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PLACENTAL ABNORMALITIES

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INTRODUCTION

Obstetric hemorrhage is still considered to be one of the leading causes of maternal mortality and morbidity[1–7]. Placental abnormalities are a major contributor to obstetric hemorrhage. The common abnormalities include placental abruption, placenta previa, morbidly adherent placentae (accreta, increta, percreta) and retained placenta. These abnormalities, for example, accounted for 36% of pregnancy-related deaths due to hemorrhage in one series[8].

PLACENTA PREVIA

Placenta previa is defined as partial or complete insertion of the placenta onto the lower uterine segment after fetal viability (20 weeks in developed countries and 24–28 weeks in developing countries). Four grades of placenta previa are recognized (Figure 1):

(1) Grade I: placenta is in the lower segment but its edge does not reach the internal os;

(2) Grade II: lower placental edges reach the os but do not cover it;

(3) Grade III: edge covers the os and the placenta is asymmetrical;

(4) Grade IV: placenta symmetrically covers the os.

Although this classification/grading system is the most common, others reflect the ultrasound definition of the placental site.

An alternative anatomical grading is provided below:

(1) *Total placenta previa*: where the internal cervical os is completely covered by placenta;

(2) *Partial placenta previa*: where the internal os is partially covered by placenta;

(3) *Marginal previa*: where the edge of the placenta is at the margin of the internal os but does not cover it;

(4) *Low-lying placenta*: where the placental edge does not reach but is in close proximity to the internal os.

This other classification depends on the state of the cervix at the time of examination; for example, a low-lying placenta at 2 cm dilatation may

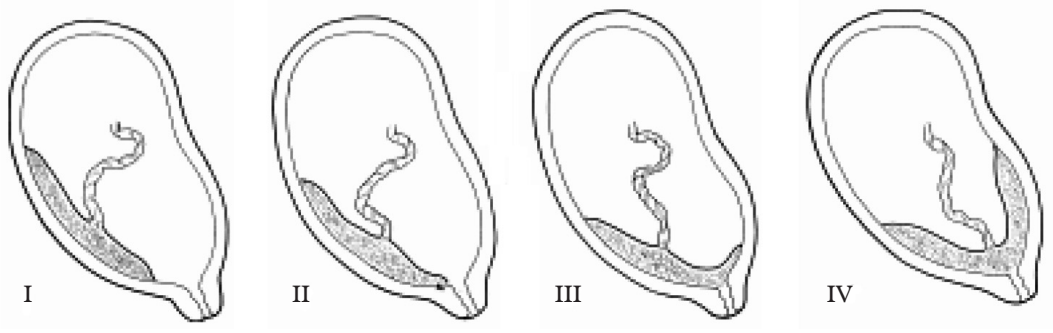

Figure 1 Grades of placenta previa: I, Encroaching on the lower segment; II, reaching the internal os; III, asymmetrically covering the internal os; IV, symmetrically covering the internal os

become a partial placenta at 8 cm dilatation. Since a digital examination is not recommended in cases of placenta previa, this alternative classification has limited clinical application.

Incidence and risk factors

The overall incidence is variable in different series, but is on average 1 in 300 deliveries[9,10]. Risk factors for placenta previa include:

(1) It is thought to be more common with advanced *maternal age*. This may, however, be a reflection of increased parity rather than age. However, a rise in incidence from 0.3% to 0.7% over a 10-year period has been attributed to a shift to an older obstetric population[11].

(2) Women of higher *parity* have a higher incidence[12].

(3) *Multifetal gestation*: secondary to an increase in the surface area occupied by the placental mass[13].

(4) The incidence increases with the number of *previous Cesarean section deliveries*[14,15]. A single Cesarean section increases the risk by 0.65%, two by 1.5%, three by 2.2% and four or more by 10%. A previous Cesarean section in association with placenta previa increases the risk of Cesarean hysterectomy almost four-fold[11].

(5) *Smoking* doubles the risk of placenta previa[13–16]. This may be attributed to placental hypertrophy secondary to carbon monoxide hypoxemia[16].

(6) Patients with *placenta previa* have 12 times the usual risk of having a recurrent previa in subsequent pregnancies.

(7) For unclear reasons, *fetal anomalies* are increased with placenta previa even after control for maternal age[9]. It is also uncertain if there is an association with intrauterine fetal growth restriction[17,18].

Diagnosis

This can either be clinical or by imaging.

Clinical

The most characteristic feature is *painless vaginal bleeding*. This is usually *recurrent* and *unprovoked* and does not commonly appear until the end of the second trimester. The first episode is usually self-limiting and is rarely so profuse as to prove fatal. However, the earlier in pregnancy the first presentation of bleeding, the more likely is the later need for early intervention. 'Fetal distress' is unusual unless the hemorrhage is severe enough to cause maternal shock.

Abdominal palpation is not diagnostic but, where the presenting part is free in late pregnancy or abnormal, placenta previa should be suspected.

Sometimes, especially with minor degrees of placenta previa, bleeding might not appear until the onset of labor. This may clinically mimic abruption (see below).

The possibility of placenta previa should always be considered in women who present with bleeding in the latter half of pregnancy. The diagnosis can seldom be made solely on a clinical basis.

There is no role for digital examination in the diagnosis unless in the operating theater as part of the double set-up with adequate preparation for proceeding to Cesarean section. Although uncommon, where imaging (see below) is easily available and reliable, it remains useful in cases where the diagnosis is in doubt and where double set-up facilities are unavailable.

Imaging

The most commonly used method of placental localization in modern obstetrics is *ultrasound scan*. It is safe, accurate and non-invasive and is the method of choice for making the diagnosis. The gestational age at which diagnosis is made significantly influences accuracy. The earlier the scan is performed, the more likely the placenta is to be found in the lower pole of the uterus. Consequently, routinely localization of the placenta at the 20–22 weeks' gestation anomaly scan poses several questions. For example, is a low-lying placenta at this stage predictive of placenta previa at the time of delivery, or does such screening reduce the adverse outcome for the

pregnancy? More importantly, should the scan be repeated at 32–34 weeks' gestation and does the asymptomatic patient have to be admitted and if so when?

About 28% of placentas in women scanned transabdominally before 24 weeks are found to be 'low' but by 24 weeks this drops to 18% and only 3% are low-lying by term[19]. Conversely, a false-negative scan for a low placenta is found in as many as 7% of cases at 20 weeks[20]. Such results are more common when the placenta is posterior, the bladder is over-filled, the fetal head obscures the margin of the placenta, or the operator fails to scan the lateral uterine wall[21]. A low-lying placenta is more common in early pregnancy because the lower segment does not exist. This apparent 'placental migration' is due to enlargement of the upper segment and formation of the lower segment, with many apparently low placentas being found to be above the lower segment. Comeau and colleagues[22] and Ruparelia and Chapman[23] have shown that the more advanced the pregnancy is, the more accurate a scan diagnosis of placenta previa will be.

Transvaginal ultrasound is not only more accurate in diagnosing placenta previa but it is more precise in defining the relationship of the lower edge of the placenta to the internal os (Figure 2). Placenta previa is diagnosed on transvaginal ultrasound scan when the placental edge is less than 3 cm from the internal os. Where the distance between the lower edge of the placenta and the internal cervical os is measured, the persistence of a low-lying placenta at a later gestation is higher. Taipale and colleagues[24], for example, observed that, if a placenta overlapped the internal os by at least 25 mm at 18–23 weeks, the positive predictive value for previa at delivery was 40% with a sensitivity of 80%. Indeed, Becker and colleagues[25] found that, when the lower edge overlapped the os by at least 25 mm at 20–23 weeks, a vaginal delivery was not possible at all at term (i.e. it had a 100% positive predictive value).

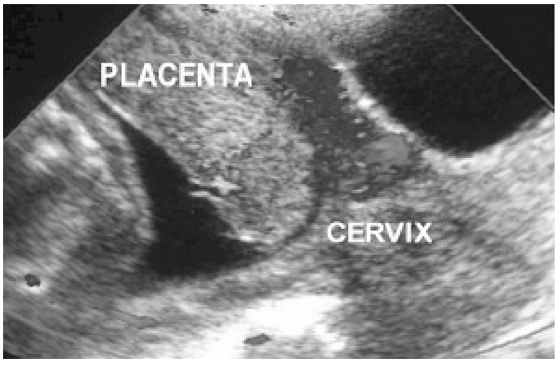

Figure 2 Transabdominal ultrasound scan with superimposed color Doppler signal showing an anterior placenta previa

Although the routine practice of localizing the placenta at the anomaly scan will no doubt continue, its limitations should be recognized and, wherever possible, transvaginal ultrasound scans should be offered to improve the accuracy of localization and also measure the distance from the os to the placental edge to help define the degree of 'low lying'.

Since there are no randomized, controlled trials of the effect of routine localization versus no localization on the mother and fetus, current practice will have to be governed by large-cohort case studies. It is, however, easy to assume that, where there is a low-lying placenta, education of patients and carers enhances the chances of a better outcome for mother and baby. Whether such patients should be routinely admitted at a later gestation is debatable. Most units do not, however, routinely admit but repeat the scans at 32–24 weeks' gestation. Dashe and colleagues[26] observed that persistence of placental previa diagnosed at 20–23 weeks occurred in 34% of cases at delivery, whereas 73% of those present at 32–35 weeks persisted at delivery. A policy of routine scanning will therefore reduce the false-positive rates but will be at the expense of increasing workload and patient anxiety. Unfortunately, none of the studies reported on the proportion of patients with low-lying placentas diagnosed at 32–34 weeks that later presented with bleeding. For units not routinely scanning for placental site at 20 weeks, scanning for placental site is only indicated with abnormal presentation, vaginal bleeding or a chance finding when ultrasound was undertaken in late pregnancy for other reasons. For such cases, a transvaginal approach is recommended as it is associated with a better diagnostic accuracy, especially with posterior placenta previa[27,28]. This approach has been shown to be safe and is well tolerated.

Transperineal sonography has been used by some investigators[29]. It allowed easy visualization of the internal os in all cases and carried a positive predictive value of 90% and a negative predictive value of 100% for placenta previa.

Magnetic resonance imaging (MRI) has been used to visualize placental abnormalities including placenta previa (Figure 3). It has the advantages of being an objective, reproducible test, minimizing the operator error. However, due to cost and logistic limitations, it is unlikely that it will replace ultrasonography for routine evaluation[30,31].

Management

Management depends on whether the patient is symptomatic or not. Asymptomatic patients (where the diagnosis is made on ultrasound scan) are managed expectantly, often as for those with mild symptoms that are non-threatening to either the mother or fetus.

Those with symptoms can be divided into four categories depending on the maternal condition, severity of hemorrhage, the gestational age and the neonatal facilities available in the unit. These categories are:

(1) Pregnancy < 37 weeks' gestation without threat to the mother;

(2) Pregnancy > 37 weeks without threat to the mother;

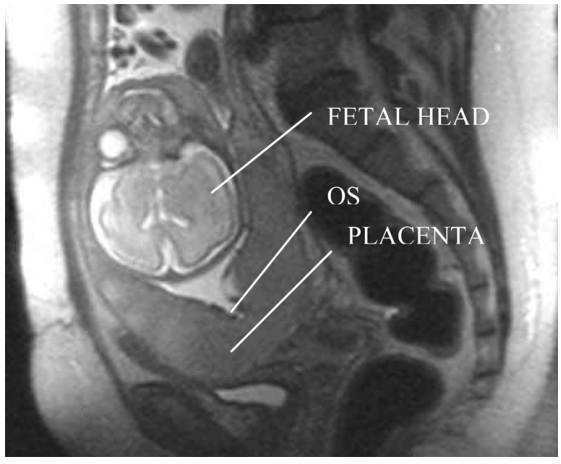

Figure 3 MRI of a grade IV placenta previa (completely covering the internal os)

(3) Severe life-threatening, non-stopping (continuing) hemorrhage < or > 37 weeks;

(4) Hemorrhage associated with uterine contractions.

The management of the third and fourth categories is immediate delivery by Cesarean section. In the presence of non-life-threatening hemorrhage after 37 weeks' gestation, a planned delivery is also advisable. This must, however, be with the recognition that such a hemorrhage could very rapidly become life-threatening. For category 1, the best approach is expectant management, although this must not be to the detriment of maternal life.

Expectant management

The perinatal mortality in placenta previa is directly related to gestational age at delivery[32–35]. Macafee[33] and Johnson and colleagues[35] introduced expectant management of placenta previa with the aim of achieving maximum fetal maturity possible while minimizing the risks to both mother and fetus, the overall objective being to reduce perinatal mortality, and, at the same time, reducing maternal mortality. This management plan was based on the assumption that most episodes of bleeding are usually small, self-limited and are not fatal to the fetus or mother in the absence of provoking trauma (e.g. intercourse, vaginal examination) or labor, and that a proportion of cases, particularly those presenting early with lesser degrees of previa, may resolve to permit vaginal delivery. More recently, an improvement in perinatal mortality attributed mainly to prolongation of pregnancy with expectant management has also been reported[36,37].

Although Macafee[33], in his regimen, advocated that the patient remained as an inpatient in a fully equipped and fully staffed maternity hospital from the time of initial diagnosis to delivery, a policy of permitting a selection of women to return home has also been advocated[38] as part of expectant management, but remains controversial. Cotton and colleagues[32] reported no difference in their perinatal and maternal mortality rates in those sent home and those managed in hospitals, whereas D'Angelo and Irwin[39] suggested keeping the mother in

hospital until delivery was justified, on the grounds that neonatal mortality and morbidity and cost of treatment were reduced. Kaunitz and colleagues[40], in a review of 355 maternities managed at home, however, reported one intrapartum death from placenta previa.

This controversy is more evident in cases of asymptomatic transvaginally diagnosed placenta previa. For this group, it is becoming increasingly acceptable to manage them at home[41,42]. In a review of 15 930 deliveries in Edinburgh, Love and Wallace[43] concluded that, while clinical outcomes were highly variable and cannot be predicted from antenatal events, the majority of cases with or without bleeding, irrespective of the degree of previa, could be managed on outpatient bases. There are no randomized, controlled trials on the different approaches to this aspect of placental previa and such evidence is urgently needed to enable rationale decision-making in clinical practice.

Although most experts will advocate immediate delivery where there is severe hemorrhage (heavy vaginal bleeding producing maternal hypovolemia), it is, however, not considered a contraindication to expectant management[43]. An aggressive approach involving admission and repeated blood transfusions improves perinatal morbidity and mortality, especially where the bleeding occurs very early in pregnancy. In one study, where approximately 20% of the women lost over 500 ml of blood, half of them were managed expectantly with a mean gain in gestation of 16.8 days[44]. Crenshaw and colleagues[34], on the other hand, managed only 43–46% of patients successfully with an aggressive expectant approach, whereas Cotton and colleagues[32], with an aggressive approach, successfully managed 66% of women expectantly.

During expectant management, preterm labor remains a problem. Brenner and colleagues[45] found that 40% of women with placenta previa had prelabor rupture of membranes, and went into spontaneous labor or other developed problems that resulted in delivery before 37 weeks' gestation. Inhibiting contractions in those with preterm labor would seem logical, but some regard antepartum hemorrhage as a contraindication to the use of tocolytics[46]. With vaginal bleeding and uterine contractions, placental abruption, which is widely regarded as a contraindication to tocolysis, cannot be excluded. In addition, placental abruption is said to coexist with placenta previa in 10% of cases, and tocolytics cause maternal tachycardia and palpitations, features that could be confused with hypovolemia. Sampson and colleagues[47] advocate the use of tocolytics in cases of placenta previa and uterine contractions after 21 weeks and cite a reduction in perinatal mortality from 126 to 41 per 1000.

Mild blood loss in placenta previa is not associated with a significantly high perinatal mortality. In contrast, significant blood loss is associated with a high perinatal loss. Liberal use of blood transfusion has been reported to nullify this effect[32]. Although there is no theoretical limit to the number of blood transfusions a patient can have, most blood banks do not have endless supplies. To optimize oxygen supply to the fetus and protect the mother against anticipated future blood loss, the ideal aim of transfusion should be to maintain a hemoglobin level of at least 10 g/dl or a hematocrit of 30%.

Despite expectant management, 20% of women with placenta previa are delivered earlier than 32 weeks. These cases account for 73% of perinatal deaths[32]. They remain a major problem and, although the use of cervical cerclage has been advocated, this is generally not used. The neonatal mortality and morbidity are reduced in this group by maternal corticosteroid administration.

Continuous hospitalization is costly and has an associated psychological effect of separation on families. In developing countries, this may be unaffordable to many families. However, the advantages include easy access to resuscitation and prompt delivery and ensuring bed rest (which anecdotally has been thought to decrease the occurrence of hemorrhage) as well as limitation of activities. With improvement in transportation facilities and ambulance services in developed countries, highly motivated women who clearly understand the necessity of restriction of activity and are within, for example, 15–30 min of the hospital perhaps may be monitored at home. This will only apply to cases of grades I–III placenta previa or asymptomatic grade IV. In all cases of expectant management, cross-matched blood (two units) must be

available at all times. However, in many hospitals this requirement is the *sine qua non* of a limitation on therapeutic options.

Method of delivery

A diagnosis of placenta previa means delivery by Cesarean section, but this is not inevitable, especially where the previa is to a minor degree. For the minor degree of placenta previa (grade I or II anterior) and an engaged fetal head, pregnancy may be allowed to continue beyond 37–38 weeks and vaginal delivery anticipated. In such patients, amniotomy followed by syntocinon can be considered.

In patients with a major grade of placenta previa (grade II posterior, grades III–IV), delivery should be by elective or emergency Cesarean section. The former is ideal since emergency delivery has a negative effect on perinatal mortality and morbidity, independent of gestational age. Cotton and colleagues[32] found that 27.7% of babies born as emergencies had anemia compared to 2.9% delivered electively.

Cesarean section for placenta previa poses several problems. It should, therefore, never be left to an inexperienced obstetrician. The Royal College of Obstetricians and Gynaecologists in the UK recommends that such Cesarean sections are performed by consultants. Although general anesthesia was preferred to regional in the past, there is an increasing tendency to using the latter especially as Frederiksen and colleagues[48] demonstrated not only its safety but a reduction in intrapartum blood loss compared to that with general anesthesia.

Procedure

Epidural analgesia is increasingly being advocated for Cesarean section (in developed countries) although Moir[49] considers placenta previa to be an absolute contraindication to an epidural. This is because epidurals, by lowering the blood pressure, may critically reduce uterine and placental perfusion. Crawford[50], however, believes that, in experienced hands, an epidural is safe. Indeed, an increasing number of anesthetists offer regional anesthesia to these patients[30,31]. Where the patient's condition is stable and there is no active bleeding, epidural or spinal anesthesia should not be regarded as contraindicated provided an experienced anesthetist is available.

The uterine incision should be a transverse lower segment incision (if possible), provided there is a lower segment. Where the lower segment is non-existent or is very vascular, some obstetricians advocate a classical or a De Lee's incision. Scott[51], however, believes that such incisions are rarely justified because of their consequences and long-term disadvantages. When difficulties are encountered with transverse lower segment incisions, these may be converted to inverted T-, J- or U-shaped incisions.

Where the placenta is anterior, two approaches are available for incising the uterus, going through the placenta or defining its edge and going through the membranes above or below the placenta. The former approach requires speed and may result in significant fetal blood loss[52]. The latter, however, may be associated with undue delay in the delivery of the fetus, more troublesome bleeding from a partially separated placenta and therefore fetal blood loss and anoxia. Myerscough[52] advises against cutting or tearing through the placenta because of the inevitable fetal blood loss that occurs as fetal vessels are torn. Because the lower segment is less muscular, contraction and retraction, which result in the occlusion of the sinuses of the placental bed, are inadequate, and intraoperative hemorrhage is therefore not uncommon[53]. Where hemostasis is difficult to achieve, bleeding sinuses could be oversewn with atraumatic sutures[51]. If this is unsuccessful, packing the uterus is possible, but the major disadvantage is that, by leaving the pack *in situ* during closure of the uterus, the bleeding may continue but remain concealed for some time as the pack is soaking through. The use of balloons with a tamponading effect on the bleeding placenta bed or intramyometrial injection of prostaglandin $F_{2\alpha}$ has been shown to be useful in such cases[52]. More recently, where the facilities are available, uterine artery embolization has been used with excellent results. The difficulty with this is planning to ensure that the facilities and the interventional radiologist are available on the labor ward during the delivery. When the bleeding remains uncontrollable,

ligation of the internal iliac artery or even hysterectomy may be necessary as the last resort (see Chapters 32 and 34).

PLACENTAL ABRUPTION

The Latin term *abruptio placentae* means '*rending asunder of the placenta*', implying and denoting a sudden accident, which is a valid clinical characteristic of most cases. It represents bleeding due to premature separation of a normally sited placenta after fetal viability. The initial event in abruption is bleeding into the decidua basalis.

Incidence and risk factors

It occurs in about 1 in 200 pregnancies[10], although higher incidences have been reported[54]. When placentas are examined routinely, the incidence is much higher at 4.5%[55] suggesting that small episodes are more common than those diagnosed clinically. Placental abruption can be revealed or concealed (Figure 4), the former occurring in 65–80% of cases. The concealed type is clinically more dangerous as it is often associated with more severe complications.

Risk factors for placental abruption include:

(1) *Parity*: more common in women of higher parity;

(2) *Age*: more common in older women but this may again be a reflection of parity rather than age;

(3) *Previous placental abruption*: this varies from 6 to 16.7% after one episode and 25% after two episodes. Up to 7% of those with abruption severe enough to result in fetal death have the same outcome in a subsequent pregnancy and 30% of all future pregnancies in women who have a placental abruption do not result in a living child[56–59].

(4) *Premature rupture of fetal membranes*: a meta-analysis of 54 studies demonstrated a three-fold increase in the risk of abruption[60] and this risk was much higher with rupture between 20 and 36 weeks' gestation and if rupture was for longer than 24 hours[61,62];

(5) *Cigarette smoking*: the incidence in smokers is almost double that in non-smokers; smokers who quit have an associated reduction in risk;

(6) *Cocaine use*: significantly increased risk compared to non-users[63];

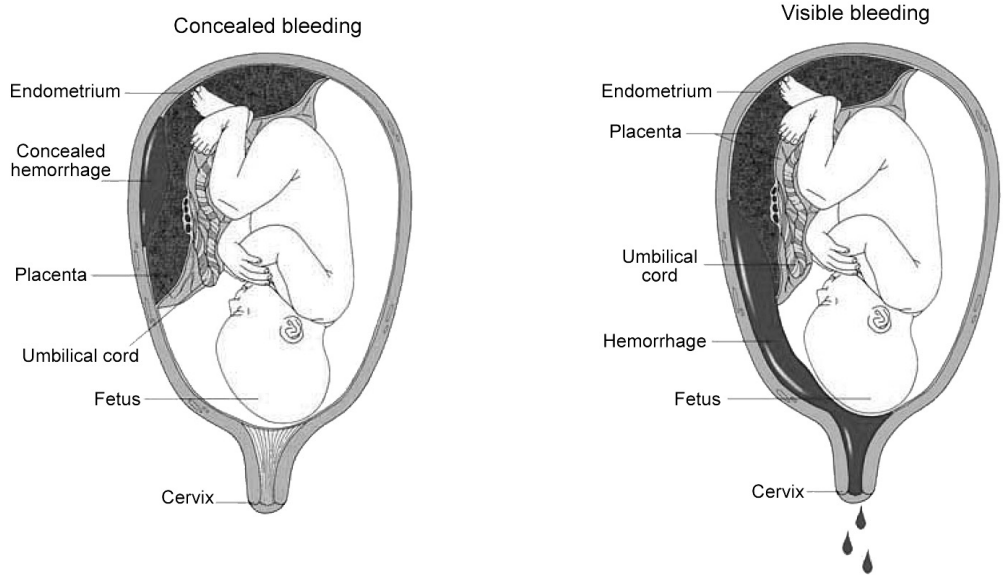

Figure 4 Concealed and revealed placental abruption

(7) *Abdominal trauma*: placental abruption complicates 1–6% of minor injuries and up to 50% of major injuries[64];

(8) *Sudden decompression of the uterus after membrane rupture*, e.g. in twin pregnancies, external cephalic version or pregnancies with polyhydramnios;

(9) Unexplained raised α-fetoprotein;

(10) Hyperhomocysteinemia and thrombophilias, especially factor V Leiden[65,66];

(11) Hypertensive disorders of pregnancy.

Diagnosis

Unlike placenta previa where ultrasound is the mainstay of diagnosis, the diagnosis of placental abruption is usually made on clinical grounds (Table 1). Ultrasonography may, however, be helpful in certain instances, for example, where there is a large retroplacental hematoma. This, however, is an uncommon finding even in severe cases. The symptoms and signs are diagnostic in moderate to severe cases. In the mild forms, the diagnosis may not be obvious until after delivery when a retroplacental clot is identified.

Placental abruption classically presents with vaginal bleeding, abdominal pain, uterine contractions and tenderness. Vaginal bleeding, however, is a symptom in no more than 70–80% of cases[28]. The bleeding which occurs after the 36th week of gestation in about 50% of cases[28] is characteristically dark and non-clotting. Because labor is the commonest factor precipitating placental separation[70], nearly 50% of patients with placental abruption are in established labor. The presence of uterine contractions may, however, be difficult to distinguish from the abdominal pain of abruption which is often unremitting. Where this distinction is possible, the contractions are characteristically very frequent with a rate often of over five in 10 min[71].

Table 1 Clinical picture of placental abruption[71]

Symptom/sign	*Frequency* (%)
Vaginal bleeding	78
Uterine tenderness or back pain	66
Fetal distress	60
Preterm labor	22
High-frequency contractions	17
Hypertonus	17
Dead fetus	15

The absence of abdominal pain does not exclude placental abruption, especially where the placenta is posteriorly sited. This is evidenced by the so-called 'unsuspected or silent abruption' referred to by Notelovitz and colleagues[72] and the higher pathological incidence of placental abruption found by Fox[55]. The presence of pain is probably indicative of extravasation of blood into the myometrium. In severe cases (grade 3), the pain is sharp, severe and sudden in onset. Some patients may, in addition, present with nausea, anxiety, thirst, restlessness and a feeling of faintness, whereas others may complain of absent or reduced fetal movements.

Some patients present with signs of shock where the blood loss is significant (tachycardia predominates; blood pressure has a poor relation with blood volume in this condition). The presence of hypertension may, however, mask true hypovolemia but an increasing abdominal girth or a rising fundal height must raise the suspicion of significant concealed hemorrhage. Typically, the uterus is 'woody hard' in severe cases where the fetus is difficult to palpate and a continuous fetal heart rate monitor or real-time ultrasonography is essential to identify the fetal heart beat. The fetus may be 'distressed' with fetal heart rate abnormalities or it may be dead. The former occurs in grades 1–2, but, in grade 3, the latter is an invariable occurrence by definition[73]. In severe cases complicated by disseminated intravascular coagulation, there may be absence of clotting in the vaginal blood loss, which is dark-colored. The incidence of coagulopathy varies from 35 to 38%[57,74] and this occurs mainly in the severe forms.

A vaginal examination reveals blood clots in the vagina, which is typically non-clotting. Serous fluid from a retroplacental clot may be confused with liquor. The cervix may be dilating since 50% of cases are in labor. If the membranes are ruptured, blood-stained liquor is usually present.

Ultrasound scan is not a sensitive method of diagnosing placental abruption but is useful in

excluding coincident placenta previa, which is present in 10% of cases. Where the retroplacental clot is large, ultrasonography identifies it as hyperechogenic or isoechogenic when compared to the placenta. Such echogenicity may therefore be misinterpreted as a thick placenta[75]. A resolving retroplacental clot appears hyperechogenic within 1 week and sonolucent within 2 weeks.

Though ultrasound scan is not an accurate diagnostic tool, it is useful in monitoring cases managed. The size of the hematoma, location and change in size over time and fetal growth are all parameters monitored by ultrasound scan. A Kliehauer–Betke test may be useful in making the diagnosis when a patient presents with abdominal pain but without vaginal bleeding or even in cases of 'unsuspected or silent abruption'.

Management

The severity of the abruption, the state of the fetus and the gestational age of the pregnancy all impinge on management which can be divided into general and specific measures. Sher and Statland[76] divided placental abruption into three degrees of severity upon which management can be based. These are shown in Table 2.

General management is similar to that for any patient presenting with bleeding (see above under placenta previa). The specific measures include immediate delivery, expectant management and management of complications.

Immediate delivery

This depends on the severity of abruption and whether the fetus is alive or dead. If the fetus is dead, vaginal delivery should be the goal after maternal resuscitation, as fetal death occurs commonly in the severe variety of placental abruption, often with coagulopathy. Once resuscitation has been initiated, the fetal membranes should be ruptured to hasten the onset of labor. This is effective in most cases but, in a few, augmentation with syntocinon may be needed. This must be administered cautiously as uterine rupture could occur from an overstimulated uterus.

Where the fetus is alive, the decision on how best to achieve delivery is not always easy. This is compounded by the fact that the outlook for the fetus is poor, not only in terms of immediate survival but also because studies have shown that as many as 15.4% of liveborn infants do not survive[77]. However, delivering by Cesarean section when the fetus is alive has been shown in non-randomized, controlled trials to have a better outcome than vaginal delivery (52% vs. 16%[78]; 20% vs. 15%[73]). Indecision and unnecessary delays in performing Cesarean sections[70] are responsible for most poor results from Cesarean section in the last quarter of pregnancy. Cesarean section must therefore be considered in all cases where the fetus is alive, particularly if there is evidence of fetal distress. However, the presence of coagulopathy adds considerable risk to the mother, and morbidity and mortality could be increased by surgery.

Once the decision is to deliver and the fetus is alive, the degree of abruption and the state of the fetus must be taken into consideration before delivering. When the abruption is severe, Cesarean section must be performed once resuscitation has commenced. Such delivery should be performed promptly, especially as most post-admission fetal deaths occur in fetuses delivered more than 2 hours after admission.

Table 2 Grading of placental abruption (Sher and Statland)[76]

Grade	*Description*
0	Asymptomatic abruption with a small retroplacental clot (< 150 ml)
1	Vaginal bleeding (150–500 ml); uterine tetany and tenderness may be present; no signs of maternal shock or fetal distress
2	Vaginal bleeding; no signs of maternal shock; signs of fetal distress
3	Vaginal bleeding; marked uterine tetany yielding a board-like consistency on palpation; persistent abdominal pain, with maternal shock and fetal demise; coagulopathy may be evident in 30% of cases

If the abruption is mild to moderate, the mode of delivery should be determined by the condition of the baby, its presentation and the state of the cervix. In the presence of abnormal fetal heart rate patterns, immediate delivery by Cesarean section is the option of choice. However, if the decision is to deliver vaginally, continuous fetal monitoring should be available to enable early identification of abnormal fetal heart rate patterns. Golditch and Boyce[79], Lunan[80] and Okonufua and Olatubosun[78] have all shown that the perinatal mortality is higher with vaginal delivery in the absence of electronic fetal monitoring. There is a place for the use of prostaglandins in the ripening of the cervix of women with mild abruption, but then the danger of inducing tetanic contractions must always be borne in mind. Where amniotomy is feasible, this often hastens delivery but, where it is not possible, syntocinon can be used, though once again maintaining vigilance for hyperstimulation.

Expectant management

This is recommended where neither the fetus nor the mother are at risk. Unfortunately, the lack of signs of fetal compromise on monitoring does not guarantee absence of deterioration in the fetal condition. With expectant management, pregnancy is prolonged in the hope of improving fetal maturity and therefore survival.

It is ideal for pregnancies less than 37 completed weeks of gestation; however, since neonatal survival is virtually guaranteed > 34–35 weeks' gestation, there is no place in persisting with such an approach for pregnancies > 34 weeks where fetal monitoring cannot be maintained. Expectant management is recommended for patients in whom vaginal bleeding is slight, abdominal pain is mild and usually localized and they are cardiovascularly stable. Once a decision has been made on conservative management, the fetal condition must be monitored closely as it may change very quickly.

Expectant management can be in the community or in the hospital; admission is not associated with a better outcome. However, where patient education and access to hospital are poor, admission may provide a safer option. It is perhaps in such communities that admission may be rejected because it is expensive or causes significant family disruptions.

During expectant management, fetal growth should be monitored by regular ultrasound scan as fetal growth restriction is a common finding in association with placental abruption. The timing of delivery depends on further vaginal bleeding, the fetal condition, gestational age and available neonatal care facilities. If the bleeding episodes are recurrent, induction at 37–38 weeks is advisable, provided there is no fetal compromise. Where the initial episode is small and self-limiting and there are no acute features of fetal compromise (e.g. abnormal cardiotocography or a biophysical profile score < 6) or chronic fetal compromise (growth restriction, oligohydramnios or abnormal umbilical artery Doppler recording), no evidence supports induction of labor. Despite this, it is nevertheless common for induction of labor at term to be advocated in such patients, using the speculative argument that some undetected damage might have occurred to the integrity and function of the placenta and, in the face of such uncertainty, delivery at term confers more advantages.

In a small proportion of cases, mild abruption may co-exist with labor. Whether abruption provoked labor, or vice-versa, is difficult to establish in these cases. The use of tocolytics in such patients is controversial, as their use in the presence of placental abruption is regarded by many as contraindicated since they may worsen the process of abruption[46]. Sholl[81], however, stated that a trial of tocolytics in the presence of mild placental abruption and labor may successfully prolong pregnancy without jeopardizing the mother and fetus. There have as yet been no large trials to confirm Sholl's statement.

Management of the complications of placental abruption

Complications of placental abruption include:

(1) *Maternal shock*: this may be disproportionate to the revealed blood loss. The type of resuscitation should therefore be determined by the clinical state of the patient. In most cases of shock, features of

disseminated intravascular coagulation must be excluded, as their presence will require additional measures to replace coagulation factors.

(2) *Disseminated intravascular coagulation* (DIC): treatment will require correction of the coagulation factor deficits, in consultation with a hematologist. Monitoring of renal function is essential as acute tubular necrosis is a recognized sequela.

(3) *Ischemic necrosis of the distal organs* (e.g. kidneys and brain): this requires adequate fluid replacement.

(4) *Postpartum hemorrhage* (secondary to DIC or Couvelaire uterus): treatment is with uterotonic drugs and other methods of managing postpartum hemorrhage.

(5) *Isoimmunization*: the administration of anti-D needs to be within 72 h but the quantity administered should be determined by Kleihauers–Betke test.

Management of cases with intrauterine fetal death

Where there is fetal death (in 20% of cases), placental detachment is usually greater than 50%, and approximately 30% of patients show evidence of coagulopathy. Such cases should therefore be classified as severe. The management should consist of the following:

Evaluation and replacement of blood loss

Blood loss > 2500 ml is common. At least 4 units of blood should be cross-matched and transfusion commenced with packed red blood cells, regardless of the initial vital signs as the initial hematocrit or hemoglobin levels may be normal due to hemoconcentration. Once resuscitation has been established, subsequent hypotension and tachycardia may then appear.

Management of coagulopathy (30% of cases)

Without evidence of excessive vaginal bleeding, no therapy is warranted even in the presence of abnormal laboratory results. Appropriate replacement of blood components and preservation of the intravascular volume are the cornerstones of treatment. Heparin has no role in the modern management of consumptive coagulopathy. The presence of coagulopathy *per se* is not an indication for Cesarean delivery but rather a strong contraindication. Also, the presence of an unfavorable cervix is not an indication for Cesarean delivery, unless the condition of the mother necessitates prompt delivery. The abdominal and uterine incisions can bleed excessively when coagulation defects persist (see Chapter 25).

Delivery

Unless there is an obstetric contraindication to vaginal delivery or hemorrhage is so brisk that it cannot be safely managed with vigorous blood transfusion, every attempt should be made to deliver these patients vaginally (without jeopardizing maternal health).

Amniotomy (artificial rupture of membranes) and syntocinon infusion should be started. The rigidity of the uterus or the presence of a high intrauterine pressure should not deter the use of syntocinon. If no rhythmic uterine contractions are superimposed on the background uterine hypertonus, then syntocinon should be started in standard doses. The benefits of achieving a vaginal delivery override the risks of using syntocinon. There is no evidence that its use is associated with enhanced passage of thromboplastin into the maternal circulation and thereby initiating or enhancing maternal consumptive coagulopathy[82]. With intrauterine fetal demise, no time limit for delivery is necessary. The maternal outcome is mainly dependent on the diligence of fluid and blood replacement rather than on the interval to delivery[83]. Where the cervix is unfavorable and maternal health is not in danger, prostaglandins may be used to induce delivery.

PLACENTA ACCRETA, INCRETA AND PERCRETA

This is a group of morbidly adherent placenta of varying severity. Such morbid adherence occurs when the implantation site is lacking a sufficient amount of decidua. Consequently, the physiological cleavage plane through the decidual

spongy layer is missing. This leads to one or more cotyledons being firmly anchored to the decidua basalis and even to the myometrium.

The term 'placenta accreta' is used to describe any placental implantation that is firmly adherent to the uterine wall. Placental villi are anchored to the myometrium due to defective decidualization. If villi invade the myometrium, the condition is called placenta increta. If the invasion goes as deep as reaching the serosal surface, this is called placenta percreta (see Chapter 8).

Although uncommon, they are associated with a significantly high maternal morbidity and sometimes mortality primarily due to hemorrhage, uterine perforation, infection and the associated surgical difficulties and complications[84].

Incidence

They occur in about 1 in 2500 deliveries. There has been a marked increase in the last 50 years, probably secondary to the increase in Cesarean section delivery rates[85].

Risk factors include implantation over the lower uterine segment overlying a previous surgical scar or excessive uterine curettage resulting in Asherman's syndrome. Placenta previa is identified in one-third of cases, and 25% of women have had a previous Cesarean delivery. Nearly one-quarter have previously undergone curettage and another quarter are grand multigravida (five or more)[86].

Diagnosis

Diagnosis is often not made until after delivery. Some patients may present with vague features which include a raised maternal serum α-fetoprotein[87] and bleeding before delivery, although this is usually a consequence of placenta previa. Uterine rupture may occur antenatally due to myometrial invasion by chorionic villi at the site of a Cesarean section scar[88].

The use of ultrasound Doppler color flow mapping improves the diagnostic sensitivity. The two most sensitive criteria are, first, a distance less than 1 mm between the uterine serosal bladder interface and the retroplacental vessels, and, second, the presence of large intraplacental lakes[89].

Preliminary work suggests that the application of three-dimensional color power Doppler ultrasound can be complementary to other techniques for antenatal imaging. It has been shown to be superior to magnetic resonance imaging in this context[90].

Management

In most cases, problems arise after delivery of the baby. Most of the complications of morbidly adherent placentas are related to the problems of delivery or failure to deliver. Management must therefore aim to minimize these complications (see Chapter 24).

Hemorrhage is the most common and this is associated with attempts to detach the placenta from the uterus. In most of these cases, unfortunately, the ultimate treatment is usually hysterectomy. Alternative approaches to management include uterine/hypogastric artery ligation or angiographic embolization. Sometimes, the percreta type might even invade the bladder base, further complicating the surgical procedure required and making the control of hemorrhage very difficult.

In cases of extensive placenta accreta (involving most of the placental surface), bleeding might be very limited until attempts at manual removal are made. At times, traction on the cord may lead to uterine inversion. Manual removal is usually not successful as the plane of cleavage between the uterus and the placenta cannot be developed. The safest treatment is usually hysterectomy. Attempts at uterine conservation include piece-meal removal of as much placental tissue as possible followed by packing of the uterine cavity, but this approach is reported to carry an unacceptably high mortality rate of 25%[86]. Another option to conserve the uterus is to leave the entire placenta *in situ* if there is no bleeding. Kayem describes a case where spontaneous resorption of the placenta occurred over 6 months following uterine artery embolization[91]. Other groups describe a similar approach, but using methotrexate. The placenta spontaneously delivered after 4 weeks[92,93].

RARE TYPES OF PLACENTAL ABNORMALITIES: SHAPE

Some anatomical variations in the shape of the placenta can give rise to serious postpartum hemorrhage. These include bipartite placentas, succenturiate lobes and placenta membranacea.

Bipartite placenta

Bipartite placenta occurs when the placenta is occasionally separated into two lobes, and the division is incomplete with vessels of fetal origin extending from one lobe to the other before ending in the umbilical cord. Its incidence is about 1 in 350 deliveries[94].

Succenturiate lobes

In this abnormal form, one or more small accessory lobes develops in the membranes at a distance from the main placenta. The succenturiate lobes usually connect to the latter with vascular connections of fetal origin. It can be considered to be like a small version of the lobate placenta. The accessory lobe may be retained in the uterus after delivery, causing serious hemorrhage. Its incidence has been reported to be as high as 5%[95].

Placenta membranacea

This type of placenta develops as a thin membrane-like structure with the whole of the fetal membranes covering the functioning villi. The diagnosis can be made with ultrasound scan. It can give rise to serious hemorrhage as an association with placenta previa or accreta. One variation is the 'ring-shaped' or 'horse-shoe' placenta where the process does not involve the whole placenta, but only a central part. This might occur in about 1 in 6000 deliveries[95].

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