Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Norwitz ER, Park JS. Overview of the etiology and evaluation of vaginal bleeding in pregnant women. Available at: http://www.uptodate.com/home. Accessed 22 October 2012.	Review/Other-Dx	N/A	To review the etiology and evaluation of vaginal bleeding in pregnant women.	N/A	4
2. Cunningham FG, Williams JW. *Williams obstetrics*. 23rd ed. New York: McGraw-Hill Medical; 2010.	Review/Other-Dx	N/A	Book.	N/A	4
3. Towers CV, Burkhart AE. Pregnancy outcome after a primary antenatal hemorrhage between 16 and 24 weeks' gestation. *Am J Obstet Gynecol* 2008; 198(6):684 e681-685; discussion 684 e685.	Observational-Dx	128 patients	To examine the pregnancy outcome after a primary antenatal hemorrhage that occurs between 16 and 24 weeks' gestation.	Overall pregnancy outcome after a primary light episode of antenatal hemorrhage between 16 and 24 weeks' gestation is fairly good. The prognosis is worse for heavy bleeding previa and nonprevia bleeding cases, but based on 95% CIs, a normal outcome would be expected in >50% of the placenta previa pregnancies vs a <50% expectation in nonprevia bleeding pregnancies.	3
4. Yang J, Hartmann KE, Savitz DA, et al. Vaginal bleeding during pregnancy and preterm birth. *Am J Epidemiol* 2004; 160(2):118-125.	Observational-Dx	2,829 pregnant women	To investigate the relation between self-reported vaginal bleeding during pregnancy and preterm birth in a prospective cohort.	The overall association between vaginal bleeding and preterm birth was modest (RR 1.3, 95% CI: 1.1, 1.6). Bleeding in the first trimester only was associated with earlier preterm birth (≤34 weeks' gestation) (RR 1.6, 95% CI: 1.1, 2.4) and preterm birth due to preterm premature rupture of the membranes (RR 1.9, 95% CI: 1.1, 3.3). Bleeding in both trimesters was associated with preterm birth due to preterm labor (RR 3.6, 95% CI: 1.9, 6.8). Bleeding of multiple episodes, on multiple days, and with more total blood loss was associated with an approximate twofold increased risk of earlier preterm birth, preterm premature rupture of the membranes, and preterm labor. In contrast, bleeding in the second trimester only, of a single episode, on a single day, and with less total blood loss was not associated with any category of preterm birth. Vaginal bleeding was not associated with preterm birth among African Americans (RR 1.2, 95% CI: 0.9, 1.7).	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
5. Ananth CV, Oyelese Y, Prasad V, Getahun D, Smulian JC. Evidence of placental abruption as a chronic process: associations with vaginal bleeding early in pregnancy and placental lesions. *Eur J Obstet Gynecol Reprod Biol* 2006; 128(1-2):15-21.	Observational-Dx	46,364 patients	To assess the associations vs contributions of the clinical feature of early gestational vaginal bleeding and histologic lesions (chronic and acute) with placental abruption.	Any episode of vaginal bleeding at <20 weeks in pregnancy conferred an increased risk of placental abruption (adjusted RR 1.6, 95% CI: 1.3, 1.8). The greatest risk occurred with bleeding in both the first two trimesters (RR 3.1, 95% CI: 2.3, 4.1). The presence of histologic lesions in the placenta, cord and membranes similarly carried an increased risk of placental abruption, even in the absence of vaginal bleeding. The risk of abruption was, however, highest in the presence of both histologic lesions and vaginal bleeding early in pregnancy.	4
6. Signore CC, Sood AK, Richards DS. Second-trimester vaginal bleeding: correlation of ultrasonographic findings with perinatal outcome. *Am J Obstet Gynecol* 1998; 178(2):336-340.	Observational-Dx	167 patients	A retrospective case control study to determine the relationship between US findings and perinatal outcome in patients with second-trimester vaginal bleeding.	Among the patients with second-trimester vaginal bleeding those with abnormal US findings had an increased risk of preterm delivery (RR 2.0, 95% CI: 1.4 to 2.8), fetal death (RR 2.6, 95% CI: 1.1 to 6.3), perinatal death (RR 2.6, 95% CI: 1.3 to 5.3), and neonatal intensive care unit admissions (RR 3.2, 95% CI: 1.6 to 6.1). The perinatal mortality rate was 258:1000 for patients with abnormal US examinations.	4
7. McCormack RA, Doherty DA, Magann EF, Hutchinson M, Newnham JP. Antepartum bleeding of unknown origin in the second half of pregnancy and pregnancy outcomes. *BJOG* 2008; 115(11):1451-1457.	Observational-Dx	28,014 singleton deliveries	To evaluate factor(s) associated with unexplained antepartum bleeding of unknown origin after 24 weeks of pregnancy and correlate unexplained hemorrhage with maternal and perinatal outcomes.	Between January 1998 and December 2004, there were 26,583 deliveries without antepartum bleeding of unknown origin and 1,431 with antepartum bleeding of unknown origin. Multivariable analyses of the antepartum bleeding of unknown origin effects revealed that antepartum bleeding of unknown origin was a simultaneously significant risk factor for term labor inductions (OR = 2.00, 95% CI: 1.72-2.32, P<0.001), preterm delivery (OR = 4.31, 95% CI: 3.84-4.84, P<0.001), NICU admission (OR = 1.23, 95% CI: 1.01-1.51, P=0.042), hyperbilirubinaemia (OR = 1.29, 95% CI: 1.01-1.63, P=0.041) and reduced birthweight (26 g, 95% CI: 3-50, P=0.026).	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
8. Ramaeker DM, Simhan HN. Sonographic cervical length, vaginal bleeding, and the risk of preterm birth. *Am J Obstet Gynecol* 2012; 206(3):224 e221-224.	Observational-Dx	2,988 women with singleton gestations	To evaluate the contributions of vaginal bleeding and cervical length to the risk of preterm birth.	There was a significant second-order relation between cervical length and preterm birth (P<.001, P=.005). Women with vaginal bleeding were at higher risk of preterm birth (OR, 1.5; 95% CI, 1.3-2.0). There was a significant interaction between cervical length and vaginal bleeding (P=.015). After accounting for cervical length and interaction, the adjusted OR for vaginal bleeding and preterm birth was 4.8 (95% CI, 1.89-12.4; P=.001).	3
9. Sakornbut E, Leeman L, Fontaine P. Late pregnancy bleeding. *Am Fam Physician* 2007; 75(8):1199-1206.	Review/Other-Dx	N/A	Review of treatment and management of late pregnancy bleeding.	Placental abruption typically manifests as vaginal bleeding, uterine tenderness or back pain, and evidence of fetal distress. Preterm labor, growth restriction, and intrauterine fetal death also may occur. The fundus often is tender to palpation, and pain occurs between contractions. Bleeding may be completely or partially concealed or may be bright, dark, or intermixed with amniotic fluid. Disseminated intravascular coagulation may result from the release of thromboplastin into the maternal circulation with placental separation. This occurs in about 10 percent of abruptions and is more common with fetal death. A chronic form of abruption may manifest as recurrent vaginal bleeding with episodic pain and contractions.	4
10. Wu S, Kocherginsky M, Hibbard JU. Abnormal placentation: twenty-year analysis. *Am J Obstet Gynecol* 2005; 192(5):1458-1461.	Observational-Dx	64,359 deliveries	To determine whether the rate of abnormal placentation is increasing in conjunction with the cesarean rate and to evaluate incidence, risk factors, and outcomes.	The overall incidence of placenta accreta was 1 in 533. Significant risk factors for placenta accreta in our final analysis included advancing maternal age (OR 1.13, 95% CI: 1.089-1.194, P<.0001), 2 or more cesarean deliveries (OR 8.6, 95% CI: 3.536-21.078, P<.0001), and previa (OR 51.4, 95% CI: 10.646-248.390, P<.0001).	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
11. Ananth CV, Demissie K, Smulian JC, Vintzileos AM. Placenta previa in singleton and twin births in the United States, 1989 through 1998: a comparison of risk factor profiles and associated conditions. *Am J Obstet Gynecol* 2003; 188(1):275-281.	Observational-Dx	37,956,020 singleton births 961,578 twin births	To compare risk factor profiles for placenta previa between singleton and twin live births.	The rate of placenta previa was 40% higher among twin births (3.9 per 1,000 live births, n=3,793 births) than among singleton births (2.8 per 1,000 live births, n=104,754 births). Comparison of risk factors for placenta previa between the singleton and twin births revealed fairly similar risk factor profiles. Compared with primigravid women <20 years old, the risk for placenta previa increased by advancing age and by increasing number of pregnancies among both singleton and twin births. The number of cigarettes smoked per day also showed a dose-response trend for placenta previa risk in the two groups.	4
12. Faiz AS, Ananth CV. Etiology and risk factors for placenta previa: an overview and meta-analysis of observational studies. *J Matern Fetal Neonatal Med* 2003; 13(3):175-190.	Review/Other-Dx	58 studies	Systematic review of the etiology and risk factors for placenta previa.	The results showed that the overall prevalence rate of placenta previa was 4.0 per 1000 births, with the rate being higher among cohort studies (4.6 per 1000 births), USA-based studies (4.5 per 1000 births) and hospital-based studies (4.4 per 1000 births) than among case-control studies (3.5 per 1000 births), foreign-based studies (3.7 per 1000 births) and population-based studies (3.7 per 1000 births), respectively. Advancing maternal age, multiparity, previous Cesarean delivery and abortion, smoking and cocaine use during pregnancy, and male fetuses all conferred increased risk for placenta previa. Strong heterogeneity in the associations between risk factors and placenta previa were noted by study design, accuracy in the diagnosis of placenta previa and population-based versus hospital-based studies. Future etiological studies on placenta previa must, at the very least, adjust for potentially confounding effects of maternal age, parity, prior Cesarean delivery and abortions.	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
13. Gilliam M, Rosenberg D, Davis F. The likelihood of placenta previa with greater number of cesarean deliveries and higher parity. *Obstet Gynecol* 2002; 99(6):976-980.	Experimental-Dx	316 multiparous women; 2,051 controls	To examine the relationship between prior cesarean delivery and placenta previa.	Women with a prior cesarean delivery were more likely to have a placenta previa than those without (OR 1.59, 95% CI: 1.21, 2.08). The likelihood of placenta previa increased as both parity and number of cesarean deliveries increased. Thus, the adjusted OR for a primiparous woman with one cesarean delivery was 1.28 (95% CI: 0.82, 1.99). For a woman who has four or more deliveries with only a single cesarean delivery, the OR increases to 1.72 (95% CI: 1.12, 2.64). This trend continues with greater parity and a greater number of cesarean deliveries such that the likelihood of placenta previa for a woman with parity greater than four and greater than four cesarean deliveries was OR 8.76 (95% CI: 1.58, 48.53).	3
14. Oppenheimer LW, Farine D, Ritchie JW, Lewinsky RM, Telford J, Fairbanks LA. What is a low-lying placenta? *Am J Obstet Gynecol* 1991; 165(4 Pt 1):1036-1038.	Observational-Dx	127 patients	Analysis of the use of TVS in placental previa.	No patient with a placental edge >2 cm from the internal cervical os required cesarean section for the indication of placenta previa, whereas 7/8 patients with a distance of ≤2 cm underwent cesarean section because of bleeding characteristic of a placenta previa. These preliminary results suggest that TVS measurement may indicate the optimal delivery route and make the traditional classification of placenta previa obsolete.	4
15. Bhide A, Thilaganathan B. Recent advances in the management of placenta previa. *Curr Opin Obstet Gynecol* 2004; 16(6):447-451.	Review/Other-Dx	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.	4
16. Oppenheimer L. Diagnosis and management of placenta previa. *J Obstet Gynaecol Can* 2007; 29(3):261-273.	Review/Other-Dx	127 patients	Analysis of the use of TVS in placental previa.	TVS measurement may indicate the optimal delivery route and make the traditional classification of placenta previa obsolete.	4
17. Vergani P, Ornaghi S, Pozzi I, et al. Placenta previa: distance to internal os and mode of delivery. *Am J Obstet Gynecol* 2009; 201(3):266 e261-265.	Observational-Dx	14,973 deliveries; 120 with placenta previa during pregnancy	To relate the mode of delivery and outcomes in a retrospective analysis of a cohort of singleton pregnancies with known placenta previa that had the last TVS scan <28 days before delivery.	Rates of cesarean section delivery (75% vs 31%; OR, 6.7; 95% CI, 2-22) and of bleeding before labor (29% vs 3%; OR, 11.5; 95% CI, 1.6-76.7) were higher in group 1 than in group 2. Blood loss at delivery (662 +/- 466 mL vs 510 +/- 547 mL) and rate of severe postpartum hemorrhage (21% vs 10%; OR, 2.3; 95% CI, 0.5-9.7) were similar in the 2 groups.	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
18. Olive EC, Roberts CL, Nassar N, Algert CS. Test characteristics of placental location screening by transabdominal ultrasound at 18-20 weeks. *Ultrasound Obstet Gynecol* 2006; 28(7):944-949.	Experimental-Dx	54 women; 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.	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.	3
19. 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. *Ultrasound Obstet Gynecol* 2001; 17(6):496-501.	Observational-Dx	8,650 patients	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.	4
20. Leerentveld RA, Gilberts EC, Arnold MJ, Wladimiroff JW. Accuracy and safety of transvaginal sonographic placental localization. *Obstet Gynecol* 1990; 76(5 Pt 1):759-762.	Observational-Dx	100 patients	To evaluate the accuracy and safety of TVS placental localization.	The diagnosis was confirmed at cesarean delivery in all cases of placenta previa found by US before delivery, resulting in a 93.3% predictive value of a positive test. The predictive value of a negative test was 97.6%; in 2 patients a low-insertion placenta diagnosed by US was found to be a placenta previa at delivery. The sensitivity and specificity of the technique were 87.5% and 98.8%, respectively. Although in some instances TVS was performed during vaginal hemorrhage, aggravation of bleeding was never observed. TVS localization of the placenta proved to be an accurate and safe diagnostic procedure.	3
21. Timor-Tritsch IE, Monteagudo A. Diagnosis of placenta previa by transvaginal sonography. *Ann Med* 1993; 25(3):279-283.	Review/Other-Dx	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
22. Hertzberg BS, Bowie JD, Carroll BA, Kliewer MA, Weber TM. Diagnosis of placenta previa during the third trimester: role of transperineal sonography. *AJR* 1992; 159(1):83-87.	Observational-Dx	164 patients	Role of transperineal sonography in the diagnosis of placenta previa during the third trimester.	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 TAS for detection of placenta previa.	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
23. Cicero S, Skentou C, Souka A, To MS, Nicolaides KH. Cervical length at 22-24 weeks of gestation: comparison of transvaginal and transperineal-translabial ultrasonography. *Ultrasound Obstet Gynecol* 2001; 17(4):335-340.	Observational-Dx	500 patients	To investigate the feasibility of measuring cervical length by transperineal or translabial sonography and compare the measurements obtained by this approach with those obtained transvaginally.	Cervical length was successfully measured transvaginally in all cases. In the first phase of the study cervical length was measured by translabial-transperineal sonography in 84% of the 200 patients but there was poor agreement with measurements obtained transvaginally and the 95% tolerance interval for paired observations was -11.0 mm to 16.1 mm. After audit of results it became apparent that the translabially-transperineally derived images were inadequate in more than half of the cases but in those with adequate paired measurements there was a very good agreement between the two and the 95% tolerance interval for paired observations was -5.8 mm to 5.2 mm. In the second phase of the study special attention was paid towards recording measurements of cervical length only in cases where both the internal and external os were adequately visualized. Successful measurements by translabial-transperineal sonography were obtained in 78% of cases and the 95% tolerance interval for paired observations was -5.8 mm to 6.1 mm. The degree of patient acceptability of the two methods was similar.	3

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
24. Meijer-Hoogeveen M, Stoutenbeek P, Visser GH. Transperineal versus transvaginal sonographic cervical length measurement in second- and third-trimester pregnancies. *Ultrasound Obstet Gynecol* 2008; 32(5):657-662.	Observational-Dx	71 patients	To investigate the reliability of, and patient satisfaction with, transperineal cervical length measurement during the third trimester of pregnancy and to compare these with measurement during the mid-trimester, using TVS of the cervix as a reference.	71 patients participated in the study, 23 in the second and 48 in the third trimester of pregnancy. There was failure to obtain a clear image on transperineal US in 30% of mid-trimester pregnancies, and in 19% of third-trimester cases. Elevation of the patient's hips improved the image in five out of 10 women in whom the scan was repeated following a postural change. Transvaginal cervical length measurements could be obtained in all cases. There was a strong correlation between transvaginal and transperineal measured cervical length (Pearson's correlation coefficient = 0.85). Sonographers preferred transvaginal images of the cervix irrespective of whether they were obtained in the second or third trimester. Transperineal US was judged as not or mildly painful by most women, but TVS was preferred.	2
25. Chie L, Levine D. Sonography of the Lower Uterine Segment. *Ultrasound Clinics* 2006; 1(2):303-319.	Review/Other-Dx	N/A	Describes lower uterine segment physiology in normal pregnancy and illustrates the appearance of the lower uterine segment 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 lower uterine segment contractions. Further research is needed to clarify how imaging of the lower uterine segment can be best used to screen for uterine dehiscence and rupture.	4
26. Dashe JS, McIntire DD, Ramus RM, Santos-Ramos R, Twickler DM. Persistence of placenta previa according to gestational age at ultrasound detection. *Obstet Gynecol* 2002; 99(5 Pt 1):692-697.	Observational-Dx	714 patients	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.	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.	4
27. Predanic M, Perni 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. *J Ultrasound Med* 2005; 24(6):773-780.	Observational-Dx	163 patients	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 <2.0 cm from the internal cervical os and a deceleration pattern of placental migration were significantly associated with an interventional cesarean delivery and a higher rate of peripartum complications.	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
28. Taipale P, Hiilesmaa V, Ylostalo P. Transvaginal ultrasonography at 18-23 weeks in predicting placenta previa at delivery. *Ultrasound Obstet Gynecol* 1998; 12(6):422-425.	Observational-Dx	3,696 patients	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.	In 57/3,696 patients (1.5%), the placental edge extended to or over the internal cervical os. In 27 patients (0.7%), the placenta extended ≥15 mm over the internal cervical os; in these cases the PPV of placenta previa at delivery was 19% (95% CI, 6%-38%) with 100% (95% CI, 48%-100%) sensitivity. With ≥25 mm used as the cut-off point, 10 cases (0.3%) were screen-positive and the PPV for previa at delivery was 40% (95% CI, 12%-74%) and sensitivity was 80% (95% CI, 28%-100%). The frequency of placenta previa at delivery in this population was 5/3,696 (0.14%, 95% CI, 0.04%-0.31%).	3
29. Oppenheimer L, Holmes P, Simpson N, Dabrowski A. Diagnosis of low-lying placenta: can migration in the third trimester predict outcome? *Ultrasound Obstet Gynecol* 2001; 18(2):100-102.	Observational-Dx	36 patients	To investigate the relationship between the rate of migration of a low-lying placenta during the third trimester and the eventual route of delivery.	The mean rates of migration in patients who had (n=7) and who did not have (n=29) Cesarean section for placenta previa were +0.3 mm/week and +5.4 mm/week, respectively (P<0.0001). When the placental edge was initially >20 mm from the internal os, migration occurred in all cases and no Cesarean section for placenta previa was performed. For those between -20 mm and +20 mm, sufficient migration to avoid Cesarean section occurred in 88.5% of cases. Beyond a 20 mm overlap, significant placental migration did not occur and all patients required Cesarean section.	4
30. Getahun D, Oyelese Y, Salihu HM, Ananth CV. Previous cesarean delivery and risks of placenta previa and placental abruption. *Obstet Gynecol* 2006; 107(4):771-778.	Observational-Dx	First 2 156,475 patients and first 3 31,102 consecutive singleton pregnancies	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% CI 1.3-1.8).	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

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31. Hata T, Tanaka H, Noguchi J, Hata K. Three-dimensional ultrasound evaluation of the placenta. *Placenta* 2011; 32(2):105-115.	Review/Other-Dx	N/A	To review 3D US evaluation of the placenta.	3D-power Doppler US can depict intraplacental vessel characteristics such as the density of vessels, branching, caliber changes, and Tortuosity. Moreover, 3D-power Doppler US was found to be superior to 2D-power Doppler US for the detection of secondary and tertiary stem vessels in the placenta, although there was no difference in the visualization of main stem vessels between 2D-power Doppler US and 3D-power Doppler US.	4
32. Miller DA, Chollet JA, Goodwin TM. Clinical risk factors for placenta previa-placenta accreta. *Am J Obstet Gynecol* 1997; 177(1):210-214.	Observational-Dx	155,670 deliveries; 62 with placenta accreta	To review clinical risk factors for placenta previa-placenta accreta.	Placenta accreta occurred in 55/590 (9.3%) women with placenta previa and in 7/155,080 (1/22,154) without placenta previa (RR 2065, 95% CI, 944 to 4516, P<0.0001). Among women with placenta previa, advanced maternal age (≥35 years) and previous cesarean delivery were independent risk factors for placenta accreta. Placenta accreta was present in 36/124 (29%) cases in which the placenta was implanted over the uterine scar and in 4/62 (6.5%) cases in which it was not (RR 4.5, 95% CI, 1.68 to 12.07). Among women with placenta previa, the risk of placenta accreta ranged from 2% in women <35 years old with no previous cesarean deliveries to almost 39% in women with two or more previous cesarean deliveries and an anterior or central placenta previa.	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

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33. Silver RM, Landon MB, Rouse DJ, et al. Maternal morbidity associated with multiple repeat cesarean deliveries. *Obstet Gynecol* 2006; 107(6):1226-1232.	Observational-Dx	30,132 cesarean deliveries; 723 women with previa	To estimate the magnitude of increased maternal morbidity associated with increasing number of cesarean deliveries.	There were 6,201 first (primary), 15,808 second, 6,324 third, 1,452 fourth, 258 fifth, and 89 sixth or more cesarean deliveries. The risks of placenta accreta, cystotomy, bowel injury, ureteral injury, and ileus, the need for postoperative ventilation, intensive care unit admission, hysterectomy, and blood transfusion requiring 4 or more units, and the duration of operative time and hospital stay significantly increased with increasing number of cesarean deliveries. Placenta accreta was present in 15 (0.24%), 49 (0.31%), 36 (0.57%), 31 (2.13%), 6 (2.33%), and 6 (6.74%) women undergoing their first, second, third, fourth, fifth, and sixth or more cesarean deliveries, respectively. Hysterectomy was required in 40 (0.65%) first, 67 (0.42%) second, 57 (0.90%) third, 35 (2.41%) fourth, 9 (3.49%) fifth, and 8 (8.99%) sixth or more cesarean deliveries. In the 723 women with previa, the risk for placenta accreta was 3%, 11%, 40%, 61%, and 67% for first, second, third, fourth, and fifth or more repeat cesarean deliveries, respectively.	4
34. Al-Serehi A, Mhoyan A, Brown M, Benirschke K, Hull A, Pretorius DH. Placenta accreta: an association with fibroids and Asherman syndrome. *J Ultrasound Med* 2008; 27(11):1623-1628.	Review/Other-Dx	2 cases	To emphasize that accreta is also identified at sites other than cesarean scars by assessing 2 cases.	The US and MRI findings of accreta are reviewed in the classic setting of prior cesarean deliveries as well as myomectomy and uterine fibroids.	4
35. Hung TH, Shau WY, Hsieh CC, Chiu TH, Hsu JJ, Hsieh TT. Risk factors for placenta accreta. *Obstet Gynecol* 1999; 93(4):545-550.	Observational-Dx	10,672 patients	To identify risk factors from the associated with placenta accreta in a large cohort study.	Women who had placenta previa (OR 54.2; 95% CI, 17.8, 165.5) and second-trimester serum levels of AFP and free beta- human chorionic gonadotropin greater than 2.5 multiples of the median (OR 8.3; 95% CI, 1.8, 39.3 and OR 3.9; 95% CI, 1.5, 9.9, respectively), and were 35 years and older (OR 3.2; 95% CI, 1.1, 9.4) were at increased risk of having placenta accreta.	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

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36. Butler EL, Dashe JS, Ramus RM. Association between maternal serum alpha-fetoprotein and adverse outcomes in pregnancies with placenta previa. *Obstet Gynecol* 2001; 97(1):35-38.	Observational-Dx	107 women	A retrospective cohort study to determine whether increased maternal serum AFP level at 15-20 weeks' gestation is a marker of adverse outcomes in women with placenta previa at delivery.	14 (13%, 95% CI 7%, 21%) had maternal serum AFP at least 2.0 multiples of the median. They were significantly more likely than those with lower maternal serum AFP levels to have one or more of the following outcomes: hospitalization for antepartum bleeding before 30 weeks' gestation (50% vs 15%), delivery before 30 weeks' gestation (29% vs 5%), or preterm delivery for pregnancy-associated hypertension before 34 weeks' gestation (14% vs none). The maternal serum AFP cutoff of 2.0 multiples of the median provided the best combination of sensitivity and specificity for those outcomes, using receiver operating characteristic curves.	4
37. Warshak CR, Ramos GA, Eskander R, et al. Effect of predelivery diagnosis in 99 consecutive cases of placenta accreta. *Obstet Gynecol* 2010; 115(1):65-69.	Observational-Dx	99 women with placenta accreta	To estimate the effects of prenatal diagnosis and delivery planning on outcomes in patients with placenta accreta.	Comparing women with predelivery diagnosis with those diagnosed at the time of delivery, there were fewer units of packed red blood cells transfused (4.7+/-2.2 compared with 6.9+/-1.8 units, P=.02) and a lower estimated blood loss (2,344+/-1.7 compared with 2,951+/-1.8 mL, P=.053), although this trend did not reach statistical significance. Comparison of neonatal outcomes demonstrated a higher rate of steroid administration (65% compared with 16%, P≤.001), neonatal admission to the neonatal intensive care unit (86% compared with 60%, P=.005), and longer neonatal hospital stays (10.7+/-1.9 compared with 6.9+/-2.1 days, P=.006). Length of neonatal intensive care unit stay, rates of respiratory distress syndrome, and surfactant administration did not differ between the groups.	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
38. Eller AG, Porter TF, Soisson P, Silver RM. Optimal management strategies for placenta accreta. *BJOG* 2009; 116(5):648-654.	Observational-Dx	76 cases of placenta accreta	To determine which interventions for managing placenta accreta were associated with reduced maternal morbidity.	When accreta was suspected, scheduled caesarean hysterectomy without attempting placental removal was associated with a significantly reduced rate of early morbidity compared with cases in which placental removal was attempted (67% vs 36%, P=0.038). Women with preoperative bilateral ureteric stents had a lower incidence of early morbidity compared with women without stents (18% vs 55%, P=0.018). Hypogastric artery ligation did not reduce maternal morbidity.	4
39. Tan CH, Tay KH, Sheah K, et al. Perioperative endovascular internal iliac artery occlusion balloon placement in management of placenta accreta. *AJR* 2007; 189(5):1158-1163.	Observational-Dx	11 patients	To evaluate the efficacy of the perioperative placement of occlusion balloons within the internal iliac arteries in reducing intraoperative blood loss and transfusion requirements during cesarean delivery for women with placenta accreta or its variants.	The mean intraoperative blood loss in the study group (2,011 mL; range, 400-5,000 mL) was 39.4% less than in the control group (3,316 mL; range, 1,000-4,000 mL) (P=0.042). The mean volume of blood transfused was 52.1% less in the study group (1,058 mL; range, 0-3,600 mL) than in the control group (2,211 mL; range, 1,190-3,980 mL) (P=0.005). There was no significant difference in the immediate postoperative change in hemoglobin levels (P=0.44), length of hospitalization (P=0.203), or intensive care unit admission (P=0.614). The duration of the surgery was significantly less in the study group (P=0.046).	3
40. Comstock CH, Love JJ, Jr., Bronsteen RA, et al. Sonographic detection of placenta accreta in the second and third trimesters of pregnancy. *Am J Obstet Gynecol* 2004; 190(4):1135-1140.	Observational-Dx	14 patients	Prospective study to determine the effectiveness of US in detecting placenta accrete in at-risk patients.	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).	4
41. Oyelese Y, Smulian JC. Placenta previa, placenta accreta, and vasa previa. *Obstet Gynecol* 2006; 107(4):927-941.	Review/Other-Dx	N/A	Review risk factors and management of placenta previa, placenta accrete and vas previa.	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

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
42. Twickler DM, Lucas MJ, Balis AB, et al. Color flow mapping for myometrial invasion in women with a prior cesarean delivery. *J Matern Fetal Med* 2000; 9(6):330-335.	Observational-Dx	215 women	To evaluate the utility of color flow mapping in the prediction of placental myometrial invasion in women with cesarean delivery.	Of 20 women with placenta previa and cesarean delivery, 15 had cesarean hysterectomy for bleeding complications and nine had the pathological diagnosis of placental invasion. The measurement of <1 mm for the smallest myometrial thickness or presence of large intraplacental lakes was predictive of myometrial invasion (sensitivity 100%, specificity 72%, PPV 72%, and NPV 100%).	3
43. Yang JI, Lim YK, Kim HS, Chang KH, Lee JP, Ryu HS. Sonographic findings of placental lacunae and the prediction of adherent placenta in women with placenta previa totalis and prior Cesarean section. *Ultrasound Obstet Gynecol* 2006; 28(2):178-182.	Observational-Dx	51 patients	To investigate the value of TVS findings of intraplacental lacunae for predicting adherent placenta and clinical outcome in patients with placenta previa total is and a history of Cesarean section.	Lacunae were classified as Grade 1+ in 10 cases, Grade 2+ in 11 cases, Grade 3+ in five cases and as Grade 0 (i.e. lacunae were absent) in the remaining 25 cases. When lacunae of ≥Grade 1+ were considered, the sensitivity, specificity, PPV and NPV of diagnosing adherent placenta were 86.9%, 78.6%, 76.9% and 88.0%, respectively.	3
44. Finberg HJ, Williams JW. Placenta accreta: prospective sonographic diagnosis in patients with placenta previa and prior cesarean section. *J Ultrasound Med* 1992; 11(7):333-343.	Review/Other-Dx	34 patients	To prospectively diagnose sonographically placenta accreta in patients with placenta previa and prior cesarean section.	Women who have had cesarean sections are at increased risk of placenta previa in subsequent pregnancies.	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
45. Belfort MA. Placenta accreta. *Am J Obstet Gynecol* 2010; 203(5):430-439.	Review/Other-Dx	N/A	To review the risks of placenta accreta, increta, and percreta, and provide guidance regarding interventions to improve maternal outcomes when abnormal placental implantation occurs.	Abnormal placentation--encompassing placenta accreta, increta, and percreta--is increasingly common. While randomized controlled trials and large observational cohort studies that can be used to define best practice are lacking, strategies to enhance early diagnosis, enhance preparation, and coordinate peripartum management can be undertaken. Women with a placenta previa overlying a uterine scar should be evaluated for the potential diagnosis of placenta accreta. Women with a placenta previa or "low-lying placenta" overlying a uterine scar early in pregnancy should be reevaluated in the third trimester with attention to the potential presence of placenta accreta. When the diagnosis of placenta accreta is made remote from delivery, the need for hysterectomy should be anticipated and arrangements made for delivery in a center with adequate resources, including those for massive transfusion. Intraoperatively, attention should be paid to abdominal and vaginal blood loss. Early blood product replacement, with consideration of volume, oxygen-carrying capacity, and coagulation factors, can reduce perioperative complications.	4
46. Chou MM, Ho ES. Prenatal diagnosis of placenta previa accreta with power amplitude ultrasonic angiography. *Am J Obstet Gynecol* 1997; 177(6):1523-1525.	Review/Other-Dx	1 patient	Case report and review of prenatal diagnosis of placenta previa accrete with power amplitude ultrasonic angiography.	It is recommended that randomized clinical studies be performed to compare its effectiveness with gray-scale US and conventional color Doppler imaging in diagnosing placenta previa accreta, especially in detecting inconspicuous placental lakes in some unusual cases that are difficult to define by conventional imaging techniques. Finally, gray-scale and color Doppler imaging are likely to remain the primary means of US assessment of mother, fetus, and placenta for the immediate future, whereas power amplitude ultrasonic imaging is likely to play a more defining and clarifying role.	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
47. Wong HS, Cheung YK, Zuccollo J, Tait J, Pringle KC. Evaluation of sonographic diagnostic criteria for placenta accreta. *J Clin Ultrasound* 2008; 36(9):551-559.	Observational-Dx	66 women	To compare the diagnostic value of reported sonographic criteria for placenta accreta and to develop a composite score system for antenatal evaluation.	The criteria of obliteration of retroplacental clear space, a myometrial thickness of <1 mm, presence of vessels bridging placenta and uterine margin, disruption of the placental-uterine wall interface, and vessels crossing the sites of interface disruption showed a statistically significant association with placenta accreta. The disruption of the placental-uterine wall interface and the presence of vessels crossing these sites were the only 2 individual criteria that could distinguish placenta accreta from non-accreta, which could also be achieved by our composite score system using a cutoff value of 40, with a sensitivity of 89% and specificity of 98%.	3
48. Chou MM, Ho ES, Lee YH. Prenatal diagnosis of placenta previa accreta by transabdominal color Doppler ultrasound. *Ultrasound Obstet Gynecol* 2000; 15(1):28-35.	Observational-Dx	80 patients	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 US in the antenatal period.	3
49. Comstock CH. Antenatal diagnosis of placenta accreta: a review. *Ultrasound Obstet Gynecol* 2005; 26(1):89-96.	Review/Other-Dx	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
50. Warshak CR, Eskander R, Hull AD, et al. Accuracy of ultrasonography and magnetic resonance imaging in the diagnosis of placenta accreta. *Obstet Gynecol* 2006; 108(3 Pt 1):573-581.	Observational-Dx	453 women	To determine the precision and reliability of US and MRI in diagnosing placenta accreta.	39 had placenta accreta confirmed by pathological examination. US accurately predicted placenta accreta in 30/39 of women and correctly ruled out placenta accreta in 398/414 without placenta accreta (sensitivity 0.77, specificity 0.96). 42 women underwent MRI evaluation because of findings suspicious or inconclusive of placenta accreta by US. MRI accurately predicted placenta accreta in 23/26 cases with placenta accreta and correctly ruled out placenta accreta in 14/14 (sensitivity 0.88, specificity 1.0).	3

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
51. Shih JC, Palacios Jaraquemada JM, Su YN, et al. Role of three-dimensional power Doppler in the antenatal diagnosis of placenta accreta: comparison with gray-scale and color Doppler techniques. *Ultrasound Obstet Gynecol* 2009; 33(2):193-203.	Observational-Dx	170 women	To prospectively assess the role of 3D power Doppler in the antenatal diagnosis of placenta accreta and compare its diagnostic performance with gray-scale and color Doppler US.	Placenta accreta and its variants (including increta and percreta) were confirmed in 39 patients at the time of cesarean delivery. Based on receiver-operating characteristics analysis, 'numerous coherent vessels' visualized using 3D power Doppler in the basal view was the best single criterion for the diagnosis of placenta accreta, with a sensitivity of 97% and a specificity of 92%. If we considered the presence of at least one criterion to be diagnostic when using each US technique, then 3D power Doppler would have the best PPV (76%), followed by gray-scale (51%) and color Doppler (47%). The majority of patients with placenta accreta showed multiple characteristic features on US imaging. In contrast, those patients with a false-positive diagnosis (ie, the final diagnosis was placenta previa alone) tended to show isolated US markers of the condition.	3
52. Baughman WC, Corteville JE, Shah RR. Placenta accreta: spectrum of US and MR imaging findings. *Radiographics* 2008; 28(7):1905-1916.	Review/Other-Dx	N/A	To evaluate the spectrum of US and MRI findings of placenta accreta.	US remains the diagnostic standard and routine US examination at 18-20 weeks gestation affords an ideal opportunity to screen for the disorder. Placental lacunae and abnormal color Doppler imaging patterns are the most helpful US markers for placenta accreta. In recent years, there has been increased interest in MRI for the evaluation of placenta accreta, since it can provide information on depth of invasion and more clearly depict posterior placentas. The most reliable MRI findings are uterine bulging, heterogeneous placenta, and placental bands. Focal interruptions in the hypointense myometrial border may also be helpful. Placenta accreta is a clinical and diagnostic challenge that is being encountered with increasing frequency. Clinicians should be aware of the clinical issues, risk factors, and imaging findings associated with placenta accreta to facilitate optimal case management.	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
53. Levine D, Hulka CA, Ludmir J, Li W, Edelman RR. Placenta accreta: evaluation with color Doppler US, power Doppler US, and MR imaging. *Radiology* 1997; 205(3):773-776.	Observational-Dx	19 patients Doppler US; 18 patients 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.	3
54. Palacios Jaraquemada JM, Bruno CH. Magnetic resonance imaging in 300 cases of placenta accreta: surgical correlation of new findings. *Acta Obstet Gynecol Scand* 2005; 84(8):716-724.	Observational-Dx	300 patients	To establish the usefulness of placental MRI in patients with a diagnosis of placenta accreta through the correlation of diagnostic images and surgical findings.	In 286 cases, MRI provided topographic information of placental invasion, and in 90 patients, it modified invasion levels. MRI helps define the topography and area of placental invasion.	4
55. Lax A, Prince MR, Mennitt KW, Schwebach JR, Budorick NE. The value of specific MRI features in the evaluation of suspected placental invasion. *Magn Reson Imaging* 2007; 25(1):87-93.	Observational-Dx	10 patients	To determine imaging features that may help predict the presence of placenta accreta, placenta increta or placenta percreta on prenatal MRI.	Using Fisher's two-sided exact test, there was a statistically significant difference between the proportion of patients with placental invasion and those without placental invasion for three of the features: abnormal uterine bulging (Rater 1, P=.005; Rater 2, P=.011); heterogeneity of T2W imaging signal intensity (Rater 1, P=.006; Rater 2, P=.010); and presence of dark intraplacental bands on T2W imaging (Rater 1, P=.003; Rater 2, P=.033).	2
56. Dwyer BK, Belogolovkin V, Tran L, et al. Prenatal diagnosis of placenta accreta: sonography or magnetic resonance imaging? *J Ultrasound Med* 2008; 27(9):1275-1281.	Observational-Dx	32 patients	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%).	4
57. Derman AY, Nikac V, Haberman S, Zelenko N, Opsha O, Flyer M. MRI of placenta accreta: a new imaging perspective. *AJR* 2011; 197(6):1514-1521.	Observational-Dx	17 patients	To identify new MRI criteria and review established MRI criteria for the diagnosis of placenta accreta.	The most sensitive MRI criteria for the diagnosis of invasive placentation to be abnormal placental vascularity in addition to the previously described intraplacental T2 dark bands.	3

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
58. Lim PS, Greenberg M, Edelson MI, Bell KA, Edmonds PR, Mackey AM. Utility of ultrasound and MRI in prenatal diagnosis of placenta accreta: a pilot study. *AJR* 2011; 197(6):1506-1513.	Observational-Dx	13 patients	To evaluate transabdominal pelvic US and MRI for the prenatal diagnosis of placenta accreta.	13 patients at risk of placenta accreta underwent both US and MRI. 9 patients had abnormal placentation. With US, abnormal placentation was correctly identified in 6/9 patients (67%) and the absence of accreta in 2/4 patients (50%). With MRI, abnormal placentation was correctly identified in 7/9 patients (78%) and the absence of accreta in 3/4 patients (75%). The volumes of low-signal-intensity bands were significantly different in the patients with abnormal placentation and those without placenta accreta (P=0.047), and band volumes were significantly different among patients with accreta, increta, and percreta (P<0.0005).	3
59. Masselli G, Gualdi G. MR imaging of the placenta: what a radiologist should know. *Abdom Imaging* 2013; 38(3):573-587.	Review/Other-Dx	N/A	To review the appearances and the role of MRI in diagnosis and management of placental conditions.	US remains the first imaging modality for evaluation of the placenta. MRI has many unique properties that make it well-suited for imaging of the placenta: the multi-planar capabilities, the improved tissue contrast that can be obtained using a variety of pulse sequences and parameters and the lack of ionizing radiation; MRI can be of added diagnostic value when further characterization is required.	4
60. Ananth CV, Oyelese Y, Yeo L, Pradhan A, Vintzileos AM. Placental abruption in the United States, 1979 through 2001: temporal trends and potential determinants. *Am J Obstet Gynecol* 2005; 192(1):191-198.	Observational-Dx	32,544 total patients	To evaluate temporal trends in abruption risk and to assess how much underlying changes in the clinical determinants may have affected these trends.	The rate of abruption increased 92% (95% CI, 88, 96) among black women 1979-1981 (0.76%; n=13,584 women) and 1999-2001 (1.43%; n=18,960 women). Among white women, the rate increased by 15% (95% CI, 14, 16) over the same period, from 0.82% (n=66,186 women) in 1979-1981 to 0.94% (n=59,284 women) in 1999-2001. The determinants that were associated with trends in abruption included anemia, gestational diabetes mellitus, preterm labor, short umbilical cord, and velamentous cord insertion, although their effects varied substantially by maternal race.	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
61. Oyelese Y, Ananth CV. Placental abruption. *Obstet Gynecol* 2006; 108(4):1005-1016.	Review/Other-Dx	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
62. Glantz C, Purnell L. Clinical utility of sonography in the diagnosis and treatment of placental abruption. *J Ultrasound Med* 2002; 21(8):837-840.	Observational-Dx	149 patients	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.	Sensitivity: 24%, Specificity: 96%, PPV: 88%, and NPV: 53%.	4
63. Kay HH, Spritzer CE. Preliminary experience with magnetic resonance imaging in patients with third-trimester bleeding. *Obstet Gynecol* 1991; 78(3 Pt 1):424-429.	Observational-Dx	15 patients	To study patients with third-trimester bleeding who underwent MRI.	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.	4
64. Masselli G, Brunelli R, Di Tola M, Anceschi M, Gualdi G. MR imaging in the evaluation of placental abruption: correlation with sonographic findings. *Radiology* 2011; 259(1):222-230.	Observational-Dx	60 consecutive patients	To assess the accuracy of the different MRI sequences in the visualization of clots, and to evaluate the correlation between MRI findings and clinical outcome.	Abruption was identified in 10 of the 19 patients (52%) with US and in all 19 (100%) with MRI (P=.002), with an interobserver agreement of 0.949. Diffusion- and T1-weighted sequences helped identify 19 (100%) and 18 (95%) of the 19 abruptions, respectively; interrater agreement was very good for all sequences (κ = 0.892-1.0). Hematomas classified as hyperacute or acute worsened to abruption grade II, with the mother being symptomatic or the fetus distressed.	4
65. Oyelese KO, Turner M, Lees C, Campbell S. Vasa previa: an avoidable obstetric tragedy. *Obstet Gynecol Surv* 1999; 54(2):138-145.	Review/Other-Dx	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

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
66. Oyelese Y, Catanzarite V, Prefumo F, et al. Vasa previa: the impact of prenatal diagnosis on outcomes. *Obstet Gynecol* 2004; 103(5 Pt 1):937-942.	Observational-Dx	155 pregnancies	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.	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.	4
67. Baulies S, Maiz N, Munoz A, Torrents M, Echevarria M, Serra B. Prenatal ultrasound diagnosis of vasa praevia and analysis of risk factors. *Prenat Diagn* 2007; 27(7):595-599.	Observational-Dx	12,063 deliveries	A retrospective study to evaluate the role of US in prenatal diagnosis of vasa praevia and to assess the risk of vasa praevia associated with different causal factors.	The prevalence of vasa praevia in our center during this period was 0.07% (9 cases). All cases were prenatally diagnosed. The mean gestational age at diagnosis was 26 weeks. Multivariate analysis revealed the following associated factors: IVF pregnancies, bilobate or succenturiate placenta, and second-trimester placenta praevia, with an OR of 7.75, 22.11 and 22.86, respectively.	4
68. Francois K, Mayer S, Harris C, Perlow JH. Association of vasa previa at delivery with a history of second-trimester placenta previa. *J Reprod Med* 2003; 48(10):771-774.	Observational-Dx	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

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
69. Nomiyama M, Toyota Y, Kawano H. Antenatal diagnosis of velamentous umbilical cord insertion and vasa previa with color Doppler imaging. *Ultrasound Obstet Gynecol* 1998; 12(6):426-429.	Observational-Dx	587 patients	To determine whether cord insertion can be consistently visualized and whether velamentous cord insertion and vasa previa can be consistently identified with color Doppler imaging during routine sonography in the mid-trimester.	Cord insertion was visualized by color Doppler imaging in 99.8% (586/587) of the fetuses in our study. The mean time required for examination was 20 s and, in 95% of the cases, cord insertion was visualized within 1 min. The sonographic identification of velamentous cord insertion had a sensitivity of 100% (5/5), a specificity of 99.8% (580/581), a PPV of 83% (5/6) and a NPV of 100% (580/580). In our study, vasa previa was diagnosed at 18 gestational weeks in two cases and, in one of the cases, vasa previa was confirmed at delivery.	4
70. Sepulveda W, Rojas I, Robert JA, Schnapp C, Alcalde JL. Prenatal detection of velamentous insertion of the umbilical cord: a prospective color Doppler ultrasound study. *Ultrasound Obstet Gynecol* 2003; 21(6):564-569.	Observational-Dx	832 pregnancies	To determine the feasibility of identifying velamentous insertion of the umbilical cord during routine obstetric US.	The placental cord insertion site was identified in 825/832 (99%) cases. Visualization was not achieved in seven third-trimester pregnancies with a posterior placenta. A velamentous insertion was suspected prenatally in 8 cases, 7 of which were confirmed after delivery as velamentous and one as markedly eccentric (battledore placenta). 3D US performed poorly at evaluating placental cord insertion site, being less efficient due to poor-quality resolution and far more time-consuming than the combined use of gray-scale and color Doppler US.	3
71. Canterino JC, Mondestin-Sorrentino M, Muench MV, Feld S, Baum JD, Fernandez CO. Vasa previa: prenatal diagnosis and evaluation with 3-dimensional sonography and power angiography. *J Ultrasound Med* 2005; 24(5):721-724; quiz 725.	Review/Other-Dx	1 cesarean section	A case report of vasa previa with 3-dimensional sonography and power angiography.	3D US may help improve the evaluation and treatment of women with suspected vasa previa. It is suggested that, when possible, 3D US with power Doppler angiography should be considered in women with vasa previa to verify the diagnosis and to optimize the treatment of these women.	4

Second and Third Trimester Bleeding
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
72. Lee W, Kirk JS, Comstock CH, Romero R. Vasa previa: prenatal detection by three-dimensional ultrasonography. *Ultrasound Obstet Gynecol* 2000; 16(4):384-387.	Review/Other-Dx	2 women	To describe 3D US for the antepartum diagnosis of vasa previa.	In the first case, 3D US provided gray-scale multiplanar and surface-rendered views of an aberrant vessel over the internal cervical os. For the second case, a 'flight-path' technique allowed the examiner to follow axial views of the endocervical canal toward the internal os until an aberrant vessel was verified. The 'niche-mode' analysis, with and without color power Doppler US, was also used to confirm the diagnosis. 3D US offers several additional imaging tools that are not currently provided by more conventional US for the detection of vasa previa. It represents an important adjunct to 2D studies, especially when this diagnosis is questionable.	4
73. Oyelese Y, Chavez MR, Yeo L, et al. Three-dimensional sonographic diagnosis of vasa previa. *Ultrasound Obstet Gynecol* 2004; 24(2):211-215.	Review/Other-Dx	N/A	Review of 3D US diagnosis of vasa previa.	3D US has an important role in the evaluation of vasa previa and other placental abnormalities, especially when the diagnosis is uncertain following 2D US. The authors recommend that the use of 3D US be considered whenever a diagnosis of vasa previa is suspected on 2D US. In particular, 3D US may play a crucial role in mapping out the relationship of the placenta, vessels and internal cervical os, to obtain the best possible outcome at the time of Cesarean delivery.	4
74. Kikuchi A, Uemura R, Serikawa T, Takakuwa K, Tanaka K. Clinical significances of magnetic resonance imaging in prenatal diagnosis of vasa previa in a woman with bilobed placentas. *J Obstet Gynaecol Res* 2011; 37(1):75-78.	Review/Other-Dx	1 case	To report a case of a pregnant woman diagnosed as having vasa previa by MRI.	MRI should be useful in the diagnosis of vasa previa when the relation between the position of the placenta and that of suspicious vessels cannot be adequately evaluated by US.	4

Evidence Table Key

Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
  a) the study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
  b) the study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
  c) the study is an expert opinion or consensus document.

Dx = Diagnostic

Tx = Treatment

Abbreviations Key

AFP = Alpha-fetoprotein

CI = Confidence interval

MRI = Magnetic resonance imaging

NPV = Negative predictive value

OR = Odds ratio

PPV = Positive predictive value

RR = Relative risk

TAS = Transabdominal ultrasound

TVS = Transvaginal ultrasound

US = Ultrasound