Green-top Guideline No. 27a
Final Draft – Winter 2017

Placenta Praevia and Placenta Accreta: Diagnosis and Management

This is the fourth edition of this guideline. The first, published in 2001, was entitled *Placenta Praevia: Diagnosis and Management*; the second, published in 2005, was entitled *Placenta Praevia and Placenta Praevia Accreta: Diagnosis and Management*; and the third, published in 2011, was entitled *Placenta Praevia, Placenta Praevia Accreta and Vasa Praevia: Diagnosis and Management*.

Executive summary

Antenatal diagnosis and management of placenta praevia or a low-lying placenta

What are the risk factors for placenta praevia or a low-lying placenta?

Caesarean delivery is associated with an increased risk of placenta praevia in subsequent pregnancies. This risk rises as the number of prior caesarean sections increases. [B]

Assisted reproductive technology and maternal smoking increase the risk of placenta praevia. [B]

Should we screen for placenta praevia or a low-lying placenta, if so, at what gestation and with what follow-up?

The midpregnancy routine fetal anomaly scan should include placental localisation thereby identifying women at risk of persisting placenta praevia or a low-lying placenta. [GPP]

The term placenta praevia should be used when the placenta lies directly over the internal os. For pregnancies at more than 16 weeks of gestation the term low-lying placenta should be used when the placental edge is 20 mm or less from the internal os on transabdominal or transvaginal scanning (TVS). [D]

If the placenta is thought to be low lying (less than 20 mm from the internal os) or praevia (covering the os) at the routine fetal anomaly scan, a follow-up ultrasound examination including a TVS is recommended at 32 weeks of gestation to diagnose persistent low-lying placenta and/or placenta praevia. [D]

What is the role and what are the risks of TVS?

Clinicians should be aware that TVS for the diagnosis of placenta praevia or a low-lying placenta is superior to transabdominal and transperineal approaches and is safe. [GPP]

In women with a persistent low-lying placenta or placenta praevia at 32 weeks of gestation who remain asymptomatic, an additional TVS is recommended at around 36 weeks of gestation to inform discussion about mode of delivery. [D]

Cervical length measurement may help facilitate management decisions in asymptomatic women with placenta praevia. A short cervical length on TVS before 34 weeks of gestation increases the risk of preterm emergency delivery and massive haemorrhage at caesarean section. [D]

Where should women with a low-lying placenta or placenta praevia be cared for in the third trimester?

Women with a low-lying placenta or placenta praevia with recurrent bleeding

Tailor antenatal care, including hospitalisation, to individual patient need and social circumstances, e.g. distance between home and hospital and availability of transportation, previous bleeding episodes, haematology laboratory results and acceptance of receiving donor blood or blood products. [GPP]

It should be made clear to any woman being treated at home in the third trimester that she should attend the hospital immediately if she experiences any bleeding, including spotting, contractions or pain (including vague suprapubic period-like aches). [GPP]

Women with asymptomatic placenta praevia or a low-lying placenta

Women with asymptomatic placenta praevia or a low-lying placenta in the third trimester should be counselled about the risks of preterm delivery and obstetric haemorrhage, and their care should be tailored to their individual needs. [GPP]

Women with asymptomatic placenta praevia confirmed at the 32-week follow-up scan and managed at home should be encouraged to ensure they have safety precautions in place, including having someone available to help them as necessary and ready access to the hospital. [GPP]

Is there a place for cervical cerclage in placenta praevia or a low-lying placenta?

The use of cervical cerclage to reduce bleeding and prolong pregnancy is not supported by sufficient evidence to recommend its use outside of a clinical trial. [GPP]

In what circumstances, and at what gestation, should women be offered antenatal corticosteroids?

A single course of antenatal corticosteroid therapy is recommended between 34^{+0} and 36^{+0} weeks of gestation for pregnant women with a low-lying placenta or placenta praevia and is appropriate prior to 34^{+0} weeks of gestation in women at higher risk of preterm birth. [GPP]

Is there a place for the use of tocolytics in women presenting with a low-lying placenta or placenta praevia and preterm labour?

Tocolysis for women presenting with symptomatic placenta praevia or a low-lying placenta may be considered for 48 hours to facilitate administration of antenatal corticosteroids. [C]

Should delivery be indicated based on maternal or fetal concerns, tocolysis should not be used in attempt to prolong gestation. [C]

At what gestation should planned delivery occur?

Late preterm (35^{+1} to 36^{+6} weeks of gestation) delivery should be considered for women presenting with complicated placenta praevia or a low-lying placenta. [C]

In what situations is vaginal delivery appropriate for women with a low-lying placenta?

In women with a third trimester asymptomatic low-lying placenta, the mode of delivery should be based on the clinical background, the woman's preferences supplemented by ultrasound findings, including the distance between the placental edge and the fetal head position relative to the leading edge of the placenta on TVS. [D]

Optimising the delivery of placenta praevia

Prior to delivery, all women with placenta praevia and their partners should have a discussion regarding delivery. Indications for blood transfusion and hysterectomy should be reviewed and concerns or plans to decline blood or blood products should be discussed openly and documented. [GPP]

Placenta praevia and anterior low-lying placenta carry a higher risk of massive obstetric haemorrhage and hysterectomy. Delivery should be arranged in a maternity unit with on-site blood transfusion services and access to critical care. [D]

Women with atypical antibodies form a particularly high-risk group and the care of these women should involve discussions with the local haematologist and blood bank. [D]

Prevention and treatment of anaemia during the antenatal period is recommended for women with placenta praevia or a low-lying placenta as for any pregnant woman. [D]

Delivery for women with placenta praevia or a low-lying placenta

What grade of obstetrician and anaesthetist should attend the caesarean delivery for a placenta praevia?

As a minimum requirement for a planned caesarean section for placenta praevia, the surgical procedure should be carried out by an appropriately experienced operator. [GPP]

In cases of planned caesarean section for placenta praevia or a low-lying placenta, a senior obstetrician (usually a consultant) and senior anaesthetist (usually a consultant) should be present within the delivery or theatre suite where the surgery is occurring. [GPP]

When an emergency arises, the senior obstetrician and senior anaesthetist should be alerted immediately and attend urgently. [GPP]

What anaesthetic procedure is most appropriate for caesarean section in placenta praevia or a low-lying placenta?

Regional anaesthesia is considered safe and associated with lower risks of haemorrhage than general anaesthesia for caesarean delivery in women with placenta praevia or a low-lying placenta. Women with anterior placenta praevia or a low-lying placenta should be advised that it may be necessary to convert to general anaesthesia if required and asked to consent. [D]

What blood products should be available?

Close liaison with the hospital transfusion laboratory is essential for women presenting with placenta praevia or a low-lying placenta. [GPP]

Rapid infusion and fluid warming devices should be immediately available. [GPP]

Cell salvage is recommended for patients where the anticipated blood loss is great enough to induce anaemia, in particular, in women who would decline blood products. [D]

What surgical approach should be used for placenta praevia or a low-lying placenta?

Consider vertical skin and/or uterine incisions when the fetus is in a transverse lie to avoid the

placenta, particularly below 28 weeks of gestation. [GPP]

Consider using preoperative and/or intraoperative ultrasonography to precisely determine placental location and the optimal place for uterine incision. [D]

If the placenta is transected during the uterine incision, immediately clamp the umbilical cord after fetal delivery to avoid excessive fetal blood loss. [D]

If pharmacological measures fail to control haemorrhage, initiate intrauterine tamponade and/or surgical haemostatic techniques sooner rather than later. Interventional radiological techniques should also be urgently employed where possible. [C]

Early recourse to hysterectomy is recommended if conservative medical and surgical interventions prove ineffective. [D]

Antenatal diagnosis and outcome of placenta accreta spectrum

What are the risk factors for placenta accreta spectrum?

The major risk factors for placenta accreta spectrum are history of accreta in a previous pregnancy, previous caesarean delivery and other uterine surgery, including repeated endometrial curettage. This risk rises as the number of prior caesarean sections increases. [B]

Women requesting elective caesarean delivery for non-medical indications should be informed of the risk of placenta accreta spectrum and its consequences for subsequent pregnancies. [GPP]

How can a placenta accreta spectrum be suspected and diagnosed antenatally?

Antenatal diagnosis of placenta accreta spectrum is crucial in planning its management and has been shown to reduce maternal morbidity and mortality. [D]

Previous caesarean delivery and the presence of an anterior low-lying placenta or placenta praevia should alert the antenatal care team of the higher risk of placenta accreta spectrum. [D]

Ultrasound screening and diagnosis of placenta accreta spectrum

Ultrasound imaging is highly accurate when performed by a skilled operator with experience in diagnosing placenta accreta spectrum. [C]

Refer women with any ultrasound features suggestive of placenta accreta spectrum to a specialist unit with imaging expertise. [B]

Women with a history of previous caesarean section seen to have an anterior low-lying placenta or placenta praevia at the routine fetal anomaly scan should be specifically screened for placenta accreta spectrum. [D]

Is there a role for magnetic resonance imaging (MRI) in the diagnosis of placenta accreta spectrum?

Clinicians should be aware that the diagnostic value of MRI and ultrasound imaging in detecting placenta accreta spectrum is similar when performed by experts. [C]

MRI may be used to complement ultrasound imaging to assess the depth of invasion and lateral extension of myometrial invasion, especially with posterior placentation and/or in women with

ultrasound signs suggesting parametrial invasion. [GPP]

Where should women with placenta accreta spectrum be cared for?

Women diagnosed with placenta accreta spectrum should be cared for by a multidisciplinary team in a specialist centre with expertise in diagnosing and managing invasive placentation. [GPP]

Delivery for women diagnosed with placenta accreta spectrum should take place in a specialist centre with logistic support for immediate access to blood products, adult intensive care unit and neonatal intensive care unit (NICU) by a multidisciplinary team with expertise in complex pelvic surgery. [D]

When should delivery be planned for women with placenta accreta spectrum?

In the absence of risk factors for preterm delivery and evidence of invasive placentation, planned delivery at 35^{+0} to 36^{+6} weeks of gestation provides the best balance between fetal maturity and the risk of unscheduled delivery. [GPP]

Planning delivery of a suspected placenta accreta spectrum

Once the diagnosis of placenta accreta spectrum is made, a contingency plan for emergency delivery should be developed, including the use of an institutional protocol for the management of maternal haemorrhage. [GPP]

What should be included in the consent form for caesarean section in cases of suspected placenta accreta spectrum?

Any woman giving consent for caesarean section should understand the risks associated with caesarean section in general, and the specific risks of placenta accreta spectrum in terms of massive obstetric haemorrhage, increased risk of lower urinary tract damage, the need for blood transfusion and the risk of hysterectomy. [GPP]

Additional possible interventions in the case of massive haemorrhage should also be discussed, including cell salvage and interventional radiology where available. [D]

What healthcare professionals should be involved?

The elective delivery of women with placenta accreta spectrum should be managed by a multidisciplinary team, which should include senior anaesthetists, obstetricians and gynaecologists with appropriate experience in managing the condition and other surgical specialties if indicated. In an emergency, the most senior clinicians available should be involved. [GPP]

What anaesthetic is most appropriate for delivery?

The choice of anaesthetic technique for caesarean section for placenta accreta spectrum should be made by the anaesthetist conducting the procedure in consultation with the patient in advance. [GPP]

The woman should be informed that the surgical procedure can be performed safely with regional anaesthesia but should be advised that it may be necessary to convert to general anaesthesia if required and asked to consent. [D]

Optimising the delivery of placenta accreta spectrum

What surgical approach should be used for placenta accreta spectrum?

Caesarean section hysterectomy with the placenta left in situ is preferable to attempting to separate it from the uterine wall. [C]

When the extent of the placenta accreta is limited in depth and surface area, and the entire placental implantation area is accessible and visualised (i.e. completely anterior, fundal or posterior without deep pelvic invasion), uterus-preserving surgery may be appropriate, including partial myometrial resection. [GPP]

Uterus-preserving surgical techniques should only be attempted by surgeons working in teams with appropriate expertise to manage such cases and after appropriate counselling regarding risks and with informed consent. [D]

There are currently insufficient data to recommend the routine use of ureteric stents in placenta creta and increta. [C]

What surgical approach should be used for placenta percreta?

There is limited evidence to support uterus-preserving surgery in placenta percreta and women should be informed of the high risk of peripartum and secondary complications, including the need for secondary hysterectomy. [D]

Expectant management (leaving the placenta in situ)

Elective peripartum hysterectomy may be unacceptable to women desiring uterine preservation or considered inappropriate by the surgical team. In such cases, leaving the placenta in situ should be considered. [D]

When the placenta is left in situ, local arrangements need to be made to ensure regular review, ultrasound examination and access to emergency care should the woman experience complications, such as bleeding or infection. [D]

Methotrexate (MTX) adjuvant therapy should not be used for expectant management as it is of unproven benefit and has significant adverse effects, including a reported maternal death. [C]

When is interventional radiology indicated?

Larger studies are necessary to determine the safety and efficacy of interventional radiology before this technique can be advised in the routine management of placenta accreta spectrum. [D]

Women diagnosed with placenta accreta spectrum who decline donor blood transfusion should be managed in a unit with an interventional radiology service. [D]

How is unsuspected placenta accreta spectrum at delivery best managed?

If at the time of an elective repeat caesarean section, where both mother and baby are stable, it is immediately apparent that placenta percreta is present on opening the abdomen, the caesarean section should be delayed until the appropriate staff and resources have been assembled and adequate blood products are available. This may involve closure of the maternal abdomen and urgent transfer to a specialist unit for delivery. [GPP]

In case of unsuspected placenta accreta spectrum diagnosed after delivery of the baby, the placenta should be left in situ and an emergency hysterectomy performed. [D]

1. Purpose and scope

The purpose of this guideline is to describe the diagnostic modalities and review the evidence-based approach to the clinical management of pregnancies complicated by placenta praevia and placenta accreta.

2. Introduction and background epidemiology

Placenta praevia and placenta accreta are associated with high maternal and neonatal morbidity and mortality.[1–5] The rates of placenta praevia and accreta have increased and will continue to do so as a result of rising rates of caesarean deliveries, increased maternal age and use of assisted reproductive technology (ART), placing greater demands on maternity-related resources. The highest rates of complication for both mother and newborn are observed when these conditions are only diagnosed at delivery.

2.1 Placenta praevia

Determining placental location is one of the first aims of routine midpregnancy (18^{+6}–21^{+6} weeks of gestation) transabdominal obstetric ultrasound examination.[6,7] Placenta praevia was originally defined using transabdominal scan as a placenta developing within the lower uterine segment and graded according to the relationship and/or the distance between the lower placental edge and the internal os of the uterine cervix. Grade I or *minor praevia* was defined as a lower edge inside the lower uterine segment; grade II or *marginal praevia* as a lower edge reaching the internal os; grade III or *partial praevia* when the placenta partially covers the cervix; and grade IV or *complete praevia* when the placenta completely covers the cervix. Grades I and II are also often defined as 'minor' placenta praevia whereas grades III and IV are referred to as 'major' placenta praevia.

The introduction of transvaginal scanning (TVS) in obstetrics in the 1980s has allowed for a more precise evaluation of the distance between the placental edge and the internal os. A recent multidisciplinary workshop of the American Institute of Ultrasound in Medicine (AIUM)[8] has recommended discontinuing the use of the terms 'partial' and 'marginal', suggesting that the term 'placenta praevia' is used when the placenta lies directly over the internal os. For pregnancies greater than 16 weeks of gestation, the placenta should be reported as 'low lying' when the placental edge is less than 20 mm from the internal os and as normal when the placental edge is 20 mm or more from the internal os on transabdominal or TVS. This new classification could better define the risks of perinatal complications, such as antepartum haemorrhage and major postpartum haemorrhage (PPH),[9,10] and has the potential of improving the obstetric management of placenta praevia. Recent articles reviewed in this guideline refer to the AIUM classification.

The estimated incidence of placenta praevia at term is 1 in 200 pregnancies.[5,9] However, this is dependent on the definition used and is likely to change with the introduction of the AIUM classification described above and with the rising incidence of the main risk factors, i.e. prior caesarean delivery and pregnancies resulting from ART. The relationship between a low-lying placenta or placenta praevia and a velamentous insertion of the umbilical cord is presented and discussed in sister Green-top Guideline no. 27b: *Vasa Praevia: Diagnosis and Management*.

2.2 Placenta accreta

Placenta accreta is a histopathological term first defined by Irving and Hertig in 1937, as the

"abnormal adherence of the afterbirth in whole or in parts to the underlying uterine wall in the partial or complete absence of decidua".[11] Irving and Hertig did not include abnormally invasive placentation in their series and thus in their description was limited to abnormally adherent placenta. Depending on the depth of villous tissue invasiveness, placenta accreta was subsequently subdivided by modern pathologists into 'creta' or 'adherenta' where the villi adheres superficially to the myometrium without interposing decidua; 'increta' where the villi penetrate deeply into the uterine myometrium down to the serosa; and 'percreta' where the villous tissue perforates through the entire uterine wall and may invade the surrounding pelvic organs, such as the bladder.[12-14] Cases of placenta accreta are also often subdivided into total, partial or focal according to the amount of placental tissue involved and the different depths of accreta placentation have been found to co-exist in the same case.[12,15] Thus placenta accreta is a spectrum disorder ranging from abnormally adherent to deeply invasive placental tissue.

Detailed data on clinical findings and, where possible, on histopathological examination are essential when describing different diagnostic or management techniques.[16,17] The diagnostic conundrum is obvious at the abnormally adherent end of the spectrum where the differential diagnosis between a difficult manual removal and an abnormally adherent or placenta accreta may be impossible in the absence of histopathological confirmation. These diagnostic difficulties probably explain the current wide variation in reported prevalence of placenta accreta ranging between 1 in 300 and 1 in 2000 pregnancies[1–5] and highlight the need for a standardised approach to imaging, clinical and histopathological descriptions. In the last decade, even the condition itself has begun to be known by many different names, with 'morbidly adherent placenta' becoming particularly popular. This terminology was originally used in the 19th century to describe the clinical complications associated with a retained placenta. This terminology is misleading as 'morbidly adherent' does not encompass the abnormally invasive end of the accreta spectrum (increta and percreta), which usually have the worst clinical outcomes.[16,17] In order to overcome these difficulties, the terms 'placenta accreta spectrum' or 'abnormally adherent and invasive placenta' should be used to include both the abnormally adherent and invasive forms of accreta placentation.[18] In this guideline, the term placenta accreta spectrum will be used.

In the 1990s, the maternal mortality of placenta percreta was reported to be as high as 7% of cases.[19] More recent large series have reported lower rates of maternal death and this is likely to be further improved by screening for placenta accreta spectrum in women at high risk and in planning the delivery in specialist centres.[20–22]

3. Identification and assessment of evidence

This guideline was developed in accordance with standard methodology for producing Royal College of Obstetricians and Gynaecologists (RCOG) Green-top Guidelines. The Cochrane Library (including the Cochrane Database of Systematic Reviews and the Database of Abstracts of Reviews of Effects [DARE]), EMBASE, Trip, MEDLINE and PubMed (electronic databases) were searched for relevant randomised controlled trials (RCT), systematic reviews and meta-analyses. The search was restricted to articles published between May 2009 and December 2017 (the search for the previous Guideline was up to May 2009). The databases were searched using the relevant Medical Subject Headings (MeSH) terms, including all subheadings, and this was combined with a keyword search. Search words included 'placenta praevia', 'low lying placenta', 'placenta accreta', 'placenta increta' 'placenta percreta', 'abnormally adherent placenta' and 'abnormally invasive placenta'. The search was restricted to humans and the English language. The National Library for Health and the National Guideline Clearinghouse were also searched for relevant guidelines and reviews.

Where possible, recommendations are based on available evidence. In the absence of published evidence, these have been annotated as 'good practice points'. Further information about the assessment of evidence and the grading of recommendations may be found in Appendix I.

4. Antenatal diagnosis and management of placenta praevia or a low-lying placenta

4.1 What are the risk factors for placenta praevia or a low-lying placenta?

Caesarean delivery is associated with an increased risk of placenta praevia in subsequent pregnancies. This risk rises as the number of prior caesarean sections increases. [B]

ART and maternal smoking increase the risk of placenta praevia. [B]

In 1997, a meta-analysis of the association of placenta praevia with history of caesarean delivery found a dose-response pattern for the relative risk (RR) of placenta praevia of 4.5 (95% CI 3.6–5.5) for one, 7.4 (95% CI 7.1–7.7) for two, 6.5 (95% CI 3.6–11.6) for three, and 44.9 (95% CI 13.5–149.5) for four or more prior caesarean deliveries compared with vaginal delivery.[23] *[Evidence level 2++]*

A systematic review and meta-analysis of 22 studies including over 2 million deliveries indicated that the incidence of placenta praevia increases from 10 in 1000 deliveries with one previous caesarean delivery to 28 in 1000 with three or more caesarean deliveries.[24] A 2014 meta-analysis confirmed these findings and reported an overall odds ratio (OR) of 1.47 (95% CI 1.44–1.51) for placenta praevia after caesarean section.[25] *[Evidence level 1+]*

Cohort studies have also reported that a second pregnancy within 1 year of a caesarean section is associated with an increased risk of placenta praevia (RR 1.7, 95% CI 0.9–3.1).[26] Compared with vaginal birth, a previous prelabour caesarean section is associated with an increased risk of placenta praevia in the second delivery (adjusted OR [aOR] 2.62, 95% CI 1.24–5.56).[27] *[Evidence level 2++]*

There have been contradictory reports regarding the incidence of placenta praevia in multiple pregnancies. A retrospective cohort study of 1 172 405 twin live births and stillbirths in the USA between 1989 and 1998 found no increased risk in twins.[28] A retrospective cohort of 67 895 singleton and twin pregnancies found that dichorionic (aOR 1.54, 95% CI 1.15–2.06) and monochorionic (RR 3.29, 95% CI 1.32–8.21) twin pregnancies had an increased risk of placenta praevia compared with singletons.[29] *[Evidence level 2+]*

ART is associated with a higher incidence of placenta praevia independently of the high rate of multiple pregnancies generated by the technique used.[30,31] A 2016 meta-analysis of ART singleton pregnancies reported a RR of 3.71 (95% CI 2.67–5.16) for placenta praevia[32] that was confirmed by a 2017 meta-analysis (OR 2.67, 95% CI 2.01–3.34).[33] Furthermore, a 2017 meta-analysis of the impact of maternal smoking on placental position[34] (OR 1.42, 95% CI 1.30–1.50) has found an increased risk of placenta praevia. *[Evidence level 1+]*

Advanced maternal age has been also associated with a slight increase in the risk of placenta praevia (OR 1.08, 95% CI 1.07–1.09) but this effect may be due to parity [35]. *[Evidence level 2–]*

4.2 Should we screen for placenta praevia or a low-lying placenta, if so, at what gestation and with what follow-up?

The midpregnancy routine fetal anomaly scan should include placental localisation thereby identifying women at risk of persisting placenta praevia or a low-lying placenta. [GPP]

The term placenta praevia should be used when the placenta lies directly over the internal os. For pregnancies at more than 16 weeks of gestation the term low-lying placenta should be used when the placental edge is 20 mm or less from the internal os on transabdominal or TVS. [D]

If the placenta is thought to be low lying (less than 20 mm from the internal os) or praevia (covering the os) at the routine fetal anomaly scan, a follow-up ultrasound examination including a TVS is recommended at 32 weeks of gestation to diagnose persistent low-lying placenta and/or placenta praevia. [D]

Placenta praevia is a well-established complication of pregnancy associated with high maternal and perinatal complication rates.[4–9] The UK National Screening Committee (UK NSC) does not recommend a national screening program for placenta praevia, but it has supported current local practices of identifying it at the routine midpregnancy (18^{+6}–21^{+6} weeks of gestation) antenatal screening ultrasound examination in women whose placenta extends onto the internal cervical os (www.screening.nhs.uk/policies).[36] An update published in 2014 that included a literature search covering the period between January 2008 and November 2012 concluded that this practice was not supported by new evidence, but that the placental site is routinely reported at the time of the routine fetal anomaly scan. In turn, this routine study has become the main screening test for placenta praevia.[37] *[Evidence level 4]*

Apparent placental 'migration' following the development of the lower uterine segment during the third trimester of pregnancy results in the resolution of the low-lying placenta in 90% of the cases before term.[38–46] This is less likely to occur in women with a previous caesarean delivery.[39] *[Evidence level 4]*

In twin pregnancies, the likelihood of persistence of placenta praevia is also dependent on the gestational age at sonographic detection. Among those with placenta praevia diagnosed in the second trimester the majority of cases resolve by 32 weeks of gestation.[29,47] After 32 weeks of gestation around 50% of the remaining placenta praevia will resolve, with no further changes after 36 weeks of gestation.[29] *[Evidence level 3]*

The timing of a confirmatory ultrasound examination in the third trimester has varied between 32 and 36 weeks of gestation depending on the extent of the placenta praevia over the internal cervical os. It is based on the perceived risk of antenatal haemorrhage, but there is no strong evidence that it makes a difference in the care of asymptomatic women.[37] The timing of the follow-up ultrasound examination should also be tailored according to a previous history of caesarean delivery to exclude an associated placenta accreta spectrum. *[Evidence level 4]*

4.3 What is the role and what are the risks of TVS?

Clinicians should be aware that TVS for the diagnosis of placenta praevia or a low-lying placenta is superior to transabdominal and transperineal approaches and is safe. [GPP]

In women with a persistent low-lying placenta or placenta praevia at 32 weeks of gestation who remain asymptomatic, an additional TVS is recommended at around 36 weeks of gestation to inform discussion about mode of delivery. [D]

Cervical length measurement may help facilitate management decisions in asymptomatic women with placenta praevia. A short cervical length on TVS before 34 weeks of gestation increases the risk of preterm emergency delivery and massive haemorrhage at caesarean section. [D]

TVS improves the accuracy of placental localisation particularly when the placenta is posterior or if the transabdominal ultrasound is unclear, for example, due to maternal obesity or the presence of large uterine fibroids.[5] *[Evidence level 4]*

There is only one small (n = 38) RCT comparing transabdominal scan and TVS for placenta praevia, which supports this safety profile and reports superior views, especially for posterior placentas.[48]

[Evidence level 1+]

If the distance between the internal os and the placental edge is 20 mm or more on TVS, the placental location should be recorded as normal and managed as per routine. Studies have not demonstrated an increased risk for caesarean section due to haemorrhage in these cases.[4,5] By contrast, if the placenta extends beyond the internal os on TVS during the second trimester, it is likely to be confirmed as placenta praevia at 32 weeks of gestation.[48–50] However, 'migration' is still possible after 32 weeks of gestation.[50,51] *[Evidence level 2+]*

TVS will reclassify 26–60% of placentas diagnosed as low lying at the routine fetal anomaly scan.[52–54] Overall, TVS has a high accuracy (positive predictive value of 93.3%, negative predictive value of 97.6% and false-negative rate of 2.33%) in predicting placenta praevia in women suspected of having a low-lying placenta on transabdominal scan in the second and early third trimester, with a sensitivity of 87.5% and a specificity of 98.8%.[55] *[Evidence level 2+]*

TVS has also been used to measure the cervical length to predict preterm birth[56] and cohort studies with low risks of confounding bias have shown that cervical length is a predictor of antepartum bleeding and emergency preterm caesarean section in placenta praevia.[57–60] A prospective cohort study of 59 women presenting with placenta praevia covering the internal os has shown that the best cut-off point for the identification of women at risk of haemorrhage requiring a caesarean delivery before 34 weeks of gestation is a cervical length of 31 mm or less (sensitivity of 83.3% and specificity of 76.6%). Women with a cervical length of less than 31 mm have a 16 times (OR 16.4; 95% CI 3.4–75.9) higher risk of emergency caesarean section due to massive haemorrhage.[57] Similarly, a prospective cohort study of 54 women with placenta praevia covering the internal os has shown that combining a cervical length of less than 30 mm and measurement of the lower placental edge thickness of more than 10 mm has a sensitivity of 83.3% and a specificity of 78.4%.[58] More prospective studies using a standardised ultrasound definition of placental edge thickness are required before this sign can be used in clinical practice. *[Evidence level 2+]*

Compared with women with a long cervical length, women with a short cervical length (less than 25 mm) have a RR of 7.2 (95% CI 2.3–22.3) for massive haemorrhage during caesarean section for placenta praevia.[59] *[Evidence level 2+]*

Serial TVS cervical length measurements from 26 weeks of gestation have indicated that when the length of the cervix decreases rapidly to 35 mm or less there is an increased risk of preterm caesarean section due to massive haemorrhage.[60] *[Evidence level 2–]*

4.4 Where should women with a low-lying placenta or placenta praevia be cared for in the third trimester?

4.4.1 Women with a low-lying placenta or placenta praevia with recurrent bleeding

Tailor antenatal care, including hospitalisation, to individual patient need and social circumstances, e.g. distance between home and hospital and availability of transportation, previous bleeding episodes, haematology laboratory results and acceptance of receiving donor blood or blood products. [GPP]

Where hospital admission has been decided, a documented assessment of risk factors for VTE in pregnancy should be performed as outlined in RCOG GTG No. 37a. [D]

It should be made clear to any woman being treated at home in the third trimester that she should attend the hospital immediately if she experiences any bleeding, including spotting, contractions or pain (including vague suprapubic period-like aches). [GPP]

The Cochrane systematic review by Nielson on the impact of an intervention in women diagnosed as having, or being likely to have a placenta praevia, which has not been updated since October 2002, includes only one small RCT (n = 53) comparing hospital versus home care for symptomatic placenta praevia.[61] This trial found little evidence of any clear advantage or disadvantage to a policy of home versus hospital care, and the only significant difference was a reduction in length of hospital stay.[62] *[Evidence level 1–]*

Two large retrospective studies of women presenting with placenta praevia at the routine fetal anomaly scan have proposed scores to predict the risk of emergency caesarean section. The first study (n = 250) found that the risk is increased if the first (sentinel) vaginal bleeding episode occurs before 29 weeks of gestation (OR 2.64, 95% CI 1.17–5.98), and with the occurrence of three or more episodes of antepartum haemorrhage (OR 2.53, 95% CI 1.1–5.86).[63] The second (n = 214) found that independent predictors for emergency delivery are a history of caesarean section (OR 4.7, 95 CI 1.2–12); antepartum haemorrhage on one (OR 7.5, 95% CI 2.5–23), two (OR 14, 95% CI 4.3–47), and three or more occasions (OR 27, 95% CI 8.3–90); and need for antenatal blood transfusion (OR 6.4, 95% CI 1.7–23).[10] A retrospective study of 214 women with singleton pregnancies found that the risk of preterm emergency caesarean delivery increases with the number of antepartum bleeding episodes with one (OR 7.5, 95% C, 2.5-23), two (OR 14, 95% CI 4.3-47), and three or more (OR 27, 95% CI 8.3-90), as well as need for blood transfusion (OR 6.4, 95% C, 1.7-23).[64] The results of these studies suggest that predictors for emergency delivery in women with placenta praevia can be used for individualised antenatal care regarding need for hospital admission, corticosteroids administration and timing of delivery. *[Evidence level 2–]*

4.4.2 Women with asymptomatic placenta praevia or a low-lying placenta

Women with asymptomatic placenta praevia or a low-lying placenta in the third trimester should be counselled about the risks of preterm delivery and obstetric haemorrhage, and their care should be tailored to their individual needs. [GPP]

Women with asymptomatic placenta praevia confirmed at the 32-week follow-up scan and managed at home should be encouraged to ensure they have safety precautions in place, including having someone available to help them as necessary and ready access to the hospital. [GPP]

Most women with asymptomatic placenta praevia (no bleeding or contractions) can be cared for as outpatients with similar outcomes compared with hospitalisation and at lower cost.[5] Numerous factors influence the chances of the placenta praevia persisting until delivery, such as prior caesarean section,[43] the distance between the placental edge and the internal os, and the thickness of the placental edge.[4] These parameters can be useful in tailoring individual patient needs. *[Evidence level 4]*

4.5 Is there a place for cervical cerclage in placenta praevia or a low-lying placenta?

The use of cervical cerclage to reduce bleeding and prolong pregnancy is not supported by sufficient evidence to recommend its use outside of a clinical trial. [GPP]

The Cochrane systematic review by Nielson[61] on the impact of cerclage in women diagnosed as having, or being likely to have, placenta praevia included two small RCTs (n = 25 and 36) comparing cervical cerclage versus no cerclage. There may be a reduction in preterm births before 34 weeks of gestation (RR 0.45, 95% CI 0.23–0.87), but this evidence is not robust enough to recommend its use outside of clinical trials. *[Evidence level 1–]*

There have been no new trials looking at this issue since the last update of this guideline.

4.6 In what circumstances, and at what gestation, should women be offered antenatal corticosteroids?

A single course of antenatal corticosteroid therapy is recommended between 34^{+0} and 36^{+0} weeks of gestation for pregnant women with a low-lying placenta or placenta praevia and is appropriate prior to 34^{+0} weeks of gestation in women at higher risk of preterm birth. [GPP]

A large case–control study found that neonatal morbidities in women with placenta praevia include an increased risk of lower 5-minute Apgar scores, neonatal intensive care unit (NICU) admission, anaemia, respiratory distress syndrome, mechanical ventilation and intraventricular haemorrhage.[65] Neonates born to mothers with placenta praevia have lower birthweights (2806 versus 3285 g) and lower gestational ages (36^{+2} versus 38^{+1} weeks). These differences were not significant after adjusting for confounders such as prematurity.[66] [*Evidence level 2++*]

Compared with placebo or no treatment with antenatal corticosteroids (betamethasone, dexamethasone or hydrocortisone), antenatal corticosteroids are associated with a reduction in the most serious adverse outcomes related to prematurity, including perinatal death (RR 0.72, 95% CI 0.58–0.89), respiratory distress syndrome (average RR 0.66, 95% CI 0.56–0.77), intraventricular haemorrhage (average RR 0.55, 95% CI 0.40–0.76) and necrotising enterocolitis (RR 0.50, 95% CI 0.32–0.78).[67] *[Evidence level 1+]*

The 2016 RCT has found that the administration of betamethasone to women with a singleton pregnancy at risk for late preterm delivery (34^{+0} to 36^{+5} weeks of gestation) significantly reduces the rate of neonatal respiratory complications.[68] *[Evidence level 1+]*

A decision analytic model designed to compare total maternal and neonatal quality-adjusted life years for delivery of women with placenta praevia at 34^{+0} to 36^{+6} weeks of gestation indicated that corticosteroids administration at 35^{+5} weeks of gestation followed by planned delivery at 36 weeks of gestation optimises maternal and neonatal outcomes.[69] *[Evidence level 4]*

4.7 Is there a place for the use of tocolytics in women presenting with a low-lying placenta or placenta praevia and preterm labour?

Tocolysis for women presenting with symptomatic placenta praevia or a low-lying placenta may be considered for 48 hours to facilitate administration of antenatal corticosteroids. [C]

Should delivery be indicated based on maternal or fetal concerns, tocolysis should not be used in attempt to prolong gestation. [C]

A systematic review to determine if the prolonged (48 hours or more) use of tocolytics in women with symptomatic preterm placenta praevia improves perinatal outcome identified two retrospective studies (total, n = 217) and one RCT (n = 60).[70] The results of the RCT showed that pregnancy can be prolonged for more than 7 days with continued tocolytics (OR 3.10, 95% CI 1.38–6.96). When combined with the data of retrospective studies, the results did not reach significance (OR 1.19, 95% CI 0.63–2.28). The RCT was judged inadequately compliant with the Consolidated Standards of Reporting Trials statement. *[Evidence level 1–]*

A recent randomised, double-blind, placebo-controlled multicentre trial including 109 women at 24^{+0} to 33^{+6} weeks with at least one episode of placenta praevia bleeding and intact membranes has shown that there is no difference in the prolongation of pregnancy between the nifedipine (n = 54) and placebo (n = 55) groups.[71] Adverse perinatal outcomes were comparable between groups. *[Evidence level 1+]*

4.8 At what gestation should planned delivery occur?

Delivery timing should be tailored according to antenatal symptoms and for women presenting with uncomplicated placenta praevia delivery should be considered between 36 and 37 weeks of gestation, [C]

As the risk of major haemorrhage increases rapidly after 36 weeks of gestation, expert opinions have highlighted that decisions regarding timing of delivery must be individualised and suggested that on the basis of limited data available, women with uncomplicated placenta praevia should undergo scheduled birth by caesarean section between 36 and 37 weeks of gestation.[69,72,73] *[Evidence level 4]*

The risks of bleeding, labour, or bleeding and labour leading to the need for emergency delivery increase with advancing gestational age, whereas the risks of morbidity associated with prematurity decrease.[4,5] The risk of an emergent bleed associated with placenta praevia has been reported to be 4.7% by 35 weeks of gestation, 15% by 36 weeks of gestation, 30% by 37 weeks of gestation and 59% by 38 weeks of gestation.[74] *[Evidence level 2–]*

A US population-based cohort study using the Centre for Disease Control and Prevention's Linked Birth-Infant Death data files has evaluated the effects of delivering placenta praevia at 35, 36 and 37 weeks of gestation on the risk of several neonatal outcomes.[75] Compared with neonates born at 38 weeks of gestation, those delivered at 35, 36 and 37 weeks of gestation have no greater odds of meconium passage, fetal distress, fetal anaemia, neonatal seizures, increased ventilator needs or infant death at 1 year. However, aOR odds of 5-minute Apgar scores of less than 7 are greater at 35 and 36 weeks of gestation (aOR 3.33, 95% CI 1.71–6.47; and aOR 2.17, 1.11–4.22, respectively) as are odds of NICU admission rates (aOR 2.25, 95% CI 2.01–2.50; and aOR 1.57, 1.38–1.76, respectively). *[Evidence level 2+]*

4.9 In what situations is vaginal delivery appropriate for women with a low-lying placenta?

In women with a third trimester asymptomatic low-lying placenta, the mode of delivery should be based on the clinical background, the woman's preferences supplemented by ultrasound findings, including the distance between the placental edge and the fetal head position relative to the leading edge of the placenta on TVS. [D]

Women presenting with a placental edge less than 20 mm from the internal os in the third trimester are more likely to need delivery by caesarean section when the placental edge is thicker (over 10 mm)[76,77] and/or contains a sponge-like echo[78] or marginal 'sinus'.[79] These additional ultrasound features are poorly defined, not routinely assessed in UK practice and the success rates of vaginal delivery when the placental edge is between 10 and 20 mm from the internal os vary widely (56% and 93%, respectively).[80–83] The corresponding studies are small, observational and retrospective, making a recommendation for a specific mode of delivery based on ultrasound findings difficult. *[Evidence level 2–]*

5. Optimising the delivery of a placenta praevia

Prior to delivery, all women with placenta praevia and their partners should have a discussion regarding delivery. Indications for blood transfusion and hysterectomy should be reviewed and concerns or plans to decline blood or blood products should be discussed openly and documented. [GPP]

Placenta praevia and anterior low-lying placenta carry a higher risk of massive obstetric haemorrhage and hysterectomy. Delivery should be arranged in a maternity unit with on-site blood transfusion services and access to critical care. [D]

Deleted: Late preterm (35+1 to 36+6 weeks of gestation)

Deleted: for women presenting with complicated placenta praevia or a low-lying placenta

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Women with atypical antibodies form a particularly high-risk group and the care of these women should involve discussions with the local haematologist and blood bank. [D]

Prevention and treatment of anaemia during the antenatal period is recommended for women with placenta praevia or a low-lying placenta as for any pregnant woman. [D]

General procedures for discussing and obtaining consent for caesarean section are described in detail in RCOG Consent Advice No.7: *Caesarean section*.[84] *[Evidence level 4]*

Women having a caesarean section for placenta praevia are at increased risk of blood loss of more than 1000 ml compared with women having a caesarean section for other indications (RR 3.97, 95% CI 3.24–4.85).[85] Women with anterior placenta regardless of type of placenta praevia are at increased blood loss.[86] Placenta praevia covering the internal cervical os and anterior placentation are independent risk factors (OR 4.1 and OR 3.5, respectively) for massive haemorrhage during caesarean section.[86] A US case–control study from the National Institute of Child Health (NICH) and Human Development Maternal-Fetal Medicine Units (MFMU) Network Caesarean Section Registry has shown that maternal haemorrhagic morbidity is more common in women with praevia (19% versus 7%, adjusted RR 2.6, 95% CI 1.9-3.5) and the main factors associated with maternal haemorrhage include pre-delivery anaemia, thrombocytopenia, diabetes and magnesium use.[87] *[Evidence level 2++]*

The risk of massive haemorrhage together with the possibility of needing a blood transfusion has been estimated to be approximately 12 times more likely in caesarean section for placenta praevia than in caesarean delivery for other indications.[88,89] Similarly to uncomplicated pregnancies, women with placenta praevia should be screened for anaemia and investigated if their haemoglobin levels are outside the normal UK range (110 g/l at first visit and 105 g/l at 28 weeks).[36] Iron supplementation should be implemented if indicated. *[Evidence level 4]*

For women at high risk of emergency transfusion, such as those presenting with placenta praevia and with no clinically significant alloantibodies, it has been recommended that group and screen samples should be sent once a week to exclude or identify any new antibody formation and to keep blood available if necessary for delivery. However, this should be at the discretion of the team responsible and managed according to local facilitites.[89] [*Evidence level* 4]

6. Delivery for women with placenta praevia or a low-lying placenta

6.1 What grade of obstetrician and anaesthetist should attend the caesarean delivery for a placenta praevia?

As a minimum requirement for a planned caesarean section for placenta praevia, the surgical procedure should be carried out by an appropriately experienced operator. [GPP]

In cases of planned caesarean section for placenta praevia or a low-lying placenta, a senior obstetrician (usually a consultant) and senior anaesthetist (usually a consultant) should be present within the delivery or theatre suite where the surgery is occurring. [GPP]

When an emergency arises, the senior obstetrician and senior anaesthetist should be alerted immediately and attend urgently. [GPP]

Maternal complications at caesarean section increase when the primary surgeon is a trainee/resident rather than an experienced surgeon.[90] Placenta praevia is often associated with

additional including fetal malpresentation (transverse or breech presentation) requiring complex intraoperative manoeuvres to deliver the baby.[91] *[Evidence level 4]*

6.2 What anaesthetic procedure is most appropriate for caesarean section in placenta praevia?

Regional anaesthesia is considered safe and associated with lower risks of haemorrhage than general anaesthesia for caesarean delivery in women with placenta praevia or a low-lying placenta. Women with anterior placenta praevia or a low-lying placenta should be advised that it may be necessary to convert to general anaesthesia if required and asked to consent. [D]

There is insufficient evidence to support one technique over another and there have been no new trials since the previous version of this guideline.

An RCT of regional versus general anaesthesia for placenta praevia, including women with placenta accreta, has indicated that blood transfusion requirements (although not estimated blood loss) are greater in the general anaesthetic group.[92] *[Evidence level 1–]*

A 4-year observational study at 19 US academic centres of women undergoing caesarean delivery found that the risk factors for haemorrhage-related morbidity are increased in those undergoing general anaesthesia.[93] *[Evidence level 2–]*

The recent case–control study from the NICHD/MFMU Network Cesarean Section Registry found general anaesthesia to be one of the main factors associated with maternal haemorrhage in women with placenta praevia.[87] *[Evidence level 2++]*

6.3 What blood products should be available?

Close liaison with the hospital transfusion laboratory is essential for women presenting with placenta praevia or a low-lying placenta. [GPP]

Rapid infusion and fluid warming devices should be immediately available. [GPP]

Cell salvage is recommended for patients where the anticipated blood loss is great enough to induce anaemia, in particular, in women who would decline blood products. [D]

Red cells, fresh frozen plasma, and cryoprecipitate or fibrinogen concentrate are all kept by blood banks supplying obstetric units. If the haemoglobin is less than 70 g/l in the postoperative period, where there is no ongoing or threat of bleeding, the decision to transfuse should be made on an informed individual basis.[89] In an extreme situation and when the blood group is unknown, group O rhesus D-negative red cells should be given.[89] Further recommendations are provided in Green-top Guideline No.52: *Prevention and Management of Postpartum Haemorrhage*.[88] *[Evidence level 4]*

There is no evidence to support the use of autologous blood transfusion for placenta praevia.[90] *[Evidence level 4]*

Cell salvage was not often used previously in obstetrics because of the perceived risk of amniotic fluid embolism or induction of maternal alloimmunisation. No definite cases of amniotic fluid embolism have been reported so far and the risks of cell salvage in the obstetric population parallel those in the non-pregnant population.[94,95] *[Evidence level 4]*

6.4 What surgical approach should be used for placenta praevia or a low-lying placenta?

Consider vertical skin and/or uterine incisions when the fetus is in a transverse lie to avoid the

placenta, particularly below 28 weeks of gestation. [GPP]

Consider using preoperative and/or intraoperative ultrasonography to precisely determine placental location and the optimal place for uterine incision. [D]

If the placenta is transected during the uterine incision, immediately clamp the umbilical cord after fetal delivery to avoid excessive fetal blood loss. [D]

If pharmacological measures fail to control haemorrhage, initiate intrauterine tamponade and/or surgical haemostatic techniques sooner rather than later. Interventional radiological techniques should also be urgently employed where possible. [C]

Early recourse to hysterectomy is recommended if conservative medical and surgical interventions prove ineffective. [D]

In cases of anterior placenta praevia, cutting through the placenta is often associated with increased maternal bleeding. A retrospective cohort study found that avoiding incision of the anterior placenta praevia after 24 weeks of gestation reduces the need for maternal blood transfusion during or after caesarean delivery.[96] *[Evidence level 2–]*

A 'J'-shaped uterine incision has been evaluated in women presenting with placenta praevia in a small retrospective study and shown to decrease intraoperative blood loss and facilitate the delivery of the fetus.[97] *[Evidence level 2–]*

Intrauterine balloon tamponade, different types of compression sutures and uterine artery occlusion techniques have been increasingly used since the previous version of the guideline in women with placenta praevia to control, reduce or stop intraoperative bleeding and PPH. Case series on the use of intrauterine hydrostatic balloon catheters, including the Bakri balloon,[98–102] the BT-Cath® balloon[103] or the Sengstaken–Blakemore tube,[104] in women with placenta praevia have reported success in controlling PPH ranging from 75% to 88%. *[Evidence level 3]*

Factors associated with the failure of Bakri balloon tamponade for placenta praevia include prior caesarean section, anterior placentation, thrombocytopenia and/or coagulopathy at the time of insertion, and a PPH volume of more than 500 ml within the first hour of placement.[100] *[Evidence level 2++]*

Uterine compressive and endouterine sutures are well established techniques for the control of haemorrhage following atonic PPH. The best known suture technique was described by B-Lynch in 1997.[105] A combined method of B-Lynch suture and the intrauterine balloon has also been successfully used in preventing PPH in placenta praevia.[106] *[Evidence level 3]*

Intraoperative interventional radiological techniques, including transarterial embolisation[107] and temporary balloon occlusion[108] of the internal iliac arteries, have also been successfully used to prevent and control haemorrhage in placenta praevia and should be considered when available. Follow-up studies of women who have undergone arterial embolisation for control of PPH suggest that the intervention does not impair subsequent menstruation and fertility.[109–111] *[Evidence level 3]*

7. Antenatal diagnosis and outcome of placenta accreta spectrum

7.1 What are the risk factors for placenta accreta spectrum?

The major risk factors for placenta accreta spectrum are history of accreta in a previous pregnancy, previous caesarean delivery and other uterine surgery, including repeated endometrial

curettage. This risk rises as the number of prior caesarean sections increases. [B]

Women requesting elective caesarean delivery for non-medical indications should be informed of the risk of placenta accreta spectrum and its consequences for subsequent pregnancies. [GPP]

All epidemiological studies of the last 2 decades have shown a direct association between the increase in caesarean deliveries and the incidence of placenta accreta spectrum (abnormally adherent and invasive placenta) in subsequent pregnancies worldwide.[112–122] The 2016 Nordic Obstetric Surveillance Study found that the risk of invasive placentation increases seven-fold after one prior caesarean section.[118] *[Evidence level 2+]*

A meta-analysis of five cohorts and 11 case–control studies reported a summary OR of 1.96 (95% CI 1.41–2.74) for placenta accreta spectrum after a caesarean section.[24] *[Evidence level 2++]*

The risk of placenta accreta spectrum increases with the number of previous caesarean sections. A systematic review reported an increase in the incidence of accreta placentation from 3.3–4.0% in women with placenta praevia and no previous caesarean delivery, to 50–67% in women with three or more caesarean deliveries.[25] When stratified for the number of previous caesarean sections, the OR for placenta accreta spectrum in a subsequent pregnancy ranges between 8.6 (95% CI 3.536–21.078)[112] and 17.4 (95% CI 9.0–31.4) for two previous caesarean sections, and 55.9 (95% CI 25.0–110.3) for three or more caesarean sections.[121] *[Evidence level 2++]*

Placenta praevia is another important risk factor for placenta accreta spectrum (see Appendix II). A large multicentre US cohort study noted that for women presenting with placenta praevia and prior caesarean section the risk of accreta placentation was 3%, 11%, 40%, 61% and 67% for one, two, three, four, and five or more caesarean deliveries, respectively.[113] The national case–control study using the UK Obstetric Surveillance System found that the incidence of placenta accreta spectrum increases from 1.7 per 10 000 women overall to 577 per 10 000 in women with both a previous caesarean section and placenta praevia.[114] *[Evidence level 2+]*

Other additional risk factors include maternal age[111,114,118,121] and ART, in particular in vitro fertilisation.[114,121,123–126] Advanced maternal age (35 years or more) in women without a previous caesarean section increases the aOR by 1.30 (95%CI 1.13-1.50) for every 1-year increase in age.[114] *[Evidence level 2-]*

Placenta accreta spectrum is not exclusively a consequence of caesarean delivery. Other surgical trauma to the integrity of the uterine endometrium and/or superficial myometrium, such as those following uterine curettage, manual removal of the placenta, postpartum endometritis or myomectomy, has been associated with accreta placentation in subsequent pregnancies.[1,12,13] Overall, the aOR for placenta accreta spectrum after previous uterine surgery is 3.40 (95% CI 1.30–8.91).[114] *[Evidence level 2+]*

The development of placenta accreta spectrum has also been reported in women with no surgical history but presenting with a uterine pathology, such as bicornuate uterus, adenomyosis, submucous fibroids and myotonic dystrophy.[1,12,13] *[Evidence level 3]*

More recently there has been an increase in reports describing implantation into deficient caesarean section scars and mounting evidence that a caesarean scar pregnancy diagnosed in early pregnancy can evolve into an abnormally adherent or invasive placenta in the second half of pregnancy.[127–131] A caesarean scar pregnancy can be diagnosed using TVS from the second month of pregnancy using specific ultrasound criteria.[130,131] In the last decade, the number of reported cases of caesarean scar pregnancy has increased due to improved awareness of the condition, widespread use of ultrasound scanning in early pregnancy and an increase in the number of prior caesarean sections. The outcome

of caesarean scar pregnancy depends on the amount of definitive placenta developing inside the scar and depth of villous invasion. Further data are required to establish the relationship between a first trimester scar pregnancy and the development of invasive placentation. *[Evidence level 3]*

7.2 How can a placenta accreta spectrum be suspected and diagnosed antenatally?

Antenatal diagnosis of placenta accreta spectrum is crucial in planning its management and has been shown to reduce maternal morbidity and mortality. [D]

Previous caesarean delivery and the presence of an anterior low-lying placenta or placenta praevia should alert the antenatal care team of the higher risk of placenta accreta spectrum. [D]

Maternal complications in placenta accreta spectrum are primarily the result of massive haemorrhage.[5] Median estimated blood loss in cohorts of placenta accreta spectrum ranges from 2000 to 7800 ml and the median number of units of blood transfused is 5 units.[132] Antenatal diagnosis of placenta accreta spectrum reduces maternal peripartum haemorrhage and morbidity.[20,133–136] *[Evidence level 4]*

Population studies have shown that placenta accreta spectrum remains undiagnosed before delivery in one-half[137] to two-thirds of cases.[121] In a series from specialist centres, approximately one-third of cases of placenta accreta were not diagnosed during pregnancy.[138] *[Evidence level 2+]*

Multidisciplinary management in a maternity unit with access to maternal and neonatal intensive care is often required for women with placenta accreta spectrum.[21,22,136,139] For such care to be organised, the diagnosis must be made antenatally. *[Evidence level 4]*

7.2.1 Ultrasound screening and diagnosis of placenta accreta spectrum

Ultrasound imaging is highly accurate when performed by a skilled operator with experience in diagnosing placenta accreta spectrum. [C]

Refer women with any ultrasound features suggestive of placenta accreta spectrum to a specialist unit with imaging expertise. [B]

Women with a history of previous caesarean section seen to have an anterior low-lying placenta or placenta praevia at the routine fetal anomaly scan should be specifically screened for placenta accreta spectrum. [D]

Numerous ultrasound imaging techniques have been reported over the years, including greyscale imaging and colour Doppler imaging (CDI), and/or three-dimensional power Doppler sonography.[16,17,140–142] In 2016, the European Working Group on Abnormally Invasive Placenta proposed a standardised description of ultrasound signs (see Appendix III) used for the prenatal diagnosis of placenta accreta[141] and the International Abnormally Invasive Placenta Expert Group produced a proforma protocol for the ultrasound assessment.[142] *[Evidence level 4]*

A systematic review and meta-analysis of 23 ultrasound studies including 3707 pregnancies at risk of placenta accreta found that the overall performance of ultrasound when performed by skilled operators was very good with a sensitivity of 90.72% (95% CI 87.2–93.6), specificity of 96.94% (95% CI 96.3–97.5) and diagnostic OR of 98.59 (95%CI 48.8–199.0). Among the different ultrasound signs, abnormality of the uterus–bladder interface had the best specificity of 99.75% (95% CI 99.5–99.9) for the prediction of placenta accreta. Abnormal vasculature on CDI had the best predictive accuracy with a sensitivity of 90.74% (95% CI 85.2–94.7), specificity of 87.68% (95% CI 84.6–90.4) and diagnostic OR of 69.02 (95% CI 22.8–208.9).[143] *[Evidence level 2++]*

A 2017 systematic review and meta-analysis using the standardised ultrasound signs (see Appendix III) has shown that in women presenting with placenta praevia and history of prior caesarean section, the performance of ultrasound for the antenatal detection of placenta accreta spectrum is even higher with a sensitivity of 97.0% (95% CI 93.0–99.0), specificity of 97.0% (95% CI 97.0–98.0) and diagnostic OR of 228.5 (95% CI 67.2–776.9) in prospective studies.[144] Placental lacunae give the placenta a 'moth-eaten' appearance on greyscale imaging and the increased vascularity of the placental bed with large feeder vessels entering the lacunae are the most common ultrasound signs associated with placenta accreta spectrum.[16,17,143,144] *[Evidence level 2++]*

Determining the depth and lateral extension of placental invasion is helpful for planning the individual care of women diagnosed with placenta accreta spectrum.[16,17,145] No ultrasound sign or a combination of ultrasound signs have so far been found to be specific to the depth of placenta accreta spectrum and thus to provide with an accurate differential diagnosis between adherent and invasive accreta placentation.[16] This may be due to the wide heterogeneity in terminology used to describe the grades of placenta accreta spectrum, differences in the study design with most studies not reporting detailed data on clinical diagnosis at birth and/or on histopathology examination, and many studies having included cases of placental retention in their cohort with no evidence of abnormal villous adherence or invasion. *[Evidence level 2++]*

As the vast majority of placenta accreta spectrum are now the consequence of low placentation into a previous caesarean section scar, TVS has an important role in the early diagnosis, follow-up, differential diagnosis between adherent and invasive accreta placentation and management of placenta accreta spectrum.[144] *[Evidence level 4]*

7.2.2 Is there a role for magnetic resonance imaging (MRI) in the diagnosis of placenta accreta spectrum?

Clinicians should be aware that the diagnostic value of MRI and ultrasound imaging in detecting placenta accreta spectrum is similar when performed by experts. [C]

MRI may be used to complement ultrasound imaging to assess the depth of invasion and lateral extension of myometrial invasion, especially with posterior placentation and/or in women with ultrasound signs suggesting parametrial invasion. [GPP]

MRI has been increasingly used for the prenatal diagnosis of placenta accreta.[146–150] The main MRI features of placenta accreta include abnormal uterine bulging, dark intraplacental bands on T2-weighted imaging, heterogeneous signal intensity within the placenta, disorganised vasculature of placenta and disruption of the uteroplacental zone. A systematic review has found that most studies are of a small sample size and thus, sensitivity and specificity of MRI in diagnosing placenta accreta varies widely between 75% and 100%, and 65% and 100%, respectively.[149] *[Evidence level 2++]*

Two systematic reviews and meta-analyses have found that the diagnostic value of ultrasound imaging and MRI in detecting placenta accreta spectrum is similar. The first review[148] included 13 studies and reported a sensitivity of 83% (95% CI 77–88), specificity of 95% (95% CI 93–96) and detection OR of 63.41 (95% CI 29.04–138.48) for ultrasound, compared with a sensitivity of 82% (95% CI 72–90), specificity of 88% (95% CI 81–94) and detection OR of 22.95 (95% CI 3.19–165.11) for MRI. The second review (2014)[149] included 18 studies and found that the overall diagnostic accuracy of MRI has a sensitivity of 94.4% (95% CI 86.0–97.9), specificity of 84.0% (95% CI 76.0–89.8) and diagnostic OR of 89.0 (95% CI 22.8–348.1). The latter review also found that MRI has high predictive accuracy in assessing both the depth and topography of placental invasion. *[Evidence level 2++]*

The use of intravenous gadolinium injection may increase the sensitivity and specificity of MRI in the diagnosis of the invasive forms of placenta accreta spectrum but the evidence on long-term fetal safety is limited.[150] Furthermore, the experience of the radiologists remains an independent factor in the diagnostic accuracy of MRI and access to expert radiologists is highly variable. *[Evidence level 4]*

7.3 Where should women with placenta accreta spectrum be cared for?

Women diagnosed with placenta accreta spectrum should be cared for by a multidisciplinary team in a specialist centre with expertise in diagnosing and managing invasive placentation. [GPP]

Delivery for women diagnosed with placenta accreta spectrum should take place in a specialist centre with logistic support for immediate access to blood products, adult intensive care unit and NICU by a multidisciplinary team with expertise in complex pelvic surgery. [D]

More data have become available since the last version of this guideline on the specific management of placenta accreta spectrum. Overall, women with accreta placentation should be cared for according to the risks of severe maternal bleeding and premature delivery. Placenta percreta can be associated with major prenatal complications from early in pregnancy, such as uterine rupture[151–153] and bladder involvement with associated life-threatening haemorrhage.[154–156] *[Evidence level 4]*

A 2015 expert review has suggested that caesarean delivery of women at high risk and/or diagnosed prenatally with placenta accreta spectrum, in particular its invasive forms, should occur in a specialist centre with multidisciplinary expertise and experience in managing complex pelvic surgery, and with access to an adult intensive care unit and NICU.[136] *[Evidence level 4]*

A retrospective cohort study of 77 women with suspected placenta accreta found that women who delivered prior to a planned delivery date were significantly more likely to have had vaginal bleeding and uterine activity when compared with women who had a scheduled delivery.[20] Each episode of antenatal vaginal bleeding is associated with an increased risk of unscheduled delivery (aOR 3.8, 95% CI 1.8–7.8) and the risk increases when associated with preterm prelabour rupture of membranes. *[Evidence level 2–]*

Considering the higher frequency of placenta praevia in the accreta group,[144,157] these results are likely to be influenced by the perinatal complications of placenta praevia. Surveys of healthcare providers in the US and Canada have highlighted widely varied approaches to virtually every aspect of care for placenta accreta spectrum.[158–161] Similarly, a recent online survey completed by members of the expert panel for the perinatal management of placenta accreta spectrum disorders for the International Federation of Gynecology and Obstetrics (FIGO) has found wide variation in global practices.[162] *[Evidence level 4]*

There is increasing evidence from retrospective cohort studies from the USA that women with placenta accreta spectrum diagnosed prenatally, cared for by a specialist multidisciplinary team, are less likely to require large volume blood transfusion and reoperation within 7 days of delivery for bleeding complications compared with women cared for by non-multidisciplinary standard obstetric care without a specific protocol.[21,22,136,139,163,164] Women admitted at 34 weeks of gestation and delivered between 34 and 35 weeks of gestation by a specialist multidisciplinary team have a significantly lower emergency surgery rate than those not cared for by such a team (23% versus 64%; $P = 0.001$) despite a similar median gestational age at delivery (34 [16–39] weeks versus 34 [19-40] weeks; $P = 0.50$, respectively).[21] In addition, maternal outcomes are improved over time with increasing experience within a well-established multidisciplinary team performing 2–3 cases per month.[22] Very few of these studies provide with data on the differential clinical diagnosis between abnormally adherent and abnormally invasive accreta and detailed pathologic confirmation of the depth and lateral extension of villous myometrial invasion. *[Evidence level 2–]*

7.4 When should delivery be planned for women with placenta accreta spectrum?

In the absence of risk factors for preterm delivery and evidence of invasive placentation, planned delivery at 35^{+0} to 36^{+6} weeks of gestation provides the best balance between fetal maturity and the risk of unscheduled delivery. [GPP]

Similarly to placenta praevia, clinical factors should be considered when determining the timing of administration of antenatal corticosteroids and the optimal gestational age for delivery in women with placental accreta.[165,166] There are currently no RCTs or well-controlled observational studies to guide best practice in delivery timing of placenta accreta spectrum. *[Evidence level 4]*

In cases of suspected placenta accreta spectrum, where significant blood loss and caesarean hysterectomy is anticipated, delivery at between 34 and 35 weeks of gestation has been proposed in order to avoid emergency delivery, which still occurs about 20% of the time even in scheduled cases.[165,167] A 2010 decision analysis supports this approach based on the increasing likelihood of emergency delivery as pregnancy goes beyond 34 weeks of gestation.[168] *[Evidence level 4]*

The data of three recent single institution retrospective cohort studies of women with prior caesarean delivery diagnosed prenatally with placenta accreta have indicated that in the absence of risk factors for preterm delivery, it is safe to plan the delivery at 36 weeks of gestation. The first study included 103 women delivered between 1982 and 2002 and found that the mean gestational age at delivery is 33^{+5} weeks of gestation in cases of deep placental invasion (increta and percreta) compared with 35^{+2} weeks of gestation in the superficial adherent group.[169] The second study of 216 women found that urgent delivery for bleeding decreased significantly with advancing gestation.[170] Most women were delivered at 36 weeks of gestation or greater, with nearly 90% in the absence of bleeding complications. The third study of 84 women who had reached 34^{+0} weeks of gestation with a suspected praevia accreta found that those with no risk factors for preterm birth are at low risk for an unscheduled delivery prior to 36 weeks of gestation.[171] *[Evidence level 2+]*

8. Planning delivery of a suspected placenta accreta spectrum

Once the diagnosis of placenta accreta spectrum is made, a contingency plan for emergency delivery should be developed, including the use of an institutional protocol for the management of maternal haemorrhage. [GPP]

Due to a lack of RCTs or well-controlled observational studies, the optimal management of placenta accreta spectrum remains undefined and is determined by the expertise available, the depth and lateral extension of the accreta portion of the placenta, the presence of an associated placenta praevia, radiological findings, the medical and surgical comorbidities, and finally, the accessibility of a regional team focused on these patients.

The main risk associated with the delivery of placenta accreta spectrum is massive haemorrhage and its associated complications, such as coagulopathy, multisystem organ failure and death. Many women with placenta accreta spectrum require massive blood transfusion (8 units or more) and their median platelet count is lowest compared with other causes of massive PPH.[172,173] *[Evidence level 2+]*

A review of 34 studies published between 1977 and 2012, including a total number of 508 617 deliveries and 865 cases of confirmed placenta accreta, found that the most significant maternal risks associated with delivery are the need for postpartum transfusion due to haemorrhage and peripartum hysterectomy. Maternal mortality remains rare, but significantly higher than among matched postpartum controls.[123] *[Evidence level 4]*

Transfusions in placenta accreta spectrum should be guided by a national and/or institutional protocol for management of PPH.[88,89] *[Evidence level 4]*

8.1 What should be included in the consent form for caesarean section in cases of suspected placenta accreta spectrum?

Any woman giving consent for caesarean section should understand the risks associated with caesarean section in general, and the specific risks of placenta accreta spectrum in terms of massive obstetric haemorrhage, increased risk of lower urinary tract damage, the need for blood transfusion and the risk of hysterectomy. [GPP]

Additional possible interventions in the case of massive haemorrhage should also be discussed, including cell salvage and interventional radiology where available. [D]

Any woman with suspected placenta accreta spectrum should meet with a senior obstetrician in the antenatal period. The different risks and treatment options should have been discussed and a plan agreed, which should be reflected clearly in the consent form and medical record. This should include standard discussion for the caesarean section procedure[84] and whether conservative management of the placenta or proceeding straight to hysterectomy is preferred in the situation where increta or percreta is confirmed at surgery. *[Evidence level 4]*

Where available, cell salvage should be considered. If the woman refuses donor blood transfusion, it is recommended[89] that she be transferred to a unit with a cell saver. *[Evidence level 4]*

8.2 What healthcare professionals should be involved?

The elective delivery of women with placenta accreta spectrum should be managed by a multidisciplinary team, which should include senior anaesthetists, obstetricians and gynaecologists with appropriate experience in managing the condition and other surgical specialties if indicated. In an emergency, the most senior clinicians available should be involved. [GPP]

Following the previous version of the guideline, the National Patient Safety Agency in collaboration with the RCOG and the Royal College of Midwives set up an expert working group to develop a care bundle for placenta accreta.[174] Six elements of good care were agreed upon. The care bundle was then tested in six units over a 5-month pilot study period and it was found to be both achievable and practical. Clinical outcomes were monitored, confirming the high morbidity associated with this condition. *[Evidence level 4]*

The six elements considered to be reflective of good care are:

- Consultant obstetrician planning and directly supervising delivery.
- Consultant anaesthetist planning and directly supervising anaesthesia at delivery.
- Blood and blood products available.
- Multidisciplinary involvement in preoperative planning.
- Discussion and consent, including possible interventions (such as hysterectomy, leaving the placenta in situ, cell salvage and interventional radiology).
- Local availability of a level 2 critical care bed.

The 2015 MBRRACE report from the Confidential Enquiry into Maternal Deaths in the UK has indicated that despite increasing numbers of women at risk from placenta accreta spectrum following previous caesarean section, only one death occurred in a woman who had a placenta

praevia percreta and history of two previous caesarean sections.[175] There were no deaths from unexpected placenta accreta found at caesarean section, suggesting that previous recommendations regarding imaging and preparations for women with placenta praevia and a previous caesarean section have been followed.[176] *[Evidence level 2++]*

A 2015 single centre retrospective cohort study of the effectiveness of a standardised operative approach in 98 cases of histologically confirmed placenta accreta supports the early presence of a gynaecological surgeon and oncologist at delivery and demonstrates that a 'call if needed' approach is not acceptable for these complex cases.[177] *[Evidence level 2+]*

The American College of Obstetricians and Gynecologists (ACOG) guidelines highlight that to enhance patient safety, it is important that the delivery be performed by an experienced obstetric team that includes an obstetric surgeon, with other surgical specialists, such as urologists, general surgeons, and gynaecological surgeons and oncologists, available if necessary.[166] *[Evidence level 4]*

8.3 What anaesthetic is most appropriate for delivery?

The choice of anaesthetic technique for caesarean section for placenta accreta spectrum should be made by the anaesthetist conducting the procedure in consultation with the patient in advance. [GPP]

The woman should be informed that the surgical procedure can be performed safely with regional anaesthesia but should be advised that it may be necessary to convert to general anaesthesia if required and asked to consent. [D]

Both general and regional anaesthetic techniques have been shown to be safe for surgical procedures required for the delivery of placenta accreta spectrum; the judgment of which type of technique to be used should be made on an individual basis.[167] *[Evidence level 4]*

There is insufficient evidence to support one technique over another and there have been no new trials since the previous version of this guideline.

8.4 Optimising the delivery of placenta accreta spectrum

There are no RCTs comparing different surgical approaches for placenta accreta spectrum suspected antenatally. Both conservative and radical surgical approaches can be associated with a high maternal morbidity although the value of an experienced team in a specialist centre decreases the risk significantly.[21,22,136,139,163,164] *[Evidence level 4]*

8.4.1 What surgical approach should be used for placenta accreta spectrum?

Caesarean section hysterectomy with the placenta left in situ is preferable to attempting to separate it from the uterine wall. [C]

When the extent of the placenta accreta is limited in depth and surface area, and the entire placental implantation area is accessible and visualised (i.e. completely anterior, fundal or posterior without deep pelvic invasion), uterus-preserving surgery may be appropriate, including partial myometrial resection. [GPP]

Uterus-preserving surgical techniques should only be attempted by surgeons working in teams with appropriate expertise to manage such cases and after appropriate counselling regarding risks and with informed consent. [D]

There are currently insufficient data to recommend the routine use of ureteric stents in placenta creta and increta. [C]

The choice of surgical technique will depend on the position of the placenta, the depth of invasion, and the parametrial extension of the placenta accreta spectrum as assessed by ultrasound and/or MRI before delivery, the visual assessment of the uterus at the time of surgery and the presenting clinical symptoms, i.e. bleeding or no bleeding.[5] *[Evidence level 4]*

The ACOG recommends planned, preterm caesarean section hysterectomy with the placenta left in situ as removal of a placenta accreta spectrum is associated with significant haemorrhagic morbidity.[166] In cases of high suspicion for accreta during caesarean delivery, the majority of members of the US Society of Maternal-Fetal Medicine (SMFM) and FIGO expert panel proceed with hysterectomy.[158–162] *[Evidence level 4]*

Similarly, in a 2017 systematic review and meta-analysis on the diagnosis and outcome of placenta accreta, an elective or emergency caesarean hysterectomy was performed in 208 out of 232 (89.7%) cases.[144] *[Evidence level 2++]*

A retrospective study of 57 cases of suspected accreta demonstrated significantly reduced short-term morbidity if the placenta is left in place and hysterectomy performed electively compared with attempting to remove the placenta first.[178] Attempting placental separation risks hysterectomy in up to 100% of cases as also confirmed by other authors.[178,179] *[Evidence level 2++]*

A case–control study of 49 women requiring a peripartum hysterectomy for massive haemorrhage, including 20 women presenting with placenta accreta, reported that the use of a vessel sealing device during surgery decreases the estimated blood loss, the need for massive blood transfusions, and does not increase operative time or complication rates.[180] *[Evidence level 2+]*

A systematic review found that uterus-preserving surgery resulted in a secondary hysterectomy in 24/77 women (31%), maternal mortality in 2/55 women (4%), subsequent menstruation in 28/34 women (82%) and subsequent pregnancy in 19/26 women (73%).[181] A more recent systematic review showed that uterus-preserving surgery is associated with a success rate of 48/76 women (63.2%), a secondary hysterectomy in 23/76 women (30.0%), maternal mortality in 2/54 women (3.7%), subsequent menstruation in 20/37 women (81.1%) and subsequent pregnancy in 21/27 women (77.8%).[182] *[Evidence level 2++]*

A small cohort study has shown that the introduction of the Triple-P procedure (perioperative placental localization, pelvic devascularization and placental non-separation) involving delivery of the fetus via transverse uterine incision above the upper border of the placenta, myometrial excision and reconstruction of the uterine wall reduces the rate of hysterectomy, PPH and duration of hospital stay in women with placenta accreta.[183] The incidence of post-operative complications of the Triple-P procedure depends on comorbidities and in particular, the placental position and the depth of villous invasion.[184] Small case series have also reported on the successful use of compression sutures and on using the cervix as a natural tamponade by inverting it into the uterine cavity, and suturing the anterior and/or the posterior cervical lips into the anterior and/or posterior walls of the lower uterine segment.[185–188] *[Evidence level 3]*

A systematic review of peripartum surgical techniques used in placenta accreta spectrum has found that methotrexate (MTX) and uterus-preserving surgical techniques are associated with a 16% unintentional urinary tract injury rate as opposed to 57% for standard hysterectomy and that use of ureteric stents reduces the risk of urologic injury.[189] *[Evidence level 2++]*

There are no RCTs on the use of ureteric stents in placenta accreta spectrum. Ureteric stents or

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catheters are more commonly used pre-operatively in the USA where around 26% of the members of both the SMFM[159] and ACOG fellows[161] are using them in the management of suspected of abnormally invasive placenta. *[Evidence level 4]*

8.4.2 What surgical approach should be used for placenta percreta?

There is limited evidence to support uterus-preserving surgery in placenta percreta and women should be informed of the high risk of peripartum and secondary complications, including the need for secondary hysterectomy. [D]

The following four approaches have been described.[137,159–161,165,167,190]

1. Primary hysterectomy following delivery of the fetus, without attempting placental separation.
2. Delivery of the fetus avoiding the placenta, with repair of the incision leaving the placenta in situ.
3. Delivery of the fetus without disturbing the placenta, followed by partial excision of the uterine wall (placental implantation site) and repair of the uterus.
4. Delivery of the fetus without disturbing the placenta, and leaving it in situ, followed by elective secondary hysterectomy 3–7 days following the primary procedure.

There are no well-controlled observational studies, and therefore, no firm recommendations can be made.

Women with placenta percreta are more likely to require additional blood products and intensive care admission than women with placenta creta or increta.[190] The incidence of urological complications is also increased, including cystotomy and ureteric injury.[191] *[Evidence level 4]*

When the urinary bladder is invaded by placental tissue, preoperative cystoscopy and the placement of ureteric stents have been recommended.[161,192] Planned cystotomy can prevent extensive muscularis damage and bleeding from attempts at dissection.[192] *[Evidence level 4]*

Filling the bladder to identify the bladder separation site, opening the bladder to identify percreta villous tissue and removal of the involved bladder area have also been recommended by different authors.[161,165,193] *[Evidence level 4]*

Uterus-preserving surgery is possible in placenta percreta as demonstrated in a cohort study of 71 women. A multidisciplinary stepwise surgical approach, including bilateral ligations of the anterior division of the iliac arteries before removing the placenta, was shown to be successful in controlling the bleeding and preserving the patient's uterus in around 90% of the cases, with 14% of urinary tract complications, most of which can be identified and repaired during caesarean section.[194] *[Evidence level 3]*

A review of 119 placenta percreta cases published in the international literature has shown that expectant management with the placenta left in situ is associated with severe long-term complications of haemorrhage and infections, including a 58% risk of secondary hysterectomy up to 9 months after the delivery. Local resection appears to be associated with fewer complications within 24 hours postoperatively compared with hysterectomy or leaving the placenta in situ. However, a selection bias in the direction of less severe cases for the local resection technique may in part explain the lower complication rates with that approach.[195] *[Evidence level 4]*

8.5 Expectant management (leaving the placenta in situ)

Elective peripartum hysterectomy may be unacceptable to women desiring uterine preservation

or considered inappropriate by the surgical team. In such cases, leaving the placenta in situ should be considered. [D]

When the placenta is left in situ, local arrangements need to be made to ensure regular review, ultrasound examination and access to emergency care should the woman experience complications, such as bleeding or infection. [D]

MTX adjuvant therapy should not be used for expectant management as it is of unproven benefit and has significant adverse effects, including a reported maternal death. [C]

Conservative management in placenta accreta spectrum, including in cases of placenta increta and percreta, is an option in women who desire to preserve their fertility. However, it is not recommended in women presenting with major bleeding as it is unlikely to be successful and risks delaying definitive treatment and increasing morbidity.[5] *[Evidence level 4]*

A retrospective multicentre study examined 167 women treated conservatively for placenta accreta in tertiary university hospital centres in France between 1993 and 2007. Conservative expectant management with part of the placenta left in situ was successful in 131 out of 167 cases (78.4%; 95% CI 71.4–84.4).[196] One woman died of myelosuppression and nephrotoxicity related to MTX administration through the umbilical cord. Spontaneous placental resorption occurred in 87 out of 116 cases (75.0%; 95% CI 66.1–82.6), with a median delay from delivery of 13.5 weeks (range 4–60 weeks).[196] *[Evidence level 2+]*

The patient should be warned of the risks of chronic bleeding, sepsis, septic shock, peritonitis, uterine necrosis, fistula, injury to adjacent organs, acute pulmonary oedema, acute renal failure, deep venous thrombosis or pulmonary embolism.[196] Prophylactic antibiotics may be helpful in the immediate postpartum period to reduce the risk of infective complications.[197] *[Evidence level 4]*

An observational case series, including 24 women with placenta accreta left in situ after delivery and treated with MTX, reported placental delivery in 33.3% of the cases (spontaneously in 55%, and in 45% following dilatation and surgical evacuation).[199] There was no control group of patients who did not receive MTX and so it is unknown whether or not the MTX was clinically helpful. One patient did suffer liver damage and the risks of this therapy must be balanced against the unproven benefit. *[Evidence level 3]*

The pattern of follow-up for the conservative management of placenta accreta spectrum is not supported by RCTs and not stratified for the according to the depth and lateral extension of villous myometrial invasion. Some authors have reported cases where retained villous tissues were removed after conservative management using hysteroscopic resection[200,201] or high-intensity focused ultrasound.[202] In rare cases, a disseminated intravascular coagulation may develop requiring a secondary hysterectomy. [203] *[Evidence level 3]*

8.6 When is interventional radiology indicated?

Larger studies are necessary to determine the safety and efficacy of interventional radiology before this technique can be advised in the routine management of placenta accreta spectrum. [D]

Women diagnosed with placenta accreta spectrum who decline donor blood transfusion should be managed in a unit with an interventional radiology service. [D]

Since the publication of the last version of this guideline there have been several cohort studies describing the use of interventional radiology in assisting surgical and conservative management of placenta accreta with variable success. The main aim of this procedure is to reduce the risks of

intraoperative haemorrhage during the caesarean delivery of pregnancies diagnosed antenatally with praevia increta or percreta. Various combinations have been proposed, including intraoperative internal iliac artery and/or postoperative uterine artery embolisation[204,205] and internal iliac artery[206–209] or abdominal balloon occlusion[210–215]. The latter technique has been increasingly used in China but the methodology of these studies is very heterogeneous with no data on the diagnosis of the different grades of villous invasion and variable confounding factors such as placental position and number of previous caesarean deliveries. Small cohort studies have also been published on the use of a tourniquet[216,217] and of surgical artery ligation.[218] *[Evidence level 3]*

A single institution observational cohort study of 45 cases of placenta accreta describes the use of prophylactic lower abdominal aorta balloon occlusion and found a reduced need for blood transfusion.[212] One of the cases was complicated by lower extremity arterial thrombosis and another by ischaemic injury to the femoral nerve. A comparative study of abdominal aortic occlusion versus internal iliac artery occlusion found that aortic balloon occlusion resulted in better clinical outcomes with less blood loss, blood transfusion, balloon insertion time, fluoroscopy time and fetal radiation dose.[215] *[Evidence level 2–]*

A systematic review reported success rates of 159/177 (89.8%) for arterial embolisation, with secondary hysterectomy being necessary in 20/177 (11.3%) and subsequent menstruation occurring in 74/85 (87.1%). In 3/10 women (30%) a subsequent pregnancy occurred. Arterial balloon occlusion catheters have been associated with a success rate of 33/42 (78.6%) and the need for a secondary hysterectomy in 8/42 (19%).[182] *[Evidence level 2++]*

The value of prophylactic placement of balloon catheters in the iliac arteries in cases of placenta accreta has been more controversial. This is mainly because of the higher risks of complications than embolisation, including iliac artery thrombus or rupture, and ischaemic nerve injury.[219–222] *[Evidence level 3]*

A small RCT of women presenting with a prenatal diagnosis of placenta accreta was published in 2015.[223] The women were randomised to either preoperative prophylactic balloon catheters (n = 13) or to a control group (n = 14). No difference was observed for the number of women with blood loss greater than 2500 ml, number of plasma products transfused, duration of surgery, peripartum complications and hospitalisation length. Reversible adverse effects related to prophylactic balloon catheter insertion were noted in 2/13 (15.4%) cases. *[Evidence level 1+]*

8.7 How is unsuspected placenta accreta spectrum at delivery best managed?

If at the time of an elective repeat caesarean section, where both mother and baby are stable, it is immediately apparent that placenta percreta is present on opening the abdomen, the caesarean section should be delayed until the appropriate staff and resources have been assembled and adequate blood products are available. This may involve closure of the maternal abdomen and urgent transfer to a specialist unit for delivery. [GPP]

In case of unsuspected placenta accreta spectrum diagnosed after delivery of the baby, the placenta should be left in situ and an emergency hysterectomy performed. [D]

If the placenta fails to separate with the usual measures, leaving it in place and closing, or leaving it in place, closing the uterus and proceeding to a hysterectomy are both associated with less blood loss than trying to separate it. Attempts at removing placenta accreta at caesarean section can lead to massive haemorrhage, high maternal morbidity and possible maternal death. These risks are particularly high when the caesarean section takes place in an environment with no emergency access to blood bank products and expertise in managing placenta accreta.[20,21,123,136] *[Evidence level 4]*

9. Clinical governance

9.1 Debriefing

Postnatal follow-up should include debriefing with an explanation of what happened, why it happened and any implications for future pregnancy or fertility. In particular, women where conservative treatment of placenta accreta spectrum has been successful should be informed of the risk of recurrence.

9.2 Training

Raising the awareness about the clinical risk factors of placenta accreta spectrum should be pursued locally, including organising policies or guidelines for flagging up women at risk and arranging for them to see a specialist consultant when suspected.

There should be appropriate training for ultrasound staff in the antenatal diagnosis of placenta accreta spectrum.

9.3 Clinical incident reporting

Any lack of compliance with the care bundle by the clinical team for a woman with either placenta praevia or accreta should be investigated.

There should be written protocols for identification of and planning further care of women suspected to have placenta accreta spectrum.

10. Recommendations for future research

- A large prospective study comparing the impact on the management of the use of the 'low-lying placenta or placenta praevia' classification with the traditional grades 1–4 classification at different gestations is needed.
- Prospective studies are needed to assess the role of third trimester ultrasound in evaluating the risks of haemorrhage and emergency caesarean section in low-lying placenta and determining the mode of delivery.
- Large prospective population-based studies are needed in order to assess whether ultrasound is a cost-effective screening tool for placenta accreta spectrum in women with a history of caesarean section(s) presenting with a low-lying placenta or placenta praevia in the second trimester of pregnancy.
- Prospective comparative ultrasound imaging including transvaginal ultrasound and MRI studies are needed to evaluate the diagnostic accuracy for evaluation of the depth and topography of villous invasion in adjacent organs.
- RCTs of optimal timing of delivery for both conditions (placenta praevia and placenta accreta) are needed.
- RCTs of surgical and nonsurgical management strategies for placenta accreta spectrum (including interventional radiology) and comparing conventional versus conservative management, stratified according to the depth and lateral extension of villous myometrial invasion, are needed.
- Future studies on the diagnosis and management of placenta accreta spectrum should use standardised evidence-based approach including a systematic correlation between ultrasound signs and detailed clinical diagnosis at delivery and pathologic confirmation of grades of villous invasiveness when possible.

11. Auditable topics

Placenta praevia

- Antenatal diagnosis of placenta praevia (100%).
- Antenatal detection and treatment of anaemia (100%).
- Antenatal imaging performed according to hospital policy (100%).
- Appropriate antenatal delivery plan made and documented, to include discussion with woman and her partner, documentation that the risks and indications for blood transfusion and hysterectomy have been discussed and that concerns, queries or refusals of treatments have been addressed (100%).
- Involvement of local blood bank and haematologist in the care of women with placenta praevia and atypical antibodies (100%).
- Appropriate personnel present at delivery (100%).
- Appropriate site for delivery (100%).
- Appropriate surgical approaches performed (100%).
- Early-term elective delivery between 37^{+0} and 37^{+6} weeks of gestation for asymptomatic women with placenta praevia and no other risk factors (100%).
- Antenatal steroid administration between 34^{+0} and 36^{+0} weeks of gestation (100%).
- Women requesting elective caesarean section for nonmedical reasons are informed of the risk of placenta praevia and accreta spectrum, and its consequences in future deliveries (100%).

Placenta accreta spectrum

- Antenatal imaging performed according to hospital policy with diagnosis confirmed at birth (100%).
- Appropriate antenatal delivery plan made and documented, to include discussion with woman and her partner, documentation that the risks and indications for blood transfusion and hysterectomy have been discussed and that concerns, queries or refusals of treatments have been addressed (100%).
- All elements of the care bundle satisfied before elective surgery in women with placenta accreta spectrum (100%):
  - consultant obstetrician planned and directly supervising delivery
  - consultant anaesthetist planned and directly supervising anaesthetic at delivery
  - blood and blood products available
  - multidisciplinary involvement in preoperative planning
  - discussion and consent includes possible interventions (such as hysterectomy, leaving the placenta in place, cell salvage and interventional radiology) and local availability of a level 2 critical care bed.

12. Useful links and support groups

- Royal College of Obstetricians and Gynaecologists. *Low-lying placenta after 20 weeks (placenta praevia). Information for you.* London: RCOG; 20XX *[insert web address].*
- National Childbirth Trust. *Placenta praevia – low-lying placenta* [https://www.nct.org.uk/pregnancy/low-lying-placenta].

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Appendix I: Explanation of guidelines and evidence levels

Clinical guidelines are: 'systematically developed statements which assist clinicians and patients in making decisions about appropriate treatment for specific conditions'. Each guideline is systematically developed using a standardised methodology. Exact details of this process can be found in Clinical Governance Advice No.1 *Development of RCOG Green-top Guidelines* (available on the RCOG website at http://www.rcog.org.uk/green-top-development). These recommendations are not intended to dictate an exclusive course of management or treatment. They must be evaluated with reference to individual patient needs, resources and limitations unique to the institution and variations in local populations. It is hoped that this process of local ownership will help to incorporate these guidelines into routine practice. Attention is drawn to areas of clinical uncertainty where further research may be indicated.

The evidence used in this guideline was graded using the scheme below and the recommendations formulated in a similar fashion with a standardised grading scheme.

Classification of evidence levels

1++	High-quality meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a very low risk of bias
1+	Well-conducted meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a low risk of bias
1–	Meta-analyses, systematic reviews of randomised controlled trials or randomised controlled trials with a high risk of bias
2++	High-quality systematic reviews of case–control or cohort studies or high-quality case–control or cohort studies with a very low risk of confounding, bias or chance and a high probability that the relationship is causal
2+	Well-conducted case–control or cohort studies with a low risk of confounding, bias or chance and a moderate probability that the relationship is causal
2–	Case–control or cohort studies with a high risk of confounding, bias or chance and a significant risk that the relationship is not causal
3	Non-analytical studies, e.g. case reports, case series
4	Expert opinion

Grades of Recommendation

A — At least one meta-analysis, systematic reviews or RCT rated as 1++, and directly applicable to the target population; or a systematic review of RCTs or a body of evidence consisting principally of studies rated as 1+, directly applicable to the target population and demonstrating overall consistency of results

B — A body of evidence including studies rated as 2++ directly applicable to the target population, and demonstrating overall consistency of results; or
Extrapolated evidence from studies rated as 1++ or 1+

C — A body of evidence including studies rated as 2+ directly applicable to the target population, and demonstrating overall consistency of results; or
Extrapolated evidence from studies rated as 2++

D — Evidence level 3 or 4; or
Extrapolated evidence from studies rated as 2+

Good Practice Points

✓ — Recommended best practice based on the clinical experience of the guideline development

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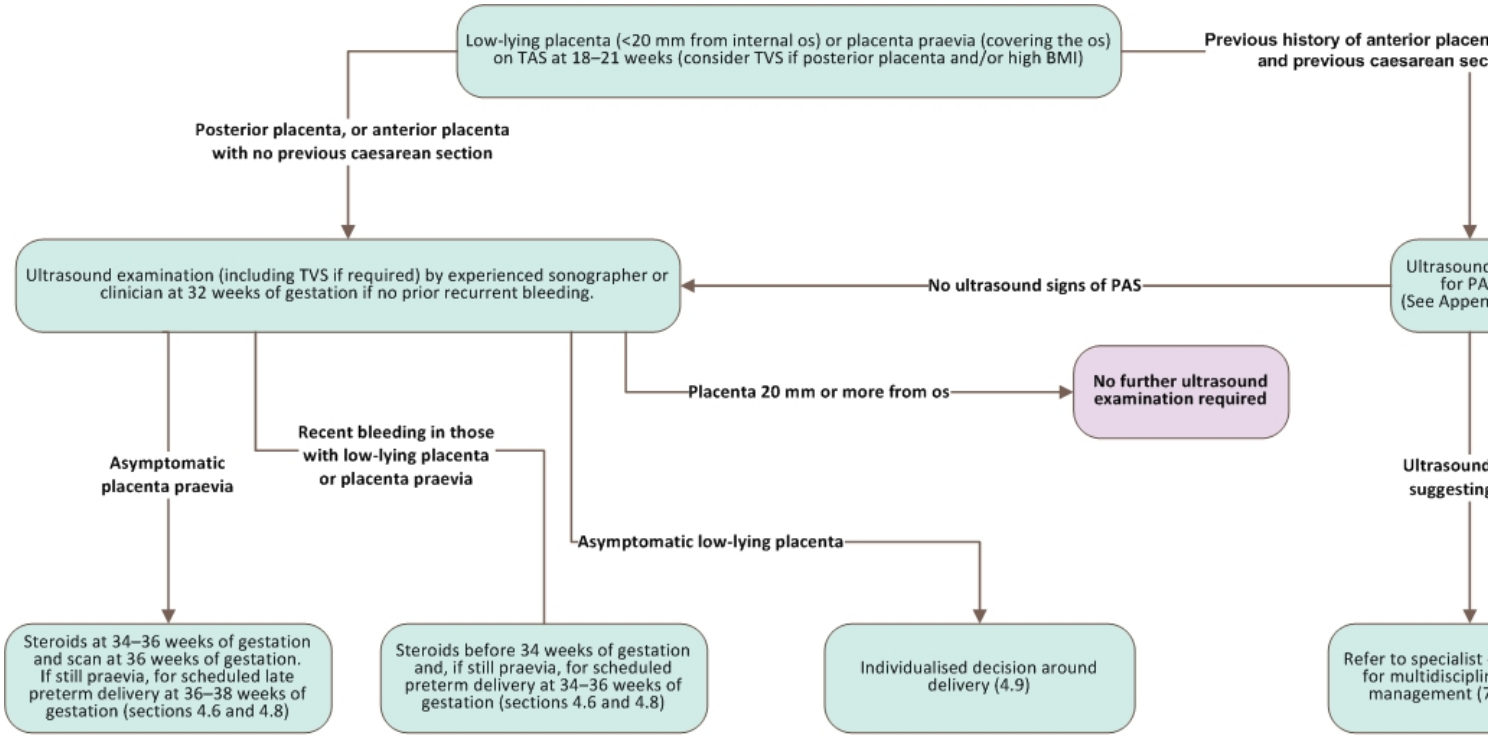
Appendix II: Flow diagram for ultrasound diagnosis and follow-up of placenta praevia and placenta accreta spectrum



Abbreviations: **BMI** body mass index; **PAS** placenta accreta spectrum; **TAS** transabdominal scan; **TVS** transvaginal scan.

Appendix III: Ultrasound imaging signs commonly used to diagnose placenta accreta spectrum (modified from Collins SL)[141]

Ultrasound imaging signs	Description
2D greyscale signs	
Loss of the 'clear zone'	Loss or irregularity of the hypoechoic plane in the myometrium underneath the placental bed (the 'clear zone').
Abnormal placental lacunae	Presence of numerous lacunae, including some that are large and irregular (Finberg grade 3), often containing turbulent flow visible in greyscale imaging.
Bladder wall interruption	Loss or interruption of the bright bladder wall (the hyperechoic band or 'line' between the uterine serosa and the bladder lumen).
Myometrial thinning	Thinning of the myometrium overlying the placenta to less than 1 mm or undetectable.
Placental bulge	Deviation of the uterine serosa away from the expected plane, caused by an abnormal bulge of placental tissue into a neighboring organ, typically the bladder. The uterine serosa appears intact but the outline shape is distorted.
Focal exophytic mass	Placental tissue seen breaking through the uterine serosa and extending beyond it. Most often seen inside a filled urinary bladder.
2D colour Doppler signs	
Uterovesical hypervascularity	Striking amount of colour Doppler signal seen between the myometrium and the posterior wall of the bladder. This sign probably indicates numerous, closely packed, tortuous vessels in that region (demonstrating multidirectional flow and aliasing artifact).
Subplacental hypervascularity	Striking amount of colour Doppler signal seen in the placental bed. This sign probably indicates numerous, closely packed, tortuous vessels in that region (demonstrating multidirectional flow and aliasing artifact).
Bridging vessels	Vessels appearing to extend from the placenta, across the myometrium and beyond the serosa into the bladder or other organs. Often running perpendicular to the myometrium.
Placental lacunae feeder vessels	Vessels with high velocity blood flow leading from the myometrium into the placental lacunae, causing turbulence upon entry.
3D colour Doppler signs	
Intraplacental hypervascularity (power Doppler)	Complex, irregular arrangement of numerous placental vessels, exhibiting tortuous courses and varying calibers.

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All RCOG guidance developers are asked to declare any conflicts of interest. A statement summarising any conflicts of interest for this guideline is available from: XXX.

The final version is the responsibility of the Guidelines Committee of the RCOG.

The guideline will be considered for update 3 years after publication, with an intermediate assessment of the need to update 2 years after publication.