

Association Between First-Trimester Subchorionic Hematomas and Adverse Pregnancy Outcomes After 20 Weeks of Gestation in Singleton Pregnancies

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OBJECTIVE: To assess the association of first-trimester subchorionic hematomas with pregnancy outcomes after 20 weeks of gestation in women with singleton pregnancies.

METHODS: We conducted a retrospective cohort study of all women with singleton pregnancies presenting for prenatal care before 14 weeks of gestation over a 3-year period at a single obstetric practice. All patients underwent routine first-trimester ultrasound examinations. We compared rates of adverse pregnancy outcomes at more than 20 weeks of gestation in women with and without a subchorionic hematoma on the initial ultrasound examination, excluding women with pregnancy loss before 20 weeks of gestation.

RESULTS: From January 2015 to December 2017, a total of 2,172 women met the inclusion criteria for the study, 389 (17.9%) of whom had a subchorionic hematoma (mean largest diameter 2.1 ± 1.4 cm). Women with subchorionic hematomas had their first ultrasound examination at earlier gestational ages (8 5/7 vs 9 6/7 weeks, $P < .001$) and were more likely to have vaginal bleeding at the time of the ultrasound examination (31.9% vs 7.9%, $P < .001$). Maternal age, race, use of in vitro fertilization, body mass index, and medical comorbidities did

not differ between the groups. On univariable analysis, subchorionic hematoma was not associated with any pregnancy outcomes at more than 20 weeks of gestation, including gestational age at delivery, preterm birth, birth weight, birth weight less than the 10th percentile for gestational age, gestational hypertension, preeclampsia, placental abruption, intrauterine fetal death at more than 20 weeks of gestation, cesarean delivery, blood transfusion, and antepartum admissions. On regression analysis including subchorionic hematoma, vaginal bleeding, and gestational age at ultrasound examination, vaginal bleeding was independently associated with preterm birth at less than 37 weeks of gestation and birth weight less than the 10th percentile. Subchorionic hematoma was not independently associated with pregnancy outcomes. This study had 80% power to detect a 5% absolute difference in the frequency of preterm birth; that is, from 10% to 15%.

CONCLUSION: In singleton pregnancies, a first-trimester subchorionic hematoma is not associated with adverse pregnancy outcomes at more than 20 weeks of gestation.

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Subchorionic hematomas are commonly observed on ultrasound examination during the first trimester. The reported incidence varies widely, from as low as 0.46% to as high as 39.5%.^{1–3} Although a study of 451 singleton pregnancies with subchorionic hematomas showed that subchorionic hematoma is not independently associated with pregnancy loss before 20 weeks of gestation,⁴ the data are conflicting regarding the association between subchorionic hematoma and adverse outcomes later in pregnancy.



A large systematic review found that subchorionic hematomas were associated with an increased risk of stillbirth, placental abruption, and preterm birth,⁵ and other studies have found associations with low birth weight,^{6,7} gestational hypertension,⁷ preeclampsia,⁷ and higher rates of cesarean delivery.⁷ Yet other studies have found no increased rate of preterm birth,⁶ stillbirth,⁶ preeclampsia,^{5,8} or small-for-gestational-age neonates.^{5,8} Subchorionic hematoma duration may also affect rates of adverse pregnancy outcomes,³ although the majority of studies did not analyze subchorionic hematoma duration and mention this as a limitation.^{7,8} Additionally, many of these studies have significant methodologic limitations that reduce their generalizability.

In light of the limitations of prior investigations, the objective of this study was to investigate the association between first-trimester subchorionic hematoma and adverse pregnancy outcomes at more than 20 weeks of gestation in unselected women with singleton pregnancies.

METHODS

This was a retrospective cohort study of all women with singleton pregnancies who presented for prenatal care before 14 weeks of gestation at a single maternal-fetal medicine practice over a 3-year period between January 2015 and December 2017. All women in our practice undergo an ultrasound examination at our affiliated imaging center at or before their initial visit. The images are all archived, and formal reports are generated. We reviewed the initial ultrasound examination performed between 6 0/7 and 13 6/7 weeks of gestation for each patient. Gestational age was determined by last menstrual period or first-trimester ultrasound examination, or both, per standard guidelines.⁹ The date of embryo transfer was used to determine gestational age of pregnancies resulting from in vitro fertilization (IVF).

We excluded pregnancies with multiple gestations, a vanishing twin, or a fetal heart rate less than 100 beats per minute. We previously have published an article regarding the association between first-trimester subchorionic hematoma and pregnancy loss at less than 20 weeks of gestation.⁴ The present study was designed to look at pregnancy outcomes after 20 weeks of gestation; therefore, we excluded women who had a pregnancy loss at less than 20 weeks of gestation.

We reviewed each ultrasound report for the presence or absence of a subchorionic hematoma, their number and size, and the presence or absence of vaginal bleeding, which are all routinely noted on the

ultrasound report. Subchorionic hematoma was defined as a crescent-shaped, echo-free area between the chorionic membrane and the myometrium.² We reviewed each woman's computerized medical record to obtain demographic and baseline clinical information.

We compared baseline characteristics between the women with and without subchorionic hematomas using χ^2 and Student's *t*-tests for parametric data and Fisher's exact test for nonparametric data, as appropriate (IBM SPSS for Windows 22.0). Outcomes measured included gestational age at delivery (mean weeks), preterm birth at less than 34 weeks of gestation, preterm birth at less than 37 weeks of gestation, birth weight (mean grams), birth weight less than the 10th percentile for gestational age, gestational hypertension, preeclampsia, placental abruption, intrauterine fetal death at more than 20 weeks of gestation, cesarean delivery, blood transfusion, and an antepartum admission. Outcomes were defined clinically at the time of diagnosis according to contemporary guidelines. We compared these outcomes between women with and without subchorionic hematomas. We correlated subchorionic hematoma size and pregnancy outcomes using Pearson's correlation test. We performed a multivariable logistic regression to control for significant differences in baseline characteristics between the two groups ($P < .05$).

For the subgroup of women with subchorionic hematomas, we also looked at their second-trimester ultrasound examinations to determine how long the hematomas persisted. We recorded whether or not the subchorionic hematoma was present during the following intervals: 14 0/7–17 6/7 weeks of gestation and 18 0/7–21 6/7 weeks of gestation. We also recorded the hematoma size by largest diameter and volume (length \times width \times height). We looked at the percentage of hematomas that persisted into the second trimester, as well as their mean size by volume and largest diameter. Lastly, we looked to see whether subchorionic hematomas that persisted into the second trimester were associated with gestational age at delivery, birth weight, placental abruption, preeclampsia, or intrauterine fetal death.

This project was approved by the Biomedical Research Alliance of New York's Institutional Review Board. There was no funding for this study.

RESULTS

A total of 2,586 women presented for prenatal care before 14 weeks of gestation with singleton gestations over the course of the study period, of whom 2,172 were ultimately included in this analysis (Fig. 1). Of



these women, 389 (17.9%) had a subchorionic hematoma and 1,783 (82.1%) did not.

Women with subchorionic hematomas had their first ultrasound examination at earlier gestational ages (8 5/7 vs 9 6/7 weeks, $P<.001$) and were more likely to have vaginal bleeding at the time of the ultrasound examination (31.9% vs 7.9%, $P<.001$). Otherwise, there were no differences in any other measured baseline characteristics, including maternal age, race, body mass index, use of IVF, uterine anomalies, leiomyomas, cervical excisional procedures, prior preterm birth, and medical comorbidities (Table 1). On univariable analysis, subchorionic hematoma was not associated with any of the measured pregnancy outcomes (Table 2).

On regression analysis including subchorionic hematoma, vaginal bleeding, and gestational age at ultrasound examination, vaginal bleeding was independently associated with preterm birth at less than 37 weeks of gestation (adjusted odds ratio 1.8, 95% CI 1.2–2.6) and birth weight less than the 10th percentile (adjusted odds ratio 1.8, 95% CI 1.2–2.6). Subchor-

ionic hematoma was not independently associated with pregnancy outcomes. Post hoc power analysis demonstrated that we had 80% power at an alpha error of 5% to detect an increased risk of preterm birth at less than 37 weeks of gestation from 10% in women without subchorionic hematomas to 15% in women with hematomas.

The (infrequent) persistence of subchorionic hematoma into the second trimester (Table 3) was not associated with gestational age at delivery, birth weight, preeclampsia, placental abruption, or intrauterine fetal death at more than 20 weeks of gestation (Appendices 1 and 2, available online at <http://links.lww.com/AOG/B541>). However, the sample size for second-trimester hematomas was small, so we were underpowered for these analyses. Among the 389 women with subchorionic hematomas, the subchorionic hematoma size, defined as largest subchorionic hematoma diameter as well as by subchorionic hematoma volume, did not correlate with any measured pregnancy outcomes (Appendix 3, available online at <http://links.lww.com/AOG/B541>).

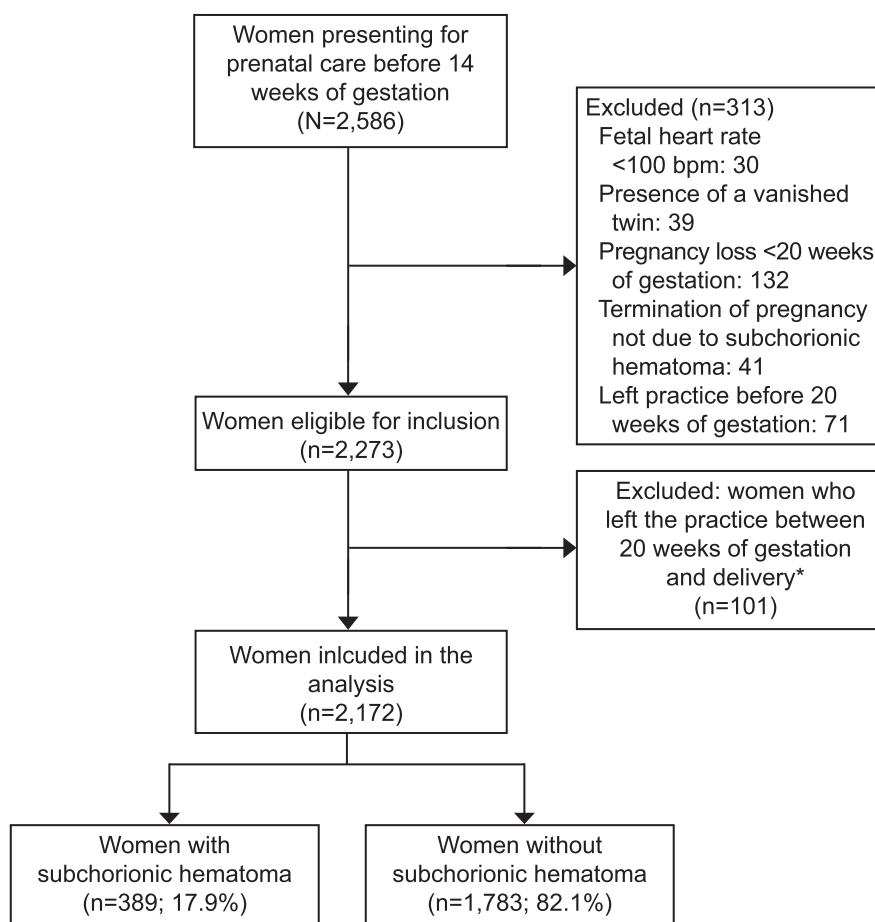


Fig. 1. Flow diagram from eligibility assessment to inclusion in analyses. *3.5% of women with subchorionic hematoma, and 4.7% of women without subchorionic hematoma, $P=.298$.

Naert. Subchorionic Hematomas and Pregnancy Outcomes After 20 Weeks. *Obstet Gynecol* 2019.



Table 1. Baseline Maternal Characteristics Based on the Presence or Absence of a Subchorionic Hematoma

Maternal Characteristic	Subchorionic Hematoma (n=389)	No Subchorionic Hematoma (n=1,783)	P*
Maternal age (y)	32.6±5.9	33.0±5.8	.243
Advanced maternal age (35 y or older)	130 (33.4)	666 (37.4)	.145
Gestational age at ultrasound examination (wk)	8.5±1.6	9.6±2.2	<.001
IVF	49 (12.6)	258 (14.5)	.337
Bleeding	124 (31.9)	141 (7.9)	<.001
Race			.189
White	339 (87.1)	1,507 (84.5)	
Non-white	50 (12.9)	276 (15.5)	
Uterine anomaly	19 (4.9)	66 (3.7)	.276
Prior cervical excision procedure	15 (3.9)	64 (3.6)	.799
Prior preterm birth	57 (14.7)	267 (15.0)	.872
Leiomyomas	30 (7.7)	115 (6.4)	.366
Prepregnancy diabetes	5 (1.3)	19 (1.1)	.707
Chronic hypertension	10 (2.6)	50 (2.8)	.799
Maternal cardiac disease	4 (1.0)	12 (0.7)	.458
Thrombophilia	26 (6.7)	84 (4.7)	.108
Systemic lupus erythematosus	1 (0.3)	13 (0.7)	.292
BMI (kg/m ²)	24.4±4.9	24.1±4.8	.151
BMI category			.321
Less than 18.5	14 (3.6)	89 (5.0)	
18.5–24.9	231 (59.4)	1,125 (63.1)	
25–29.9	93 (23.9)	371 (20.8)	
30 or higher	49 (12.6)	192 (10.8)	
Unknown	2 (0.5)	6 (0.3)	

IVF, in vitro fertilization; BMI, body mass index.

Data are mean±SD or n (%) unless otherwise specified.

* Chi-square or Student's *t*-test.

DISCUSSION

Our data suggest that the presence of a first-trimester subchorionic hematoma in singleton pregnancies is not associated with adverse pregnancy outcomes after

20 weeks of gestation. Subchorionic hematoma size was also not associated with pregnancy outcomes. In addition, we found that most subchorionic hematomas present during the first trimester resolved by the

Table 2. Pregnancy Outcomes Based on the Presence or Absence of a Subchorionic Hematoma

Pregnancy Outcome	Subchorionic Hematoma (n=389)	No Subchorionic Hematoma (n=1,783)	P*
Gestational age at delivery (wk)	38.8±2.2	38.9±2.1	.280
Preterm birth at less than 34 wk	10 (2.6)	43 (2.4)	.854
Preterm birth at less than 37 wk	44 (11.3)	181 (10.2)	.496
Birth weight (g)	3,243±552	3,235±546	.794
Birth weight less than the 10th percentile for gestational age	39 (10.0)	210 (11.8)	.565
Gestational hypertension (without preeclampsia)	13 (3.3)	58 (3.3)	.932
Preeclampsia	12 (3.1)	71 (4.0)	.405
Placental abruption	7 (1.8)	21 (1.2)	.325
Intrauterine fetal death at more than 20 wk	2 (0.5)	13 (0.7)	.999 [†]
Cesarean delivery	123 (31.6)	611 (34.3)	.317
Blood transfusion	2 (0.5)	14 (0.8)	.752 [†]
Antepartum admission	18 (4.6)	76 (4.3)	.749

Data are mean±SD or n (%) unless otherwise specified.

* Chi-square or Student's *t*-test.

[†] Fisher's exact test.



Table 3. Persistence and Progression of Subchorionic Hematomas Across Gestational Age

Gestational Age (wk)	Subchorionic Hematoma Present	Subchorionic Hematoma Largest Diameter (cm)	Subchorionic Hematoma Volume* (cm ³)
6 0/7–13 6/7	389/2,172 (17.9)	2.1±1.4	5.3±15.0
14 0/7–17 6/7	36/2,172 (1.7)	4.2±2.1	28.0±36.6
18 0/7–21 6/7	17/2,172 (0.8)	4.3±1.7	20.0±18.2

Data are n/N (%) or mean±SD.

* Length×width×height.

second trimester. Therefore, women diagnosed with a first-trimester subchorionic hematoma should be reassured that their rate of adverse pregnancy outcomes at more than 20 weeks of gestation is not affected by the presence of the subchorionic hematoma. Additionally, we have previously shown that first-trimester subchorionic hematoma is not associated with pregnancy loss at less than 20 weeks of gestation.⁴ This is important information for counseling patients, because subchorionic hematoma diagnoses can cause significant concern among expectant parents. Our only significant finding was that first-trimester bleeding was independently associated with preterm birth at less than 37 weeks of gestation and birth weight less than the 10th percentile.

Although several previous studies have found increased rates of various late pregnancy outcomes, including stillbirth, preterm delivery, and placental abruption, among others, in women with subchorionic hematomas,⁵ other studies report different associated adverse outcomes.^{6,7} However, many of these studies are limited by incomplete follow-up, varying inclusion criteria, and difficulty controlling for baseline variables that may influence the rate of adverse outcomes. Many studies are also subject to selection bias because the patients diagnosed with subchorionic hematoma do not represent a general obstetrics population because study participants may have undergone an early ultrasound examination only as a result of the use of IVF, recurrent pregnancy losses, or vaginal bleeding, for example. As such, it is difficult to draw conclusions from these conflicting results.

Studies looking at the association of subchorionic hematoma duration with pregnancy outcomes are even more limited. Many studies found that hematomas disappeared by the end of the first trimester¹⁰ or by the end of the 25th week of gestation,^{11–13} but these studies lacked definitive conclusions on the association between duration and pregnancy outcome.³ In our study, 90.7% of subchorionic hematomas resolved by the second trimester. We did specifically look at

the association between duration and pregnancy outcomes, and we found that subchorionic hematoma persistence into the second trimester was not associated with an increased risk of adverse pregnancy outcomes. However, we were underpowered for this analysis, so it remains possible that persistence of subchorionic hematoma is associated with pregnancy outcomes.

The strengths of our study include the large sample size, detailed clinical information, minimal selection bias, and low percentage of women lost to follow-up. In our practice, all women undergo early ultrasound examination, so selection bias is minimized. All ultrasound images are archived, and formal reports are generated. We have routine documentation of the presence of vaginal bleeding at the time of the ultrasound examination per protocol. In addition, all of our patients' records are in an electronic medical record system. This allows for a complete and thorough review of the patients' ultrasound reports, maternal risk factors, and pregnancy outcomes. Our study included a large number of low-risk and high-risk women with a wide range of comorbidities. This is an improvement from several prior studies that looked only at specific subsets of the obstetric population, such as patients undergoing fertility treatment.^{6,14}

Our study is limited by its retrospective design. In addition, our study may be limited by using data from one obstetric practice as opposed to a more heterogeneous population. Nonetheless, we believe that including patients from a single practice increases the reliability of the data, because all of the patients' medical records were available to be analyzed. Another limitation of this study is that ultrasonographers and physicians were not blinded as to whether a patient had vaginal bleeding or not; thus, it is possible that an increased index of suspicion may have affected the detection of subchorionic hematomas in those women, as well as the gestational age at diagnosis. In addition, our analysis of second-trimester subchorionic hematoma did not include women who developed a subchorionic hematoma for the first time



in the second trimester, and these patients may have different outcomes. Finally, our analysis included several outcomes, but we did not have as much power to detect a difference between the groups for the less common outcomes.

In conclusion, in women with singleton pregnancies, the presence of subchorionic hematoma in the first trimester was not associated with adverse pregnancy outcomes at more than 20 weeks of gestation.

REFERENCES

1. Seki H, Kuromaki K, Takeda S, Kinoshita K. Persistent subchorionic hematoma with clinical symptoms until delivery. *Int J Gynaecol Obstet* 1998;63:123–8.
2. Johns J, Hyett J, Jauniaux E. Obstetric outcome after threatened miscarriage with and without a hematoma on ultrasound. *Obstet Gynecol* 2003;102:483–7.
3. Xiang L, Wei Z, Cao Y. Symptoms of an intrauterine hematoma associated with pregnancy complications: a systematic review. *PLoS One* 2014;9:e111676.
4. Naert MN, Khadraoui H, Rodriguez AM, Naqvi M, Fox NS. Association between first trimester subchorionic hematomas and pregnancy loss in singleton pregnancies. *Obstet Gynecol* 2019;134:276–81.
5. Tuuli MG, Norman SM, Odibo AO, Macones GA, Cahill AG. Perinatal outcomes in women with subchorionic hematoma: a systematic review and meta-analysis. *Obstet Gynecol* 2011;117:1205–12.
6. Zhou J, Wu M, Wang B, Hou X, Wang J, Chen H, et al. The effect of first trimester subchorionic hematoma on pregnancy outcomes in patients underwent IVF/ICSI treatment. *J Matern Fetal Neonatal Med* 2017;30:406–10.
7. Nagy S, Bush M, Stone J, Lapinski RH, Gardo S. Clinical significance of subchorionic and retroplacental hematomas detected in the first trimester of pregnancy. *Obstet Gynecol* 2003;102:94–100.
8. Palatnik A, Grobman WA. The relationship between first-trimester subchorionic hematoma, cervical length, and preterm birth. *Am J Obstet Gynecol* 2015;213:403.e1–4.
9. Methods for estimating the due date. Committee Opinion No. 700. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2017;129:e150–4.
10. Tower CL, Regan L. Intrauterine haematomas in a recurrent miscarriage population. *Hum Reprod* 2001;16:2005–7.
11. Jouppila P. Clinical and ultrasonic aspects in the diagnosis and follow-up of patients with early pregnancy failure. *Acta Obstet Gynecol Scand* 1980;59:405–9.
12. Pedersen JF, Mantoni M. Prevalence and significance of subchorionic hemorrhage in threatened abortion: a sonographic study. *AJR Am J Roentgenol* 1990;154:535–7.
13. Mantoni M, Pedersen JF. Intrauterine haematoma. An ultrasonic study of threatened abortion. *Br J Obstet Gynaecol* 1981;88:47–51.
14. Asato K, Mekaru K, Heshiki C, Sugiyama H, Kinjo T, Masamoto H, et al. Subchorionic hematoma occurs more frequently in in vitro fertilization pregnancy. *Eur J Obstet Gynecol Reprod Biol* 2014;181:41–4.

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