Prenatal ultrasound diagnosis and outcome of placenta previa accreta after cesarean delivery: a systematic review and meta-analysis

Eric Jauniaux, MD, PhD; Amar Bhide, MD

BACKGROUND: Women with a history of previous cesarean delivery, presenting with a placenta previa, have become the largest group with the highest risk for placenta previa accreta.

OBJECTIVE: The objective of the study was to evaluate the accuracy of ultrasound imaging in the prenatal diagnosis of placenta accreta and the impact of the depth of villous invasion on management in women presenting with placenta previa or low-lying placenta and with 1 or more prior cesarean deliveries.

STUDY DESIGN AND DATA SOURCES: We searched PubMed, Google Scholar, clinicalTrials.gov, and MEDLINE for studies published between 1982 and November 2016.

STUDY ELIGIBILITY CRITERIA: Criteria for the study were cohort studies that provided data on previous mode of delivery, placenta previa, or low-lying placenta on prenatal ultrasound imaging and pregnancy outcome. The initial search identified 171 records, of which 5 retrospective and 9 prospective cohort studies were eligible for inclusion in the quantitative analysis.

STUDY APPRAISAL AND SYNTHESIS METHODS: The studies were scored on methodological quality using the Quality Assessment of Diagnostic Accuracy Studies tool.

RESULTS: The 14 cohort studies included 3889 pregnancies presenting with placenta previa or low-lying placenta and 1 or more prior cesarean deliveries screened for placenta accreta. There were 328 cases of placenta previa accreta (8.4%), of which 298 (90.9%) were diagnosed prenatally by ultrasound. The incidence of placenta previa accreta was 4.1% in women with 1 prior cesarean and 13.3% in women with $\geq$2 previous cesarean deliveries. The pooled performance of ultrasound for the antenatal detection of placenta previa accreta was higher in prospective than retrospective studies, with a diagnostic odds ratios of 228.5 (95% confidence interval, 67.2—776.9) and 80.8 (95% confidence interval, 13.0—501.4), respectively. Only 2 studies provided detailed data on the relationship between the depth of villous invasion and the number of previous cesarean deliveries, independently of the depth of the villous invasion. A cesarean hysterectomy was performed in 208 of 232 cases (89.7%) for which detailed data on management were available. Positive correlations were found in the largest prospective studies between the cumulative rates of the more invasive forms of accreta placentation and the sensitivity and specificity of ultrasound imaging but not with diagnostic odds ratio values. We found no data on the ultrasound screening of placenta accreta at the routine midtrimester ultrasound examination from the nonexpert ultrasound units.

CONCLUSION: Planning individual management for delivery is possible only with accurate evaluation of prenatal risk of accreta placentation in women presenting with a low-lying placenta/previa and a history of prior cesarean delivery. Ultrasound is highly sensitive and specific in the prenatal diagnosis of accreta placentation when performed by skilled operators. Developing a prenatal screening protocol is now essential to further improve the outcome of this increasingly more common major obstetric complication.

Key words: cesarean delivery, placenta accreta, placenta previa, prenatal diagnosis, ultrasound

Placenta accreta is a complication of human placentation first defined in 1937 by Irving and Hertig as the "abnormal adherence of the afterbirth in whole or in parts to the underlying uterine wall."[1] Histopathologically, placenta accreta is now universally defined by a partial or complete absence of decidua basalis, resulting in placental villi being attached to or invading into the scarred myometrium underneath.[2-4]

Placenta accreta is graded according to the depth of villous invasiveness into placenta creta or vera when the villi adhere to the myometrium without invading it, placenta increta when the villi invade the myometrium, and placenta percreta when the villi invade down to or penetrate through the uterine serosa.[2-4]

Abnormal adherence or invasion results in the failure of the placenta to separate normally from the uterine wall at delivery. When unsuspected at the time of delivery, attempts to manually remove a placenta accreta typically provoke massive hemorrhage, leading to high maternal morbidity and mortality.

From the EGA Institute for Women's Health, Faculty of Population Health Sciences, University College London (Dr Jauniaux), and the Fetal Medicine Unit, Department of Obstetrics and Gynaecology, St George's Hospital (Dr Bhide), London, United Kingdom.

Received Jan. 14, 2017; revised Feb. 21, 2017; accepted Feb. 25, 2017.

The authors report no conflict of interest.

Corresponding author: Professor Eric Jauniaux, MD, PhD. e.jauniaux@ucl.ac.uk

0002-9378/$36.00

http://dx.doi.org/10.1016/j.ajog.2017.02.050

There is increasing evidence that multidisciplinary management of patients with suspected placenta accreta is superior to standard obstetric care.[5-7] For such care to be organized, the diagnosis must be made prenatally.[8-10] Recent population studies have shown that accreta placentation remains undiagnosed before delivery in half[11,12] to two thirds of the cases.[13] Even in series from specialist centers, up to a third of cases of placenta accreta are not diagnosed during pregnancy.[14]

The incidence of placenta accreta is directly linked with the increase in cesarean delivery.[13-19] The main additional factor for the risk of placenta accreta after a previous cesarean delivery is placenta previa. The risks of both placenta previa and placenta accreta in subsequent pregnancies increase with the number of previous cesarean deliveries[13,16,20,21] and is higher in women with a previous classical cesarean delivery.[21] A large multicenter cohort study has noted that for women presenting with placenta previa and prior cesarean delivery, the risk of accreta placentation is 3%, 11%, 40%, 61%, and 67% for first, second, third, fourth, and fifth or more cesarean deliveries, respectively.[17] These risks are independent of other maternal characteristics, such as parity, body mass index, tobacco use, and coexisting hypertension or diabetes.[2,4,14,15,17]

Given these data, the identification at the midtrimester ultrasound examination of an anterior placenta previa or low-lying placenta in a woman with a history of cesarean delivery should prompt a more detailed search for signs of placenta accreta and evaluation of the depth of villous myometrial invasion.

The main objective of this review is to evaluate the accuracy of ultrasound imaging in diagnosing placenta previa accreta in women presenting prenatally with prior cesarean delivery. Cases of placenta accreta following other types of uterine surgeries were excluded from our review and analysis. We have also evaluated the impact of the prenatal diagnosis of placenta previa accreta on pregnancy management and outcome and address the issues in screening for these high-risk cases in the growing number of women with a history of cesarean delivery in the general population.

Material and Methods

Systematic review information sources and search strategy

We undertook a PubMed, Google Scholar, clinicalTrials.gov, and MEDLINE search for studies published between the first prenatal ultrasound description of placenta accreta in 1982 by Tabsh et al[22] and Nov. 1, of 2016. The search protocol was designed a priori and registered on PROSPERO (number 42016049990) (http://www.crd.york.ac.uk/PROSPERO).

The search strategy consisted of MeSH headings for placenta accreta, placenta increta, placenta percreta, abnormally invasive placenta, and morbidly adherent placenta, which were combined with terms regarding placenta previa, low-lying placenta, sonography, ultrasound diagnosis, ultrasound screening, prenatal diagnosis, cesarean section, or cesarean delivery. Title, abstracts, and full text were independently assessed by the authors for content, data extraction, and analysis. References of included studies were also reviewed. The search was limited to articles published in English. We contacted the authors for clarification in which 2 × 2 tables could not be constructed from the published data.

Systematic review eligibility criteria

The primary eligibility criteria were articles that correlated prenatal ultrasound imaging with pregnancy outcome in women with a history of previous cesarean delivery and presenting with a placenta previa or low-lying placenta.

We included retrospective and prospective cohort studies. The index test consisted of at least 1 ultrasound evaluation performed during pregnancy with the specific aim of diagnosing placenta accreta. The reference standard for confirmation of accreta placentation after delivery was histopathological observation of placental villi directly attached to the myometrium or invading the uterine wall or at delivery by direct observation by the operating surgeon.

Systematic review study selection

The initial database search provided 166 reports and cross-referencing provided an additional 5 reports, making a total of 171 records after removal of 3 duplicates (Figure 1). Of the 171 records screened, 86 did not include data on prenatal ultrasound imaging of placenta accreta and were therefore excluded. After a second selection, case reports and letters with no description of the case were excluded. The full text of 26 articles identified on second selection were read independently and were examined in detail the authors. A further 12 reports in which antenatal ultrasound was performed but the cohort studies did not include data on previous uterine surgery were excluded, leaving 14 reports for the quantitative analysis.

The authors independently assessed inclusion criteria, data extraction, and analysis. The studies were scored on methodological quality using the Quality Assessment of Diagnostic Accuracy Studies tool (QUADAS-2) using 4 key domains: patient selection, index test, reference standard, and flow and timing.[23]

The quality items assessed were study design and the conduct and analysis of all included studies. Each item was scored as high or low or unclear if there was insufficient information to make an accurate judgment on the risk for bias. When there was inconsistency in study selection or quality assessment, we solved it by weighing arguments.

We constructed 2 × 2 tables, cross-classifying the outcome of the index test against the outcome of the reference standard. Authors were contacted for additional data if it was not possible to create 2 × 2 tables. Heterogeneity was identified using Cochran's Q test and the I^2 statistic, in which $P < .05$ and $I^2 \geq 50\%$ indicate significant heterogeneity as previously described.[24]

According to the results of heterogeneity testing, we chose a random statistical model to pool data with 95% confidence interval (CI) on sensitivity, specificity, positive and negative likelihood ratios, and the diagnostic odds ratio (DOR) defined as the ratio of the odds of the test being positive if the