above and compared to the diagnostic sample.

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