Published in final edited form as:
Am J Obstet Gynecol. 2010 October ; 203(4): 330.e1–330.e5. doi:10.1016/j.ajog.2010.05.014.

Effect of Placenta Previa on Fetal Growth

Lorie M. HARPER, M.D.[1], **Anthony O. ODIBO, M.D., M.S.C.E.**[1], **George A. MACONES, M.D., M.S.C.E**[1], **James P. CRANE, M.D.**[1], and **Alison G. CAHILL, M.D. M.S.C.I** [1]

[1] Department of Obstetrics and Gynecology, Washington University in St. Louis

Abstract

Objective—To estimate the association between placenta previa and abnormal fetal growth.

Study Design—Retrospective cohort study of consecutive women undergoing ultrasound between 15–22 weeks. Groups were defined by the presence or absence of complete or partial placenta previa. The primary outcome was intrauterine growth restriction (IUGR), defined as a birth weight <10th percentile by the Alexander growth standard. Univariable, stratified and multivariable analyses were used to estimate the effect of placenta previa on fetal growth restriction.

Results—Of 59,149 women, 724 (1.2%) were diagnosed with a complete or partial previa. After adjusting for significant confounding factors (black race, gestational diabetes, preeclampsia, and single umbilical artery,), the risk of IUGR remained similar (adjusted odds ratio 1.1, 95% CI 0.9–1.5). The presence of bleeding did not impact the risk of growth restriction.

Conclusion—Placenta previa is not associated with fetal growth restriction. Serial growth ultrasounds are not indicated in patients with placenta previa.

Keywords

intrauterine growth restriction; placenta previa

Introduction

Placenta previa, defined as a placenta that implants at or over the cervical os,[1] occurs in approximately 0.3–0.5% of pregnancies at delivery. Because of the possibility of maternal hemorrhage, it is a significant contributor to maternal morbidity, as well as prematurity and perinatal mortality.[2–4] Additionally, this inherently abnormal placentation creates concern for fetal well being and fetal growth. Several features of placenta previa suggest that this patient population is at higher risk of intrauterine growth restriction, a significant risk factor for perinatal mortality.[5, 6] First, the blood supply to the lower uterine segment is less than at the fundus,[4, 7] presumably resulting in less perfusion for a placenta previa. Also, repeated bleeding episodes from placental previa may impact fetal oxygenation and growth. Prior

Corresponding Author: Lorie M. Harper, M.D. –Department of Obstetrics and Gynecology, Washington University School of Medicine, St. Louis, MO, Phone: 314 362 7139; Fax: 314 362 0041, harperl@wudosis.wustl.edu.

To be presented as a poster at the Annual Meeting of the Society for Maternal Fetal Medicine, 2010

Reprints not available

studies assessing the association between placenta previa fetal growth restriction have yielded conflicting results.[8, 9]

Although the majority of placenta previa diagnosed at routine mid-trimester anatomy ultrasound will resolve, prediction of previa resolution or persistence is impossible at this time. It is only a late-gestation ultrasound which can definitively establish persistence or resolution of placenta previa, which does little to assist the clinical management of fetal surveillance if a relationship between placenta previa and restricted fetal growth exists. In the many interim weeks, concern for poor fetal growth potential would necessitate additional ultrasounds for fetal growth assessments, as opposed to a single scan in the late third trimester to assess placental location to determine mode of delivery.

We therefore sought to estimate the relationship between placenta previa and fetal growth restriction in an effort to assist physicians with clinical management.

Materials and Methods

We performed a retrospective cohort study of all consecutive patients undergoing routine second trimester (15–22 weeks) ultrasound at a single tertiary center. Institutional review board approval was obtained. Data was prospectively collected over an 18-year period (1990–2008) by dedicated research nurses. Each patient seen in our center was given a standardized form requesting information regarding the pregnancy outcome, to be returned after delivery. If a form was not returned within four weeks of the expected delivery date, the coordinator called the patient. If the patient could not be contacted, the coordinator contacted the referring physician to obtain outcome data. The follow up form contains details regarding pregnancy complications, delivery complications and neonatal outcomes.

Patients were included in this study if they had a confirmed singleton gestation delivered after 20 weeks gestation. They were excluded if they had a fetal demise at the time of presentation for anatomic survey or if they carried a higher-order fetal gestation. Because women with known major fetal anomalies have an increased risk for growth restriction, they were excluded from this analysis. Gestational age was determined by either last menstrual period if known and concordant with ultrasound (within seven days of first trimester ultrasound or 14 days of second trimester ultrasound) or by the earliest ultrasound available when the last menstrual period was unknown or discordant with ultrasound.

At our institution, second trimester ultrasounds routinely involve assessment of placenta location.[10, 11] Suspected placenta previa by trans-abdominal scanning is confirmed with trans-vaginal ultrasound. Placenta previas diagnosed by trans-vaginal ultrasound were coded as complete (placenta covering the entire cervical os), partial (placenta covering part of the internal cervical os), or marginal (placenta within 2 centimeters of the internal cervical os). Comparisons were made between women with no placenta previa and those diagnosed with either a complete or partial previa. As the majority of marginal previas are known to resolve, they were not included in the primary analysis.[4]

The primary outcome was intrauterine growth restriction (IUGR), defined as a birth weight less than the 10^{th} percentile using the Alexander growth standard for gestational week at delivery.[12] The secondary outcome examined was birth weight less than the 5^{th} percentile using the Alexander growth standard. Secondary analyses included assessing the impact of previa type on fetal growth, as well as examining the effect of previa persistence on fetal growth in the subset of patients whom underwent at least one repeat ultrasound.

The incidence of placenta previa by previa type was described, and their association with IUGR was estimated. Patients with and without placenta previa were compared with

descriptive and bivariate statistics using unpaired Student's *t* tests for continuous variables and χ^2 tests for categorical variables. Potentially confounding variables of the exposure-outcome association were identified in the stratified analyses. Multivariable logistic regression models for IUGR less than the 10^{th} and 5^{th} percentiles were then developed to better estimate the effect of placenta previa on fetal growth while adjusting of potentially confounding effects. Clinically relevant covariates for initial inclusion in multivariable statistical models were selected using results of the stratified analyses, and factors were removed in a backward step-wise fashion, based on significant changes in the exposure adjusted odds ratio or significant differences between hierarchical models using likelihood ratio test. In patients with a repeat ultrasound, the rate of previa at the first and the last ultrasound were described. McNemar χ^2 analysis was used to compare the rate of resolution between types of previa, and Pearson χ^2 test for trend across groups. The statistical analysis was performed using STATA, version 10 Special Edition (College Station, TX).

Results

Of 72,373 women who underwent routine second trimester ultrasound at our facility, complete outcome data were available for 65,414 (90.4%). Within the cohort of 65,414 women for whom complete outcomes data were available, 57,739 remained after exclusions for presence of any fetal anomaly. Of these women, 1665 were diagnosed with any type of previa on routine second trimester ultrasound: 392 complete, 332 partial, and 941 marginal. The 724 patients diagnosed with either complete or partial previa were included in the primary analysis. Patients with and without placenta previa differed slightly (Table 1). Patients with placenta previa tended to be slightly older, had had more pregnancies, had less preeclampsia, and had higher rates of preterm premature rupture of membranes, bleeding during pregnancy and IUFD. The two groups were similar with respect to tobacco use, diabetes, and single umbilical artery.

Of the 724 women with placenta previa on second trimester ultrasound, 51 (7.2%) had an infant with a birth weight less than the tenth percentile, compared to 4026 (7.2%) in patients without placenta previa (risk ratio [RR] 1.0, 95% confidence interval [CI] 0.77–1.3) (Table 2). After adjusting for black race, diabetes, preeclampsia, and single umbilical artery, the rate of IUGR remained the same between those with and without previa (adjusted odds ratio [AOR] 1.1, 95% CI 0.9–1.5). The presence of bleeding did not impact the rate of IUGR. The rate of IUGR less than the 5^{th} percentile was similar between the two groups (3.0% versus 3.1%, AOR 1.1, 95% CI 0.8–1.7).

In a secondary analysis, the association between IUGR and type of placenta previa was examined (Table 3). In patients with any type of previa, 103 out of 1665 were diagnosed with IUGR (6.5%). Compared to patients with no previa, patients with any previa had similar odds of IUGR (AOR 1.0, 95% CI 0.8–1.2). Of 392 patients with a complete previa, 32 (8.7%) were diagnosed with intrauterine growth restriction (AOR 1.4, 95% CI 0.9–2.0). Nineteen (5.9%) of 332 patients with partial previa experienced IUGR (AOR 0.9, 95% CI 0.6–1.4), and 52 (5.8%) of 941 patients with a marginal previa were affected (AOR 0.8, 95% CI 0.6–1.1).

The rate of previa resolution and the risk of IUGR in persistent previa was also examined (Table 3). A second ultrasound was available in 1,002 patients. Of these women, 185 (16.9%) had a placenta previa (complete, partial, or marginal) on third trimester ultrasound, indicating that 83.1% of all previas diagnosed in the second trimester resolve. A marginal previa was the most likely to resolve (94.5%), followed by partial previa (80.1%), then complete previa (58.5%, $p < 0.01$).

The risk of IUGR was examined in patients with a persistent placenta previa (Table 3). In the 94 patients where complete previa did not resolve, 20.2% were affected by IUGR, compared to 13.5% of patients whose complete previa did resolve. The adjusted odds ratio for IUGR was 1.6 (95% CI 0.7–3.5) after controlling for the presence of a single umbilical artery. Patients with persistent partial previa had no cases of IUGR. The rate of IUGR in patients who had a resolved marginal previa versus those who had a persistent previa was similar (4.3% vs. 10.2%, AOR 0.5, 95% CI 0.1–4.2).

Finally, in a sensitivity analysis comparing those women with complete follow-up information to those without, the rate and types of placenta previa was similar between the two groups (2.8% versus 2.7%, p=0.58). Compared to patients for whom complete data was available, patients who had incomplete outcome data differed only slightly in that they were more likely to be black (40.6% vs 20.7%, p<0.01) and to smoke (16.0% vs 11.3%, p<0.01), but they were less likely to have a single umbilical artery (0.3% versus 0.6%, p=0.01). They were statistically similar on all other measured covariates and baseline characteristics.

Comment

We found no association between placenta previa diagnosed at routine second trimester ultrasound and a birth weight less than the 10th percentile, or less than the 5th percentile, on the Alexander growth standard. Additionally, we found that the risk of IUGR is not increased in patients with persistent placenta previa through the third trimester.

In an era when the majority of patients will undergo a second trimester ultrasound,[11] clinicians must be capable of counseling patients on the implications of the findings of that ultrasound. Prior large studies examining the relationship between placenta previa and neonatal outcomes have limited analyses to placenta previa confirmed at delivery, which many argue is the most accurate and precise method of defining placenta previa.[13, 14] Unfortunately, when a patient is diagnosed with placenta previa in the second trimester, one cannot predict whether or not their previa will persist until delivery and must counsel and devise a clinical plan based on the information available at the time. The inclusion of placenta previa diagnosed at second trimester ultrasound makes this study clinically applicable; based on our findings, a patient diagnosed with placenta previa at second trimester ultrasound can be managed with a follow up ultrasound in the third trimester to document placental location but does not need serial ultrasounds for growth. Furthermore, the finding that placenta previa is not associated with growth restriction suggests that placenta previa is not synonymous with placental insufficiency. In the absence of evidence of uteroplacental insufficiency or presence of factors associated with stillbirth, antepartum testing, a tool reserved for fetuses at risk for stillbirth, may not be warranted in this population. Two large population-based studies have addressed the impact of placenta location on fetal growth. Ananth et al performed a retrospective cohort study using ICD-9 codes to identify patients with placenta previa and linked birth certificate data to obtain infant birth weights; this large study of over 500,000 patients found a small increase in the rate of IUGR in patients with placenta previa that they felt was predominantly explained by the increased rate of prematurity.[13] However, the use of ICD-9 codes to identify cases of placenta previa may have resulted in a non-differential misclassification bias, which would dilute the effect of placenta previa on fetal growth, and bias the results towards not finding a difference in birth weights between patients with and without previa. Crane et al also performed a retrospective cohort study that utilized a perinatal database based on a coding system similar to ICD-9 codes.[14] In this study, a difference in birthweight was found that was not significant after being adjusted for gestational age. However, the authors did not comment on the comparative difference in the frequency of growth restriction in patients with and without previa.

Ogueh et al performed a study similar to ours in which they examined 703 pregnancies diagnosed with “low-lying” placenta at second trimester ultrasound compared to 6938 women with normally situated placentas.[15] However, defining the exposure as “low-lying” makes this study difficult to interpret. A placenta may be located in the lower uterine segment but more than two centimeters from the internal os; furthermore, no comment was made on the use of trans-vaginal ultrasound to confirm placental location in suspected placenta previa. Consequently, it was likely that many patients without the true risk factor (placenta covering or partially covering the cervical os) were included in this study, potentially biasing the study results toward the null.

One strength of our study was the large sample size, allowing us to test a hypothesis regarding a fairly rare exposure (placenta previa). Furthermore, the prospectively collected nature of the information provided a uniquely robust data set with complete follow up in over 90% of patients who underwent routine second trimester ultrasound at our facility. The comprehensive clinical data available in this cohort allowed us to assess important confounding factors for IUGR, such as preeclampsia, single umbilical artery, and diabetes.

One important consideration when interpreting the results from this study is the potential for selection bias with regard to those patients in whom outcome data was incomplete. However, these patients comprise less than 10% of the total study population and were statistically similar to those in the study sample (data not presented; available on request). Most importantly, they had the same rate and type of placenta previa, making this potential source for bias unlikely to have impacted the findings.

A second concern is that only a subset of patients underwent a repeat ultrasound at our facility, and patients who had repeat ultrasounds at other facilities could not be included in the sub-analysis of the impact of previa resolution on fetal growth restriction, thereby introducing a potential bias into the study population. As this is a tertiary facility, patients who continue their care at our facility tend to be higher risk patients compared to those who are followed at nearby community facilities; consequently, any bias introduced would likely influence results away from the null. However, in the subgroup of patients with previa and a repeat scan that were statistically representative of the larger sample with previa, we did not find an association between previa and IUGR. The attrition of patients due to lack of follow up and previa resolution also decreased our sample size in the follow up groups, potentially limiting our ability to detect a difference in the rate of IUGR between those with a persistent previa and those with a resolved previa (Type II error). However, in the subgroup of patients with a persistent complete previa, a post-hoc power analysis assuming an alpha error of 0.05, demonstrated that our study had 80% power to detect a 2.1-fold increase in the rate of IUGR, which we would offer is a reasonable threshold of clinical significance. Lastly, the diagnosis of placenta previa was not confirmed at the time of delivery, allowing for the possibility of resolution between the time of the latest ultrasound and delivery. However, as discussed above, this approach estimates the relationship between the antepartum clinical diagnosis of previa and the risk of IUGR, improving generalizability to clinical management. In light of this, we feel clinically useful conclusions can be drawn from this study.

Despite the fact that placenta previa represents an abnormal placentation, it does not appear to be independently associated with an increased risk for IUGR, regardless of whether the placenta previa is complete, partial, or marginal. While patients with such a diagnosis should undergo at least one additional ultrasound to evaluate for the resolution of placenta previa, serial ultrasounds for the purpose of fetal growth assessment based on previa alone do not seem warranted.

References

1. Oyelese Y, Smulian JC. Placenta previa, placenta accreta, and vasa previa. [see comment]. Obstetrics & Gynecology. 2006; 107(4):927–41. [PubMed: 16582134]
2. Iyasu S, Saftlas AK, Rowley DL, Koonin LM, Lawson HW, Atrash HK. The epidemiology of placenta previa in the United States, 1979 through 1987. American Journal of Obstetrics & Gynecology. 1993; 168(5):1424–9. [PubMed: 8498422]
3. Martin, JAHB.; Ventura, SJ.; Menacker, F.; Park, MM.; Sutton, PD. NCfH. National vital statistics reports. Vol. 51. Hyattsville M: Statistics; 2002. Births: Final data for 2001.
4. Hull, AD.; Resnick, R. Placenta previa, placenta accreta, abruptio placentae, and vasa previa. In: Creasy, RK.; Resnick, R.; Iams, JD.; Lockwood, CJ.; Moore, TR., editors. Creasy & Resnik's Maternal-Fetal Medicine Principles and Practice. 6. Philadelphia, PA: Saunders Elsevier; 2009. p. 725-37.
5. US Department of Health and Human Services. Healthy People 2010: Understanding and Improving Health. 2. Washington, DC: Government Printing Office; 2000.
6. Creasy, RK.; Resnik, R.; Iams, JD. Creasy and Resnik's maternal-fetal medicine: principles and practice. 6. Philadelphia, PA: Saunders/Elsevier; 2009.
7. Benirschke, K.; Kaufmann, P.; Baergen, RN. Pathology of the human placenta. 5. New York: Springer; 2006.
8. Varma TR. Fetal growth and placental function in patients with placenta praevia. Journal of Obstetrics & Gynaecology of the British Commonwealth. 1973; 80(4):311–5. [PubMed: 4704676]
9. Brenner WE, Edelman DA, Hendricks CH. Characteristics of patients with placenta previa and results of "expectant management". American Journal of Obstetrics & Gynecology. 1978; 132(2): 180–91. [PubMed: 686107]
10. American Institute of Ultrasound in M. AIUM Practice Guideline for the performance of an antepartum obstetric ultrasound examination [see comment]. Journal of Ultrasound in Medicine. 2003; 22(10):1116–25. [PubMed: 14606571]
11. American College of Obstetricians and G. ACOG Practice Bulletin No 101: Ultrasonography in pregnancy. Obstetrics & Gynecology. 2009; 113(2 Pt 1):451–61. [PubMed: 19155920]
12. Alexander GR, Himes JH, Kaufman RB, Mor J, Kogan M. A United States national reference for fetal growth. Obstetrics & Gynecology. 1996; 87(2):163–8. [PubMed: 8559516]
13. Ananth CV, Demissie K, Smulian JC, Vintzileos AM. Relationship among placenta previa, fetal growth restriction, and preterm delivery: a population-based study. Obstetrics & Gynecology. 2001; 98(2):299–306. [PubMed: 11506849]
14. Crane JM, van den Hof MC, Dodds L, Armson BA, Liston R. Neonatal outcomes with placenta previa. Obstetrics & Gynecology. 1999; 93(4):541–4. [PubMed: 10214830]
15. Ogueh O, Morin L, Usher RH, Benjamin A. Obstetric implications of low-lying placentas diagnosed in the second trimester. International Journal of Gynaecology & Obstetrics. 2003; 83(1): 11–7. [PubMed: 14511867]

Table 1

Demographic Data

	No Previa (n = 57,015)	Previa (n = 724)	p
Age (yrs)	30.2 ± 6.3	32.5 ± 5.8	<0.01
Gravidity	2.7 ± 1.6	3.1 ±1.7	<0.01
Parity	1.1 ± 1.2	1.2 ± 1.2	<0.01
Race			
White	36337 (63.7%)	479 (66.2%)	0.18
Black	11716 (20.5%)	124 (17.1%)	0.02
Tobacco Use	6308 (11.1%)	94 (13.0%)	0.11
Diabetes	2998 (5.4%)	38 (5.3%)	0.95
Preeclampsia	4244 (7.6%)	38 (5.3%)	0.02
Preterm Premature Rupture of Membranes	1311 (2.3%)	27 (3.8%)	0.01
Single Umbilical Artery	260 (0.5%)	2 (0.3%)	0.47
Intrauterine Fetal Demise	415 (0.7%)	13 (1.8%)	<0.01
Bleeding (any time)	3286 (5.8%)	123 (17.0%)	<0.01

Table 2

Risk of IUGR in Placenta Previa

	No Previa (n = 57015)	Complete or Partial Previa (n = 724)	RR (95% CI)	AOR* (95% CI)	P
Birthweight <10th %ile	4026 (7.2%)	51 (7.2%)	1.0 (0.8–1.3)	1.1 (0.9 – 1.5)	0.70
Birthweight <5th %ile	1705 (3.1%)	21 (3.0%)	0.98 (0.6–1.5)	1.1 (0.8 – 1.7)	0.93

*Adjusted for black race, diabetes, preeclampsia, and single umbilical artery

Am J Obstet Gynecol. Author manuscript; available in PMC 2011 October 1.

Table 3

Risk of IUGR by Previa Type and Resolution

	IUGR (%)	AOR* (95% CI)	p	Resolved Previa (%)	Persistent Previa (%)	IUGR in Persistent Previa (%)	AOR† (95% CI)	p
Any Previa (n = 1665) (Second Scan Available 1002)	103 (6.5%)	1.0 (0.8–1.2)	0.33	837 (83.5%)	165 (16.5%)	21 (13.9%)	1.4‡ (0.8–2.3)	0.23
Complete Previa (n = 392) (Second Scan Available 229)	32 (8.7%)	1.4 (0.9 – 2.0)	0.23	135 (59.0%)	94 (41.0%)	15 (20.2%)	1.6‡ (0.7–3.5)	0.23
Partial Previa (n = 332) (Second Scan Available 208)	19 (5.9%)	0.9 (0.6 – 1.4)	0.43	168 (80.8%)	40 (19.2%)	0	-	0.23
Marginal Previa (n = 941) (Second Scan Available 565)	52 (5.8%)	0.8 (0.6 – 1.1)	0.11	534 (94.5%)	31 (5.5%)	1 (4.3%)	0.5§ (0.1–4.2)	0.56

*Reference Group: Patients with no previa, n=57015, rate of IUGR 7.2% (see Table 2). Adjusted for black race, diabetes, preeclampsia, and single umbilical artery.

†Reference Group: Patients with resolved previa.

‡Adjusted for single umbilical artery

§Adjusted for preeclampsia