9 Placenta previa and placental abruption

Ann K. Lal and William J. Watson

Antepartum hemorrhage can be divided into obstetric and non-obstetric causes. Frequent non-obstetric causes of antepartum vaginal hemorrhage include cervicitis, cervical polyps, cervical cancer, or vaginal lacerations. In the third trimester, the main clinically important causes of antepartum hemorrhage are placenta previa and placental abruption. When the clinician is evaluating a patient with antepartum hemorrhage, a precise diagnosis is needed so that proper management can be expeditiously implemented.

PLACENTA PREVIA

Placenta previa is defined as abnormal placental implantation over the cervical os. There are several variants of this definition. A low-lying placenta occurs when the placenta implants in the lower uterine segment; the placental edge lies near, but not over the cervical os. A low-lying placenta is not considered a category of placenta previa, but it is a form of irregular placentation, which may cause vaginal bleeding when the lower uterine segment develops during labor. When the edge of the placenta lies exactly at the internal cervical os, a marginal placenta previa is present. A complete placenta previa occurs when the internal cervical os is completely covered by the placenta. Clinicians refer to a “central previa” when the center of the placenta is covering the internal os of the cervix (Figs. 1 and 2). The term “partial placenta previa” in which part of the placenta covers the internal os of the cervix is not clinically useful, given the above definitions.

Epidemiology

Placenta previa is thought to be caused by an implantation abnormality. With increasing gravity and parity, for example, the underlying endometrium may be damaged, and in subsequent pregnancies, the embryo may implant in the lower uterine segment because it is a potentially more suitable site (1). The incidence of placenta previa complicating pregnancy is 0.26% to 1% (2,3). In gravidas with parity of five or greater, the incidence increases to 2.2% (4).

There are many known risk factors for placenta previa. One of the most significant risk factors is prior cesarean delivery. In a patient with two prior cesarean deliveries, the risk of previa is approximately 1.9%; this increases to 4.1% in those with three or more previous cesareans (5). If a patient with a prior cesarean section has a placenta previa in a subsequent pregnancy, the probability that the previa will persist until the term is increased (Table 1) (6).

A history of placenta previa confers an eightfold increased risk of previa in a subsequent pregnancy (7). A history of prior uterine curettage is a risk factor for previa, most likely due to the endometrial scarring from the surgical procedure (8). Advanced maternal age also increases the risk for the development of placenta previa. One report found that in

women of age 19, the risk of previa was 1/1500, but the incidence of previa increased to 1/100 in gravidas greater than 35 years old (3). Smoking poses a twofold elevated risk for the development of placenta previa. This is thought to be secondary to carbon monoxide-induced hypoxemia, which causes placental hypertrophy and impaired decidual vascularization (9). Likewise, an amplified risk is noted in patients who live at higher altitudes, most likely due to an increased placental surface area (10).

Clinical Presentation

The classic presentation of placenta previa is painless sudden vaginal bleeding. The first episode of bleeding is called the “sentinel bleed.” Most sentinel bleeds occur after the 28th week of gestation. About 70% of patients with placenta previa experiencing an antepartum hemorrhage will have this occur prior to 34 weeks of gestation (11). This painless hemorrhage usually has an onset without previous signs or symptoms. Fortunately, most initial bleeds are small and stop spontaneously. In patients with marginal placenta previa, it is more likely that the sentinel bleed will occur with the onset of labor. The cause of this bleeding is the development, or thinning, of the lower uterine segment and dilation of the cervix, which can cause dissociation of the placental connection to the uterus. This bleeding is augmented by the fact that the lower uterine segment has less contractile activity and is therefore impaired in its ability to constrict and stop ongoing hemorrhage. Bhide et al. studied 121 patients with low-lying placenta and placenta previa and noted that in cases of partial or marginal placenta previa, 57% had antepartum hemorrhage (12). The risk of bleeding with low-lying placenta was inversely related to the distance of the placental edge from the cervical os.

Diagnosis

The diagnosis of placenta previa is clinically important when a patient presents with antepartum hemorrhage. Among patients with placenta previa, specifically those with antepartum hemorrhage, the average gestational age at diagnosis is 32 weeks. Classical teaching is that pelvic exams are contraindicated in a patient with antepartum hemorrhage and unknown placental location. Before the availability of accurate real-time ultrasound, if a pelvic exam was to be performed in a patient with vaginal bleeding in the latter half of pregnancy, a double setup was required. A double setup is a digital cervical exam performed in the operating room with the necessary staff and equipment ready to perform an immediate cesarean delivery should heavy bleeding occur. Current ultrasound technology has made the double setup exam obsolete and relegated this procedure to the history books.

Initially, transabdominal ultrasound was used for diagnosis. Transabdominal ultrasonography, however, may be limited by

Figure 1 Abdominal ultrasound image of complete placenta previa, with a cervical length of 3.24 cm.

Figure 2 Transvaginal ultrasound image of complete placenta previa.

Table 1 Risk Factors for Placenta Previa

Prior cesarean delivery	Prior placenta previa
Prior uterine curettage	Multiparity
Cigarette smoking	Advanced maternal age

difficulty visualizing a posterior placenta, difficulty visualizing the lower uterine segment secondary to fetal positioning, and poor visualization in cases of maternal obesity (13). Although pelvic examination is contraindicated, clinical experience has shown that transvaginal ultrasound is safe to perform in patients with placenta previa (14). It has also been proven to be superior to abdominal ultrasound as diagnostic tool (15). Translabial ultrasounds can be of diagnostic assistance, but this technique does not appear to offer an advantage over transvaginal sonography. With the improved diagnostic accuracy of transvaginal ultrasound, in cases with a low-lying placenta, the ultrasound report should state the actual distance of the placental edge from the cervical os (13).

Natural History

If placenta previa is diagnosed at less than 24 weeks of gestation in an asymptomatic patient, a repeat ultrasound

should be performed at 32 weeks. This is done because 90% of placenta previas diagnosed at mid-trimester will resolve by term (16). The chance that the placenta previa will continue until term depends on whether it is marginal or complete. Zelop and colleagues found that complete placenta previa will persist at delivery 26% of the time, while a marginal placenta previa will persist only 2.5% of the time (17). If the placental edge is not touching the internal os at mid-trimester scan, the chance of a placenta previa at term is remote (15,18). Mustafa and colleagues, in a study of 337 gravidas examined by transvaginal ultrasound, found that in the general population, 42.3% had placenta previa at 11 to 14 weeks, 3.9% had previa at 20 to 24 weeks, and 1.9% had previa at term (19).

Because of the clinical observation that placenta previa diagnosed early in pregnancy often resolves later in pregnancy, the question of placental migration must be addressed. The phenomenon of placental migration can be attributed to two underlying causes (20). The first is trophotropism, which states that the placenta migrates toward areas of better endometrial vascularity. The second is that the placenta appears to migrate because it undergoes atrophy of the areas implanted over the cervical os, due to inadequate blood supply. Another hypothesis is that the placenta moves away from the cervical os as the lower uterine segment develops. The lower uterine segment extends during pregnancy and has been shown to change its total length from 0.5 cm at 20 weeks to 5 cm at term (21). It is noteworthy that the rate of placental migration appears to be variable (18).

Clinical Care

In patients with placenta previa, delivery occurs at a gestational age less than 36 weeks over 50% of the time. Because of this, careful management decisions must be made both in patients with a known diagnosis of previa and in those who present symptomatically with vaginal bleeding. The clinician must consider both maturity of the infant and maternal well-being.

In present-day obstetric practice, most cases of placenta previa are diagnosed early in pregnancy, and thus, management and delivery plans are started very early in pregnancy. No activity restrictions appear to be necessary in a stable patient without clinical symptoms prior to 28 weeks of gestation. Some clinicians advise against intercourse after the diagnosis is made early in pregnancy, but there is no objective data to guide the clinician. After 28 weeks of gestation in an asymptomatic patient, there are a few basic principles which are followed. Patients are counseled to present to the labor and delivery unit early with any sign of hemorrhage, and they are advised to avoid strenuous physical activity and sexual intercourse (8). Follow-up should include ultrasounds to assess the placental location. If the placenta previa resolves during this time of follow-up, no further evaluation is needed and the patient is free from activity restrictions. If, however, the placenta previa persists to the third trimester, the clinician should continue to follow serial ultrasounds and the patient should continue with activity restrictions.

In the clinical management of gravidas who present with preterm bleeding, the initial management should consist of admission to the labor and delivery unit with continuous fetal heart monitoring and monitoring of maternal vital signs. Large-bore intravenous access should be established in the mother.

Initial laboratory evaluation includes hemoglobin, hematocrit, platelet count, type and screen, and coagulation studies; Rh-immune globulin should be administered to Rh-negative gravidas. If the gestational age is <34 weeks, antenatal corticosteroids should be administered. Depending on the location of the institution and availability of neonatal care, transfer to a larger facility should be considered. Transfer of an actively bleeding patient may not be possible because of the maternal risk during transport. Of gravidas who present with an initial bleeding episode greater than 500 mL, 50% will not require immediate delivery (10). Only 5% who present initially with profuse vaginal bleeding need immediate delivery (22).

When patients with placenta previa present with a sentinel bleed, many experience uterine contractions or uterine irritability, which may augment the bleeding. Tocolytic therapy may decrease uterine irritability and decrease bleeding that is occurring secondary to uterine contractions (23). Depending on the clinical presentation, tocolysis can be utilized. Magnesium sulfate may be a better choice when compared with beta-mimetics, due to a lesser effect on the maternal cardiovascular status (24). In one retrospective study by Towers et al., 72% of patients diagnosed with placenta previa received tocolytic agents. The mean birth weight of infants born to mothers who had received tocolytics was 2276 versus 2076 g for those who did not receive tocolytic therapy (25). Neither the need for blood transfusion was increased in patients who received tocolytic therapy nor the maternal morbidity. Besinger et al. found that in the group of patients who received tocolysis, the mean birth weight was 2520 versus 2124 g in the no tocolytic group (26). Additionally, delivery was 39.2 days from admission in the group that received tocolytics versus the group that did not, where it was 26.9 days. In this study, both short-term and long-term tocolyses were used. In patients receiving only short-term intravenous magnesium sulfate treatment, the time until delivery was 15.3 days. In patients receiving longer term tocolysis, the delay until delivery was 40.9 and 47.4 days, respectively. This was statistically significant from the short-term application of tocolytics only (26). Similarly, a study by Sharma and colleagues using ritodrine as a tocolytic showed prolonged time to delivery, higher mean birth weight, no difference in bleeding episodes between the two groups, and an acceptable maternal and fetal safety profile (27).

The use of any tocolytic is controversial in modern obstetric practice. Specifically in the case of a stable patient with placenta previa and contractions, there are no prospective studies to guide the clinician. Tocolysis is appropriate to use during maternal transport. We think that tocolysis with a non-beta-mimetic is reasonable during the 48-hour window of steroid administration. There is no convincing evidence that use of long-term tocolysis in this clinical circumstance is beneficial. The use of a prophylactic tocolytic agent, such as 17-alpha-hydroxyprogesterone, to prevent the development of the lower uterine segment and possibly delay the onset of the sentinel bleed has not been investigated.

The conservative management of patients who are carrying preterm infants and are clinically stable after an initial antepartum hemorrhage includes expectant management with in-hospital bed rest. This in-hospital management includes daily fetal monitoring, fluid management, maternal blood

transfusion, if needed, and fetal lung maturity tests (25). Lam et al. assessed patients with known placenta previa and found that the overall incidence was 0.9%, with 60% of the patient experiencing antepartum hemorrhage (11). Between the patients who experienced an antepartum hemorrhage and those who did not, there was no difference in their age, parity, initial hemoglobin level, previous elective abortions, previous spontaneous abortions, previous dilation and curettages, prior cesarean sections, and history of placenta previa. In the group of patients presenting with antepartum hemorrhage, there was an increase in antenatal corticosteroid use, tocolytic administration, and an increase in emergency cesarean sections. With conservative management, this same study showed that the mean interval between bleeding and delivery via cesarean section was 3 weeks. Less than 25% of women had cesarean sections within 1 week of the initial presentation with bleeding.

In patients with previa who present with an initial bleeding episode and remain clinically stable without bleeding for 48 hours of observation, some might be eligible for outpatient management (20). For a patient to be eligible for outpatient care, she must understand her diagnosis and its implications. She should also live in close proximity to the hospital and have constant access to a telephone and transportation. In a randomized controlled trial by Wing and colleagues evaluating the significant differences in outcome between inpatient and outpatient management, there was no significant difference in mean time interval from enrollment to delivery, mean gestational age of the infant at delivery, birth weight, neonatal intensive care unit (NICU) admissions, and neonatal morbidity (22). Only 5 of 26 patients initially randomized to outpatient care had to be admitted for a third episode of bleeding, which was the criterion for changing groups in this study. Similar numbers of inpatients and outpatients had a second episode of vaginal bleeding (22). In Love's retrospective study assessing management strategy for placenta previa, the need for urgent delivery, defined as delivery within 4 hours of the presenting episode of vaginal bleeding, was unpredictable and showed no association with the number of bleeding incidents, the type of placenta previa, or outpatient management (28). Moreover, in women with placenta previa managed on an outpatient basis who needed an immediate delivery, there was no increase in maternal or neonatal morbidity and mortality (28). The decision for outpatient management needs to be individualized, with an emphasis on careful patient selection and education prior to discharge.

In most all patients with placenta previa, the mode of delivery must be cesarean section. Timing of delivery is a delicate balance between the risk of maternal bleeding and fetal prematurity. Without acute bleeding, delivery can be accomplished at 36 weeks with or without an amniocentesis. In a patient with any bleeding at a gestational age >34 weeks, it is reasonable to deliver her. In patients with a marginal placenta previa, greater than 2 cm from the internal cervical os, a vaginal delivery can be attempted; however, the facility and clinician must be prepared for immediate cesarean delivery. Additionally, there is an increased risk for postpartum hemorrhage in these patients (15).

During the cesarean delivery, two to four units of packed red blood cells should be readily available. The clinician should be prepared for significant postpartum hemorrhage. Ideally,

the placenta should not be disrupted with the hysterotomy. However, a transverse incision will most often extend through the placenta and, nonetheless, maternal and fetal outcomes remain good. The fetus should be delivered expeditiously when going through the placenta after hysterotomy. During the delivery, risk factors for blood transfusion include use of general anesthesia, history of cesarean delivery, and the need to perform a cesarean hysterectomy (29). In the case of previa with prior cesarean and suspected accreta, the incision should be made vertically, high on the uterus, above the placental implantation site.

Postpartum hemorrhage is a known risk that may occur after cesarean section for placenta previa. Hemostasis can be attempted with intravenous or intramuscular oxytocin, methylergonovine, carboprost, or uterine massage. These techniques may not be effective because the bleeding is coming from the lower uterine segment, which may not contract down well after delivery. If bleeding continues, the physician can try uterine artery ligation, bilateral ligation of the internal iliac artery, or cesarean hysterectomy as a last resort. Additional procedures to try during surgery include circular isthmic-cervical suture placement and parallel vertical compression sutures. Cervical isthmic sutures obstruct the site where the placenta was abnormally attached by interrupting the uterine blood flow below the placental implantation site (30). Dedes reported no complications from the suture placement; hysterectomy was not needed, and at ultrasonography performed 6 weeks after delivery, no abnormalities were demonstrated. Vertical compression sutures placed in the lower uterine segment can also help to achieve control of postpartum hemorrhage in patients with abnormal placentation (31). These sutures were found to effectively control bleeding in 14 women in whom they were placed, without intraoperative complications. Additionally, all women had a normal ultrasound 1 month postpartum and resumed normal menstrual flow after the conclusion of breastfeeding. If all other means for obtaining hemostasis have been attempted, and bleeding continues despite abnormal maternal coagulation status, cesarean hysterectomy can be performed. In one report, the most common cause for cesarean hysterectomy was placenta accreta (51.1%), followed by placenta previa at 26.7% (32).

PLACENTA ACCRETA

A significant risk associated with placenta previa is placenta accreta. Placenta accreta is abnormal attachment of the placenta, with an absence of deciduas basalis and an incomplete development of the fibrinoid layer. More severe variants are placenta increta and percreta, with placental extension into the myometrium and through the myometrium, respectively. Two significant risk factors for placenta accreta formation are history of a prior cesarean section and a diagnosis of placenta previa. In a patient with a placenta previa and no prior uterine scar, the risk of an accreta is 3%. However, in patients with one cesarean section and a previa, the accreta risk is 11% and increases to 67% in those with four prior cesareans (33). In the absence of a placenta previa, placenta accreta is rare (34). Because of the significant risk associated with placenta accreta, investigators have attempted to elucidate ultrasonographic signs to accurately diagnose this condition.

Multiple irregular vascular spaces in the placenta have been associated with accrete (Figure 3) (15). Other ultrasonographic signs include loss of the normal hypoechoic zone behind the placenta, focal exophytic masses in the placental bed, and a disturbed bladder-uterine connection (33,35). Doppler may also be helpful in making this diagnosis (33,35). MRI can also be used as an adjuvant tool to assess placental invasion. In one study when the placenta was implanted anteriorly overlying a previous cesarean section scar, 29% of cases were accreta (34). The major morbidity associated with accreta is postpartum hemorrhage and maternal blood loss; 55% of cases require blood transfusion, and in 15% of cases, there can be more than 5 liters of blood loss (34). Other surgical complications include ureteral transection, cystotomy, disseminated intravascular coagulation, hypotensive shock, and enterotomy.

VASA PREVIA

Vasa previa is defined as fetal blood vessels running through the membranes over the maternal cervix, unprotected by either the umbilical cord or the placenta (Figure 4). It is associated with velamentous umbilical cord insertion. With

Figure 3 Placenta previa and accreta seen on ultrasound with multiple vascular lacunae present.

Figure 4 Ultrasonographic depiction of vasa previa with fetal vessels, unprotected by umbilical cord, evident by Doppler ultrasound between fetal head and cervix.

the rupture of membranes, these fetal vessels can rupture and result in significant fetal bleeding. The fetus can lose a large portion of its blood volume; therefore, this condition is associated with a high fetal mortality rate (8). It is also noteworthy that vasa previa can be present after a low-lying placenta is visualized on a second-trimester ultrasound (15).

POST-DELIVERY COMPLICATIONS

The clinician also needs to be aware of post-delivery complications. Placenta previa is rarely associated with coagulopathy. Massive blood loss per se can be associated with coagulopathy (see chapter on postpartum hemorrhage). However, in a study by Wing and colleagues, fibrinogen was abnormal in only 1.1% of the cases, and prothrombin times were normal in all of the women with symptomatic placenta previa who were studied (36). In patients with placenta previa, there is a significant increased risk of postpartum hemorrhage, probably due to the poor contractility of the lower uterine segment. In one report, 8.3% of women with previa had postpartum hemorrhage, even without a diagnosis of placenta accreta (12). Hemoglobin and hematocrit are most likely to be abnormal of the initial laboratory studies (36). After massive blood loss, complications from hypotension can occur, including acute tubular necrosis and Sheehan syndrome.

FETAL RISKS

The most significant fetal complication is prematurity. The mean gestational age at delivery is 34 to 35 weeks of gestation. Lam et al. found that 60% of infants were born at less than 37 weeks, in 26% the infant was born at less than 34 weeks, and in 5% delivery occurred at less than 30 weeks (11). Because of this increase in premature birth rates, the neonatal mortality rate is increased threefold. Importantly, however, when controlled for gestational age at delivery, there is no association with intrauterine growth restriction. There is not a difference in the birth weight of term infants (11). There is a slightly elevated risk of fetal anemia. In women with placenta previa who experience antepartum hemorrhage, neonatal risks include respiratory distress syndrome, lower birth weight, lower Apgar scores, and an increase in NICU admission (11).

SPECIAL CIRCUMSTANCES

First-trimester bleeding is a common problem for an obstetrician. Typically, placenta previa is not associated with first-trimester bleeding; it has been shown, however, that threatened abortion is a 2.5-fold increased risk factor for placental abruption and placenta previa (37). Varma found that if a placenta previa is detected with ultrasound in the first trimester or early second trimester, it is linked to an increase in vaginal bleeding during pregnancy, an increased rate of spontaneous abortion, and an increased chance of a placenta previa persisting to a later gestational age (38). Obed and colleagues examined 374 patients with threatened abortion; they found that 2% had placenta previa, compared with a control group rate of 1% for the same diagnosis (37).

While second-trimester bleeding is less common than first-trimester bleeding, if bleeding does occur, it is necessary to elucidate the cause of the bleeding. Two common causes are placenta previa and non-previa bleeding that is most likely associated with placental abruption (39). Towers and Burkhart

found that in gravidas who bleed between 16 and 24 weeks, the best outcomes were associated with light bleeding, whether or not the patient was diagnosed with a placenta previa. The worst outcome was associated with a patient who presented with heavy vaginal bleeding, not attributed to a placenta previa; 50% of these pregnancies were lost prior to viability (39).

A patient with a known placenta previa and either an intrauterine fetal demise or a fetus with chromosomal or structural abnormalities diagnosed in the second trimester presents a special problem for the clinician. In these patients, the safest approach for termination of the pregnancy needs to be decided. Halperin retrospectively studied 306 gravidas; 2.6% had a complete placenta previa and underwent laminaria placement and subsequent dilation and evacuation (40). This study found no difference in operative time, the need for packed red blood cells, postoperative morbidity, duration of hospital stay or bleeding with laminaria placement, when comparing those with and without placenta previa. In Thomas's retrospective study, there was slight increase in blood loss in patients with placenta previa; however, there was no increase in blood transfusion, infection, or postoperative complications (41). Most patients with placenta previa have a previous cesarean section; however, it has been shown that even in patients with prior uterine surgery who undergo laminaria placement and subsequent dilation and evacuation, there is no increase in anesthetic complications, uterine perforation, mean operative time, or cervical lacerations (42).

In pregnancy complicated by placenta previa with fetal demise or fetal anencephaly after 22 weeks of gestation, hysterotomy is the generally accepted practice for delivery. It may be possible in rare cases, after fetal demise has occurred, to attempt vaginal delivery by expectantly managing the patient, allowing the vascularity of the placenta to decrease. There are risks of conservative management in such cases, which include bleeding and coagulopathy. Delivery must occur in a facility where immediate cesarean can be performed. In such cases, maternal care must be individualized.

PLACENTAL ABRUPTION

Placental abruption is defined as separation of the placenta from the maternal endometrium that occurs before birth. This leads to bleeding at the site of separation from local maternal blood vessels. Most often, the maternal blood then tracks downward between the fetal membranes and uterine wall and comes out of the cervix. If this bleeding remains trapped behind the placenta and is not clinically evident, then the abruption is "concealed." This occurs in approximately 10% of cases. This placental separation may occur secondary to an acute process, such as maternal trauma, or from a chronic process, such as maternal smoking.

The etiology of abruption is unknown. Some cases are associated with rapid changes in uterine size or shape. This is the case with maternal trauma or abruption that can occur after delivery of one fetus in a multifetal pregnancy or after reduction amniocentesis. Other cases may be related to acute vascular changes in the mother, such as that which may occur after maternal cocaine use. Abruption may also occur in association with chronic placental disease. It is known that

Table 2 Risk Factors for Placental Abruption	
Maternal trauma	Cigarette smoking
Maternal cocaine use	Hypertension during pregnancy
Abruption in a previous pregnancy	Premature rupture of membranes
Reduction amniocentesis	Polyhydramnios
	Chorioamnionitis
Disorders of maternal fibrinogen	Advanced maternal age

abruption is increased, for example, in gravidas with elevated maternal serum alpha fetoprotein levels. Low Papp-A levels are similarly associated with abruption. Serum levels of placental growth factor are decreased in gravida who subsequently develop placental abruption (43). Thrombophilia disorders are common, and some studies have noted an association between thrombophilia and placental abruption (44–47). This association, however, does not establish thrombophilia as a cause of abruption. Newer prospective studies are finding little association between inherited thrombophilias and pregnancy complication such as placental abruption. Currently, there is no evidence that patients with a history of abruption and known thrombophilia should be treated with heparin during pregnancy for the prevention of abruption recurrence (48). It is reasonable to use folate to treat hyperhomocysteinemia in patients with prior abruption. Risk factors for abruption are shown in Table 2 (49–53).

Clinical evidence of abruption occurs in approximately 1% of pregnancies (49). The frequency is higher than this if one considers abnormal placental findings in asymptomatic gravidas. The spectrum of clinical disease ranges from mild bleeding with a stable mother and baby to fetal death with heavy maternal bleeding and coagulopathy. It is estimated that an abruption of 50% of the placental surface volume will cause fetal mortality. Abruption severe enough to cause fetal loss is estimated to occur with a frequency of 1 in 830 births (54). Clinical observation indicates that abruption occurs most frequently during the gestational age of 24 to 26 weeks, with a decreasing frequency as the pregnancy progresses to term (49). Abruption is important clinically because it can be a cause of premature birth, with consequent increased perinatal mortality.

The diagnosis of abruption is clinical. Clinical findings include uterine hypertonus with pain and vaginal bleeding. This helps the clinician to distinguish abruption from previa; with placenta previa, painless vaginal bleeding is most commonly seen. The diagnosis can be confounded because, as mentioned above, in some cases of abruption, bleeding is concealed and pain may be insignificant. Abruption should be suspected in a gravida who presents with abdominal or back pain, with vaginal bleeding, or even with symptoms of preterm labor. Typically the uterine contractions are described as high frequency/low amplitude. This pattern may occur as a focal uterine response to limit bleeding at the point of placental separation. The amount of vaginal bleeding observed may not correlate with the extent of abruption. Furthermore, the rate of progression or extension of abruption is unpredictable. Clinicians have noted “port-wine”-colored amniotic fluid in some cases of placental abruption.

The main usefulness of ultrasound lies in finding the placenta location and excluding placenta previa. It is well known that abruption may not be visible on ultrasound study, because the blood may be similar in appearance to the placenta. A retroplacental blood collection may also be hyperechoic or hypoechoic relative to the placenta. If a hyper- or hypoechoic mass is seen in a pregnant women with the classical presentation of abruption, then the sonographic accuracy for diagnosis of abruption is high. Sonography, however, cannot be used to exclude abruption. Nyberg et al. reviewed 57 cases of placental abruption sonographically and noted that acute hemorrhage was difficult to distinguish from the adjacent placenta and may be isoechoic with the placenta (55). Resolving hematomas became hypoechoic over 1 to 2 weeks of time period. Some cases were confused with other mass lesions. Glantz reported ultrasound findings on 149 patients with vaginal bleeding after 24 weeks of gestation and confirmed the poor sensitivity of ultrasound in the detection of placental abruption (56).

CLINICAL MANAGEMENT

Abruption can present as an acute or a chronic process. Acute abruption typically presents clinically with pain and bleeding. In a patient who presents with abdominal pain and vaginal bleeding after the period of fetal viability, the clinician must quickly assess maternal and fetal status. It is necessary to obtain IV access and to send blood for type and crossmatch, as well as coagulation studies. A Kleihauer-Betke test, to assess for fetal cells in the maternal circulation, may be indicated only in the Rh-negative mother. The most important parameter in the coagulation panel is maternal fibrinogen level. In normal pregnancy, fibrinogen levels increase. A fibrinogen level below 250 mg% is low during pregnancy and levels below 150 mg% are critically low. A clot (red top) tube can be used to rapidly estimate maternal coagulation status (see chapter on postpartum hemorrhage). If the fetus is alive (less than 50% abruption) and at a viable gestation age, then electronic fetal monitoring (EFM) is used to assess fetal status. After a bedside ultrasound excludes previa, a vaginal exam to assess cervical status is safe to do and is clinically indicated to assess the status of labor.

If fetal demise has occurred, the goal is to accomplish vaginal delivery while minimizing maternal morbidity. Maternal anemia and coagulopathy, if present, can be corrected by transfusion of packed red blood cells and fresh frozen plasma. Coagulopathy is more commonly seen with large abruptions, and it may be seen in up to 30% of cases where abruption causes fetal demise. Clinically, labor in most cases is rapid, and vaginal delivery can be accomplished despite maternal bleeding. In the case of massive bleeding in a mother remote from delivery, cesarean delivery may be needed for maternal indications, despite the fetal demise. When performing a cesarean section on a mother with coagulopathy, blood products to correct coagulopathy (fresh frozen plasma, platelets) should be infusing at the time of the initial skin incision, if possible.

Cesarean is also indicated in cases of abruption with a living fetus at a viable gestational age, if there is evidence of abnormal EFM. Ominous findings may include sustained fetal bradycardia or recurrent late decelerations. Rapid delivery in cases of fetal bradycardia may improve fetal outcome in pregnancy

complicated by abruption. The uterine incision at the time of cesarean is dictated by obstetric indications. A vertical incision may be needed if the fetus is a premature breech or back-down transverse lie. Bleeding will usually abate after delivery of the placenta and correction of coagulopathy, if present.

At the time of cesarean section, the obstetrician may note a dark purple discoloration of the uterus. This is called a Couvelaire uterus; it is caused by extravasation of blood into the myometrium. This was described by Alexandre Couvelaire, a French obstetrician, who wrote a classic paper on the subject in 1911 (57). He termed the condition "uterine apoplexy" and noted that blood from abruption could extravasate not only into the uterine muscle but also into the serosa of the uterus, the broad ligament, and the pelvic peritoneum. Initially it was thought that Couvelaire uterus was an indication for hysterectomy, but with the current therapy for coagulopathy, Couvelaire uterus per se is not considered an indication for hysterectomy.

Following delivery, bleeding may continue due to coagulopathy or uterine atony, and these conditions can be managed medically, as they would in a patient without abruption (see chapter on postpartum hemorrhage). After surgery, the patient should be monitored closely, and general parameters include transfusing packed red cells to keep the hematocrit at or near 30%, platelets above 50,000/ml, and fibrinogen above 150 mg%. Fluids are given to maintain urine output at >30 cc/hr. Serial assessments of complete blood count and coagulation parameters are needed.

Chronic abruption presents a clinical dilemma because there is no known way to predict recurrent bleeding or extension of abruption. Second-trimester bleeding in the absence of previa most commonly is from marginal placental abruption, and perinatal mortality is increased. In cases managed conservatively after fetal viability, steroids should be given to the mother to enhance fetal pulmonary maturity. If bleeding abates for 48 hours and the fetus has reassuring testing, the patient may be discharged to close outpatient follow-up. Since abruption is associated with growth restriction, it is important to perform serial ultrasound evaluation for growth.

RECURRENCE RISKS

Previous abruption is a known risk factor for recurrence in a subsequent pregnancy. The recurrence risk is estimated to be 5% to 15%. If the initial abruption was from a temporary risk factor such as trauma, then the recurrence risk may be lower. In abruption associated with modifiable risk factors, such as maternal smoking or cocaine use, quitting these activities will decrease the recurrence incidence. An interesting observation is that quitting smoking before pregnancy may not reduce the abruption recurrence risk to that of the general population. The abruption risk of former smokers remains elevated (58). In gravidas whose prior pregnancy was complicated by abruption, there is an increase in growth restriction, pre-eclampsia, and preterm birth in subsequent pregnancies, in addition to abruption. This suggests a common etiologic process of vasculopathy in these conditions.

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