

**Second and Third Trimester Bleeding
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Problem (Purpose of Study)	Study Results	Strength of Evidence
1. Sakornbut E, Leeman L, Fontaine P. Late pregnancy bleeding. <i>Am Fam Physician</i> 2007; 75(8):1199-1206.	12	N/A	Review on management of vaginal bleeding in late pregnancy.	No results stated.	4
2. Bhide A, Thilaganathan B. Recent advances in the management of placenta previa. <i>Curr Opin Obstet Gynecol</i> 2004; 16(6):447-451.	12	N/A	Review on recent advances supporting the screening, diagnosis and management of placenta previa.	Proposed a simple and pragmatic US classification of placenta previa and low-lying placenta.	3
3. Oppenheimer LW, Farine D, Ritchie JW, Lewinsky RM, Telford J, Fairbanks LA. What is a low-lying placenta? <i>Am J Obstet Gynecol</i> 1991; 165(4 Pt 1):1036-1038.	13	127	Analysis of the use of transvaginal US (TVS) in placental previa.	TVS measurement may indicate the optimal delivery route and make the traditional classification of placenta previa obsolete.	3
4. Hertzberg BS, Bowie JD, Carroll BA, Kliewer MA, Weber TM. Diagnosis of placenta previa during the third trimester: role of transperineal sonography. <i>AJR Am J Roentgenol</i> 1992; 159(1):83-87.	10	164	Role of transperineal sonography in the diagnosis of placenta previa during the third trimester.	<ul style="list-style-type: none"> • Transperineal sonography successfully visualized the internal surface of the cervix in all patients, allowing determination of the presence or absence of placenta previa. • Transperineal sonography complements transabdominal US (TAS) for detection of placenta previa. 	2
5. Olive EC, Roberts CL, Nassar N, Algert CS. Test characteristics of placental location screening by transabdominal ultrasound at 18-20 weeks. <i>Ultrasound Obstet Gynecol</i> 2006; 28(7):944-949.	10	54 168 randomly selected controls	Case control study of 54 women with placenta previa at time of delivery and 168 randomly selected controls to determine the test characteristics of a second-trimester transabdominal fetal anomaly scan in screening for placenta previa.	<ul style="list-style-type: none"> • Different second-trimester placenta-os measurements for case control and randomly selected controls. • False positives among the much larger population of women without placenta previa. • Second-trimester transabdominal fetal anomaly scan is a useful screening test for placenta previa. 	1
6. Becker RH, Vonk R, Mende BC, Ragosch V, Entezami M. The relevance of placental location at 20-23 gestational weeks for prediction of placenta previa at delivery: evaluation of 8650 cases. <i>Ultrasound Obstet Gynecol</i> 2001; 17(6):496-501.	9	8,650	Prospective study using TAS and TVS to determine the correlation between placental position at 20-23 weeks and incidence of birth complications caused by placental position.	At 20-23 weeks, combining TAS and TVS location of placental position is effective in predicting placenta previa at delivery.	1
7. Smith RS, Lauria MR, Comstock CH, et al. Transvaginal ultrasonography for all placentas that appear to be low-lying or over the internal cervical os. <i>Ultrasound Obstet Gynecol</i> 1997; 9(1):22-24.	10	131	Prospective study to determine in what percentage of cases the assessment of placental localization using TAS was changed following TVS.	<ul style="list-style-type: none"> • Optimal visualization of the placental edge and internal cervical os is usually difficult with TAS when the placenta appears low-lying or over the internal cervical os. • Assessment of placental localization was changed in over one-quarter of cases (26%) after TVS was performed. 	2

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8. Hertzberg BS, Kliever MA, Baumeister LA, McNally PB, Fazekas CK. Optimizing transperineal sonographic imaging of the cervix: the hip elevation technique. <i>J Ultrasound Med</i> 1994; 13(12):933-936; quiz 1009-1010.	10	23	To determine if hip elevation technique could improve transperineal sonographic imaging of the cervix.	Hip technique improved cervical visualization in 19/23 cases.	3
9. Timor-Tritsch IE, Monteagudo A. Diagnosis of placenta previa by transvaginal sonography. <i>Ann Med</i> 1993; 25(3):279-283.	12	N/A	Review on diagnosis of placenta previa by TVS.	TVS should be the principal diagnostic modality used in the work-up of an obstetric patient with vaginal bleeding.	4
10. Chie I, Levine D. Sonography of the Lower Uterine Segment. <i>Ultrasound Clinics</i> 2006; 1(2):303-319.	13	N/A	Describes lower uterine segment (LUS) physiology in normal pregnancy and illustrates the appearance of the LUS in abnormal pregnancies and discusses the implications of these findings.	Careful imaging is needed to avoid the pitfalls in diagnosis associated with overfilling of the bladder and LUS contractions. Further research is needed to clarify how imaging of the LUS can be best used to screen for uterine dehiscence and rupture.	3
11. Predanic M, Pemi SC, Baergen RN, Jean-Pierre C, Chasen ST, Chervenak FA. A sonographic assessment of different patterns of placenta previa "migration" in the third trimester of pregnancy. <i>J Ultrasound Med</i> 2005; 24(6):773-780.	13	163	Retrospective study to compare the rates and patterns of placental "migration" with the mode of fetal and placental delivery and the incidence of peripartum complications.	A final placental distance of less than 2.0 cm from the internal cervical os and a deceleration pattern of placental migration were significantly associated with an interventional CD and a higher rate of peripartum complications.	2
12. Dashe JS, McIntire DD, Ramus RM, Santos-Ramos R, Twickler DM. Persistence of placenta previa according to gestational age at ultrasound detection. <i>Obstet Gynecol</i> 2002; 99(5 Pt 1):692-697.	10	714	Retrospective cohort study to evaluate gestational age at US detection of placenta previa as a predictor of previa persistence and to estimate the effects of previa type, parity, and prior cesarean delivery on previa persistence.	<ul style="list-style-type: none"> • Previa was detected during 940 US examinations in 714 pregnancies. • Concluded that gestational age at US detection of placenta previa may be used to predict likelihood of previa persistence. 	2
13. Taipale P, Hiilesmaa V, Ylostalo P. Transvaginal ultrasonography at 18-23 weeks in predicting placenta previa at delivery. <i>Ultrasound Obstet Gynecol</i> 1998; 12(6):422-425.	10	3696	To determine if TVS at 18-23 weeks' gestation is useful in predicting placenta previa at delivery. Performed TVS and routine TAS in non-selected pregnant women with singleton fetuses and measured the distance from the placental edge to the internal cervical os.	<ul style="list-style-type: none"> • 57 patients (1.5%): Placental edge extended to or over the internal cervical os. • 27 patients (0.7%): Placenta extended ≥ 15 mm over the internal cervical os (0.31%). • Study recommends confirmatory TVS if placenta previa is suspected at TAS in mid-pregnancy, and reexamination at 26-30 weeks if the placental edge covers the internal cervical os by 15 mm or more. 	1
14. Getahun D, Oyelese Y, Salihu HM, Ananth CV. Previous cesarean delivery and risks of placenta previa and placental abruption. <i>Obstet Gynecol</i> 2006; 107(4):771-778.	13	First 2 (n=156,475) First 3 (n=31,102)	Retrospective cohort study to examine the association between cesarean delivery and previa and abruption in subsequent pregnancies.	Pregnancy after cesarean delivery was associated with increased risk of previa (0.63%) compared with a vaginal delivery (0.38%, RR 1.5, 95% confidence interval [CI] 1.3-1.8).	1

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15. Ananth CV, Oyelese Y, Yeo L, Pradhan A, Vintzileos AM. Placental abruption in the United States, 1979 through 2001: temporal trends and potential determinants. <i>Am J Obstet Gynecol</i> 2005; 192(1):191-198.	13	<u>Black women</u> 1979-81 n=13,584 1999-01 n=18,960 <u>White women</u> 1979-81 n=66,186 1990-01 n=59,284	The National Hospital Discharge Summary data was used to evaluate temporal trends in abruption risk and to assess how much underlying changes in the clinical determinants influenced these trends.	<ul style="list-style-type: none"> Black women rate of abruption increased 92% (95% CI, 88, 96) among black women between 1979-1981 (0.76%; n=13,584 women) and 1999-2001 (1.43%; n=18,960 women). White women rate increased by 15% (95% CI, 14, 16) from 0.82% (n=66,186 women) in 1979-1981 to 0.94% (n=59,284 women) in 1999-2001. 	1
16. Oyelese Y, Ananth CV. Placental abruption. <i>Obstet Gynecol</i> 2006; 108(4):1005-1016.	12	N/A	Review risk factors, diagnosis and management of placental abruption.	Prediction or prevention of most placental abruption cases is impossible. But, in some cases, maternal and infant outcomes can be optimized through attention to the risks and benefits of conservative management, ongoing evaluation of fetal and maternal well-being, and through expeditious delivery.	4
17. Glantz C, Purnell L. Clinical utility of sonography in the diagnosis and treatment of placental abruption. <i>J Ultrasound Med</i> 2002; 21(8):837-840.	10	149	Review reports to determine the sensitivity, specificity, positive and predictive values of sonography for detection of placental abruption and to determine whether sonographic results correlate with management or outcome.	<ul style="list-style-type: none"> Sensitivity: 24% Specificity: 96% PPV: 88% NPV: 53% Sonography is not sensitive for detection of placental abruption, but a positive finding is associated with more aggressive management and worse neonatal outcome.	2
18. Kay HH, Spritzer CE. Preliminary experience with magnetic resonance imaging in patients with third-trimester bleeding. <i>Obstet Gynecol</i> 1991; 78(3 Pt 1):424-429.	10	15	Study on patients with third-trimester bleeding who underwent MRI.	<ul style="list-style-type: none"> MRI correctly identified 3 cases of placenta previa. In 4 patients, intrauterine blood was identified in hematomas. One patient had a normal MRI but had a fresh clot at delivery. 7 patients had negative MRI scans with normal placentas at delivery. MRI is helpful in evaluating patients with unexplained third-trimester bleeding. 	3
19. Oyelese KO, Turner M, Lees C, Campbell S. Vasa previa: an avoidable obstetric tragedy. <i>Obstet Gynecol Surv</i> 1999; 54(2):138-145.	12	N/A	Review of risk factors and associated conditions; clinical presentations and management; diagnostic tools available for vasa previa.	TVS combined with color Doppler is the most effective tool in the antenatal diagnosis of vasa previa and is recommended in patients at risk, specifically those with bilobed, succenturiate-lobed, and low-lying placentas, pregnancies resulting from in vitro fertilization, and multiple pregnancy.	4

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20. Francois K, Mayer S, Harris C, Perlow JH. Association of vasa previa at delivery with a history of second-trimester placenta previa. <i>J Reprod Med</i> 2003; 48(10):771-774.	3c	13 cases of vasa previa	Retrospective case-control study to determine whether vasa previa at delivery is associated with a history of second-trimester placenta previa.	9 cases (9/13, 69.2%) of vasa previa at delivery had a second-trimester placenta previa as documented by mid-trimester US, whereas 2 controls (2/52, 3.8%) had a second-trimester placenta previa (P<.000001, OR=56.3, 95% CI=8.9-354.1). Highly significant association between vasa previa at delivery and a history of second-trimester placenta previa.	3
21. Oyelese Y, Catanzarite V, Prefumo F, et al. Vasa previa: the impact of prenatal diagnosis on outcomes. <i>Obstet Gynecol</i> 2004; 103(5 Pt 1):937-942.	13	155 pregnancies	Multicenter study to evaluate outcomes and predictors of neonatal survival in pregnancies complicated by vasa previa and to compare outcomes in prenatally diagnosed cases of vasa previa with those not diagnosed prenatally.	<ul style="list-style-type: none"> • Overall perinatal mortality was 36% (55/155). In 61 cases (39%), vasa previa was diagnosed prenatally; 59/61 (97%) infants from these pregnancies survived compared with 41/94 (44%) in cases not diagnosed prenatally (P<.001). • The only significant predictors of neonatal survival were prenatal diagnosis (P<.001) and gestational age at delivery (P=.01). • Good outcomes with vasa previa depend on prenatal diagnosis and cesarean delivery at 35 weeks of gestation or earlier should rupture of membranes, labor, or significant bleeding occur. 	2
22. Oyelese Y, Smulian JC. Placenta previa, placenta accreta, and vasa previa. <i>Obstet Gynecol</i> 2006; 107(4):927-941.	12	N/A	Review risk factors and management of placenta previa, placenta accrete and vasa previa.	<ul style="list-style-type: none"> • Placenta previa; diagnostic modality of choice is TVS. Women with a complete placenta previa should be delivered by cesarean. • Placenta accrete; prenatal diagnosis by imaging, followed by planning of peripartum management by a multidisciplinary team. Hysterectomy required for women with placenta accreta. • Vasa previa; diagnosed prenatally by US examination. 	4
23. Miller DA, Chollet JA, Goodwin TM. Clinical risk factors for placenta previa-placenta accreta. <i>Am J Obstet Gynecol</i> 1997; 177(1):210-214.	4	155,670 deliveries 62 with placenta accreta	Review hospital records to define the clinical risk factors associated with placenta previa-placenta accrete.	Placenta accreta occurs in about 1 of 2,500 deliveries. Incidence is about 10% in women with placenta previa. Independent risk factors in this high-risk group are advanced maternal age and previous cesarean section.	2

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24. Comstock CH, Love JJ, Jr., Bronsteen RA, et al. Sonographic detection of placenta accreta in the second and third trimesters of pregnancy. <i>Am J Obstet Gynecol</i> 2004; 190(4):1135-1140.	10	14	Prospective study to determine the effectiveness of US in detecting placenta accrete in at-risk patients	<ul style="list-style-type: none"> • Diagnosis of placental accreta was suspected strongly in 86% of the patients (12/14 patients). There were 18 false-positive cases (54.5%; 18/33 patients). • Diagnostic sign with highest predictive value for placenta was the presence of multiple linear irregular vascular spaces within the placenta (placental lacunae). • Placenta accreta can be detected 15-20 weeks of gestation in most at-risk patients by visualization of irregular vascular spaces within the placenta (placental lacunae). 	3
25. Comstock CH. Antenatal diagnosis of placenta accreta: a review. <i>Ultrasound Obstet Gynecol</i> 2005; 26(1):89-96.	12	N/A	Review antenatal diagnosis of placenta accreta.	Color Doppler will show that some of the placental sinuses traverse the uterine wall. MRI has not yet been shown to aid in the diagnosis, but in the future, with improvement of resolution and shortened sequences, it should be useful in identifying the patients that have placenta percreta.	4
26. Chou MM, Ho ES, Lee YH. Prenatal diagnosis of placenta previa accreta by transabdominal color Doppler ultrasound. <i>Ultrasound Obstet Gynecol</i> 2000; 15(1):28-35.	10	80	Prospective evaluation of the efficacy of transabdominal color Doppler US in diagnosing placenta previa accreta.	Color Doppler imaging in the diagnosis of placenta previa: Sensitivity 82.4%, specificity 96.8%. The PPV and NPV were 87.5% (14/16) and 95.3% (61/64), respectively. Variable vascular morphological patterns of placenta previa accreta were exhibited and categorized by transabdominal color Doppler sonography in the antenatal period.	2
27. Finberg HJ, Williams JW. Placenta accreta: prospective sonographic diagnosis in patients with placenta previa and prior cesarean section. <i>J Ultrasound Med</i> 1992; 11(7):333-343.	10	34	Prospective sonographic diagnosis for possible placenta accreta in patients with placenta previa and a history of one or more cesarean sections.	Of 18 patients with positive sonographic results, 14 had proof of placenta accreta and 16 of the patients underwent hysterectomy. Of 16 patients with negative sonographic results, only one had placenta accreta, and two patients required hysterectomy.	3
28. Levine D, Hulka CA, Ludmir J, Li W, Edelman RR. Placenta accreta: evaluation with color Doppler US, power Doppler US, and MR imaging. <i>Radiology</i> 1997; 205(3):773-776.	9	19 patients underwent color Doppler and power Doppler US 18 patients underwent MRI	Prospective interpretation of images to determine the value of TAS, TVS, color Doppler US, power Doppler US, and MRI in the diagnosis of placenta accreta.	MRI enabled the diagnosis of placenta accreta, which was not well depicted at US. In patients with a history of uterine scars, vaginal US with power Doppler US performed well in the evaluation of lower-uterine-segment placenta accreta.	2

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29. Dwyer BK, Belogolovkin V, Tran L, et al. Prenatal diagnosis of placenta accreta: sonography or magnetic resonance imaging? <i>J Ultrasound Med</i> 2008; 27(9):1275-1281.	3a	32	To compare the accuracy of TAS and MRI for prenatal diagnosis of placenta accreta.	US correctly identified the presence of placenta accreta in 14/15 patients (93% sensitivity; 95% CI, 80%-100%) and the absence of placenta accreta in 12/17 patients (71% specificity; 95% CI, 49%-93%). MRI correctly identified the presence of placenta accreta in 12/15 patients (80% sensitivity; 95% CI, 60%-100%) and the absence of placenta accreta in 11/17 patients (65% specificity; 95% CI, 42%-88%).	3
30. Lax A, Prince MR, Mennitt KW, Schwebach JR, Budorick NE. The value of specific MRI features in the evaluation of suspected placental invasion. <i>Magn Reson Imaging</i> 2007; 25(1):87-93.	10	20	Retrospective review of MRI to determine imaging features that may help predict the presence of placenta accreta, placenta increta or placenta percreta on prenatal MRI scanning.	MRI can be a useful adjunct to US in diagnosing placenta accreta prenatally. Three features that are seen on MRI in patients with placental invasion appear to be useful for diagnosis: uterine bulging; heterogeneous signal intensity within the placenta; and the presence of dark intraplacental bands on T2-W imaging.	2
31. Palacios Jaraquemada JM, Bruno CH. Magnetic resonance imaging in 300 cases of placenta accreta: surgical correlation of new findings. <i>Acta Obstet Gynecol Scand</i> 2005; 84(8):716-724.	9	300	To establish the usefulness of placental MRI in patients with a diagnosis of placenta accreta through the correlation of diagnostic images and surgical findings.	<ul style="list-style-type: none"> • In 286 cases, MRI provided topographic information of placental invasion, and in 90 patients, it modified invasion levels. • Undiagnosed parametrium extent was determined in 11 cases, and 11 other cases were reclassified as placenta previa. • MRI helps define the topography and area of placental invasion. 	2
32. Shellock FG, Crues JV. MR procedures: biologic effects, safety, and patient care. <i>Radiology</i> 2004; 232(3):635-652.	12	N/A	Review MR biologic effects, safety, and patient care.	To prevent accidents in the MR environment, it is necessary to revise information on biologic effects and safety according to changes that have occurred in MR technology and with regard to current guidelines for biomedical implants and devices.	4
33. De Wilde JP, Rivers AW, Price DL. A review of the current use of magnetic resonance imaging in pregnancy and safety implications for the fetus. <i>Prog Biophys Mol Biol</i> 2005; 87(2-3):335-353.	12	N/A	Review use of MRI in pregnancy and risks to the fetus. The hazards discussed are biological effects, miscarriage, heating effects and acoustic noise exposure.	Need for further research into effects of MRI. Need for further research into the effects of MRI in pregnancy.	4
34. Kanal E, Barkovich AJ, Bell C, et al. ACR guidance document for safe MR practices: 2007. <i>AJR</i> 2007; 188(6):1447-1474.	15	N/A	ACR guidance document for safe MR practices. Purpose of document is to guide MR facilities in the development of safe MR programs.	N/A	N/A
35. OMNISCAN® package insert: Nycomed Imaging A.S. Princeton, NJ.	N/A	N/A	Package insert.	N/A	4

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36. American College of Radiology. <i>Manual on Contrast Media</i> . Available at: http://www.acr.org/SecondaryMainMenuCategories/quality_safety/contrast_manua.aspx .	15	N/A	Guidance document on contrast media to assist radiologists in recognizing and managing risks associated with the use of contrast media.	N/A	3

Evidence Table Key

Study Type Key

Numbers 1-7 are for studies of therapies while numbers 8-15 are used to describe studies of diagnostics.

1. Randomized Controlled Trial — Treatment
2. Controlled Trial
3. Observation Study
 - a. Cohort
 - b. Cross-sectional
 - c. Case-control
4. Clinical Series
5. Case reviews
6. Anecdotes
7. Reviews

8. Randomized Controlled Trial — Diagnostic
9. Comparative Assessment
10. Clinical Assessment
11. Quantitative Review
12. Qualitative Review
13. Descriptive Study
14. Case Report
15. Other (Described in text)

Strength of Evidence Key

- Category 1 - The conclusions of the study are valid and strongly supported by study design, analysis and results.
- Category 2 - The conclusions of the study are likely valid, but study design does not permit certainty.
- Category 3 - The conclusions of the study may be valid but the evidence supporting the conclusions is inconclusive or equivocal.
- Category 4 - The conclusions of the study may not be valid because the evidence may not be reliable given the study design or analysis.