RCOG Green-top Guideline No. 27a
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Placenta Praevia and Placenta Accreta Spectrum: Diagnosis and Management

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This is the fifth 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 Accreta: Diagnosis and Management*; the third, published in 2011, was entitled *Placenta Praevia, Placenta Accreta and Vasa Praevia: Diagnosis and Management* and the fourth was divided into GTG27a *Placenta Praevia, Placenta Accreta Diagnosis and Management and GTG27b Vasa Praevia: Diagnosis and Management.*

Key recommendations

Placenta praevia

- The fetal anomaly screening (FAS) ultrasound examination at 18^{+0}–20^{+6} weeks of gestation should include placental location. [Grade A]
- For pregnancies > 16 weeks of gestation, the placental location should be recorded on ultrasound imaging as praevia if covering (partially or completely) the internal os of the uterine cervix, and low-lying if its leading edge is < 20 mm from the internal os. [Grade B]
- Women and pregnant people with a symptomatic (pain and/or bleeding low-lying placenta or placenta praevia should be provided with antenatal care, including hospitalisation, tailored to their individual clinical need and social circumstances. [Grade GPP]
- Asymptomatic pregnant women with a low-lying placenta or placenta praevia can be cared as outpatients and should be offered follow-up ultrasound examination including a transvaginal scan at 32 weeks by an experienced operator for delivery management planning. [Grade GPP]
- Tocolysis for women presenting with symptomatic placenta praevia may be considered for 48 hours to facilitate administration of antenatal corticosteroids but cervical cerclage is not recommended. [Grade B]
- Corticosteroids should be offered to pregnant women with a placenta praevia between 24^{+0} and 34^{+6} weeks' gestation in whom imminent preterm birth is anticipated (either due to established preterm labour or planned preterm birth for medical indications). [Grade A]
- For women and pregnant people presenting with an uncomplicated low-lying placenta or placenta praevia, timing of birth should be tailored according to antenatal symptoms and planned birth should be considered no later than 37^{+6} weeks of gestation. [Grade A]
- Pregnant women presenting with a placenta praevia carry a high risk of intraoperative haemorrhage, post-partum haemorrhage and hysterectomy and birth should be arranged in a maternity unit with on-site blood transfusion services and access to critical care. [Grade C]
- Cell salvage is recommended for women with a placenta praevia where the anticipated blood loss is great enough to induce anaemia, in particular, in women who decline transfusion of blood products. [Grade B]

- If pharmacological measures (uterotonics and tranexamic acid) fail to control haemorrhage during and after birth in women with low-lying placenta or placenta praevia, intrauterine balloon tamponade should be initiated and uterine compression sutures should be considered. [Grade B]

Caesarean scar pregnancy

- Women and pregnant people diagnosed with a viable caesarean scar ectopic pregnancy (CSEP) at the end of the first trimester of pregnancy must be informed by an expert consultant of the high risk of developing major complications such as placenta praevia and placenta praevia accreta in the second and third trimester. [Grade B]

Placenta accreta spectrum

- Women at high-risk of PAS at birth (previous history of caesarean birth with a pregnancy resulting from in-vitro fertilisation) should be identified at the first antenatal appointment and provided with a care plan including screening for ultrasound signs associated with PAS at the at 18^{+0}–20^{+6} weeks FAS ultrasound examination. [Grade C]
- Where ultrasound imaging expertise including transvaginal scan is available, MRI is not recommended in routine evaluation of women with a high probability of PAS at birth. [Grade C]
- Women with a high probability of PAS should be assessed by a multidisciplinary team (MDT) in a specialist centre with expertise in regularly diagnosing and caring for complex caesarean sections. [Grade B]
- Timing of birth of women and pregnant people with a high probability of PAS should be tailored according to antenatal symptoms and placental location. In the absence of risk factors for PTB and or antenatal bleeding, planned birth at 35^{+0} to 36^{+6} weeks of gestation provides the best balance between prematurity and the risk of operative complications associated with unscheduled delivery. [Grade B]
- Delivery of women with a high probability of PAS at birth should take place in a specialist centre with an MDT with expertise in complex obstetric surgery and logistic support for immediate access to blood products, adult intensive care unit and NICU. [Grade B]
- Attempting to separate the placenta from the uterine wall or incising through the placenta for fetal extraction should be avoided in all patient with a high probability of PAS at birth**.** [Grade B]
- The routine use of prophylactic ureteric stents is not recommended in the management of PAS but collaboration with a urologic surgeon is advisable in cases presenting with major uterine remodelling and hypervascularity of the bladder-uterine interface on pre-operative imaging. [Grade C]
- Interventional radiology procedures are not recommended in the routine care of PAS. [Grade C]
- When the placenta is left in situ after delivery of the fetus, local arrangements need to be made to ensure regular review, ultrasound examinations and access to emergency care, should the patient experience complications such as bleeding or infection. Methotrexate adjuvant therapy should not be used in this context. [Grade D]
- The patient and her partner should be involved in the pre-operative decision concerning the mode of anaesthesia and post-operative discussion about pain control and informed of the availability of psychological support before and after birth. [Grade C]
- Women with PAS who were managed conservatively (uterine preservation surgery or placenta left in situ) should be informed of the high risk of recurrence in subsequent pregnancies. [Grade C]

1. Purpose and scope

The purpose of this guideline is to describe the diagnostic modalities and review the evidence-based approach to the clinical care of pregnancies complicated by placenta praevia and placenta accreta spectrum (PAS). Many observational studies do not have rigorous design regarding the diagnosis of these conditions and there are very few randomised controlled trials to support specific approaches to care limiting the ability to provide detailed evidence-based recommendations for some specific aspects of care.

This guideline is for healthcare professionals who care for women, non-binary and trans people with placenta praevia or PAS. Within this document we use the terms woman and women's health. However, it is important to acknowledge that it is not only women for whom it is necessary to access women's health and reproductive services in order to maintain their gynaecological health and reproductive wellbeing. Gynaecological and obstetric services and delivery of care must therefore be appropriate, inclusive and sensitive to the needs of those individuals whose gender identity does not align with the sex they were assigned at birth.

2. Introduction and background epidemiology

Placenta praevia and PAS are associated with high maternal and neonatal morbidity and mortality due to antepartum haemorrhage (APH) and/or major obstetric haemorrhage (MOH) during birth and preterm birth (PTB).[1-4] The rates of both placenta praevia and accreta have increased and are likely to continue to do so as a result of rising rates of caesarean births and use of assisted reproductive technology (ART), in particular in vitro-fertilisation (IVF). The highest rates of complication for both the woman and pregnant person and their newborn are observed when these conditions co-exist and are only diagnosed during birth.[4-8] There is no evidence of ethnic variations in the prevalence nor incidence of these placental-related complications of pregnancy.

2.1 Placenta praevia

The first clinical description of a placenta praevia is attributed to Paul Portal a 17th century French surgeon.[9] Placenta praevia was a major cause of perinatal mortality until the development of radiology imaging, and identifying placental location was one of the first aims of the use ultrasound in obstetric care.[10,11] Determining the placental location is now part of the fetal anomaly screening (FAS) scan also called the mid-pregnancy fetal anomaly scan around the world[12] (performed at 18^{+0}–20^{+6} weeks of gestation in the UK).

For pregnancies > 16 weeks of gestation, the placenta should be reported as 'low-lying' when the lower placental edge is < 20 mm from the internal os (IO) of the uterine cervix, but not covering it and as normal when the placental edge is $\geq$ 20 mm from the IO on ultrasound imaging.[13] If the placental edge reaches or covers the IO on ultrasound examination, the placenta should be reported as praevia. This version and the previous version of the guideline endorses this ultrasound classification as this standardised protocol is less confusing than the old clinical classification (low-lying, marginal, partial covering) and better defines the risks of perinatal complications, such as APH and postpartum haemorrhage (PPH), and has recently been shown to improve the obstetric care of both placenta praevia and placenta praevia accreta.[14,15]

The reported prevalence of placenta praevia in the second half of pregnancy ranges between 1 in 50 to 1 per 500 pregnancies.[3,16] These numbers depend on gestational age at confirmation of diagnosis, the use of transvaginal ultrasound (TVS) together with the standardised classification described above and with the incidence of the main risk factors in different populations, i.e. numbers of prior caesarean births and IVF conceptions. 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 spectrum

Placenta accreta is a clinical diagnosis which can only be made at birth when the placenta cannot be detached digitally from the uterine wall. The histopathologic criteria used to describe placenta accreta were published between the 1920s and 1960s and include the entire or partial absence of decidua basalis with villous tissue directly attached or sometimes growing in between the individual fibers of the myometrium (increta)[17-19] and sometime invading through the entire uterine wall and beyond into the surrounding pelvic tissues and organs (percreta).[20] These descriptions have been used ever since by perinatal pathologists to confirm the diagnosis of PAS at birth and included in 2019 the International Federation of Gynecology and Obstetrics (FIGO) placenta accreta spectrum (PAS) classification[21] and endorsed in 2020 by Society for Pediatric Pathology.[22]

Recent studies have shown that the clinical and histopathologic descriptions of placenta percreta are the consequence of the uterine scarring with secondary dehiscence and intra-operative dissection of the lower uterine segment (LUS) and there is no histologic evidence of placental villi found to spontaneously "invade" the entire thickness of the uterine wall and beyond, previously called placenta percreta.[23-26] Abnormal villous attachment into the myometrial scar area i.e. superficial (creta/adherenta) and deep (increta) can be found in the same specimen and thus accreta placentation can be described as a spectrum depending on the depth and lateral extension of the accreta area.[23-26] The PAS diagnostic conundrum is also obvious at the other end of the spectrum where the differential diagnosis between a difficult manual removal, and commonly associated uterine atony, after a vaginal birth and superficially abnormally attached villous tissue may be impossible in the absence of histopathological confirmation. Overall, the lack or limited clinical description and/or detailed data on histopathologic examination at birth is a major limitation to the interpretation of the results of many observational and case-control studies on PAS.[27,28] When the placenta spontaneously detaches at birth or during the post-partum period or retained cotyledons can be removed by simple curettage/aspiration without the need to surgically remove the part of the uterine wall under the area of abnormal villous attachment[29], the case should not be reported as PAS in the patient record or maternity database. These diagnostic difficulties can explain the current wide variation in reported prevalence of placenta accreta ranging between 1 in 100 and 1 in 10 000 pregnancies[27] and highlight the need for the use of standardised approach to imaging, clinical and histopathologic descriptions.

The continuous rise in caesarean birth rates has changed the epidemiology and pathophysiology of PAS.[30] Over the last decade, there has been mounting evidence that most cases of PAS result from placentation into a caesarean scar defect (CSD).[31] Some clinical aspects of caesarean scar ectopic pregnancy (CSEP) are therefore included in the present guideline.

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 December 2017 and September 2023 (the search for the previous Guideline was up to November 2017). 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 'low-lying placenta'; 'placenta praevia', 'low lying placenta', 'placenta accreta', 'placenta increta' 'placenta percreta', 'abnormally adherent placenta' and 'abnormally invasive placenta'. The search was restricted to human studies 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. What are the risk factors associated with low-lying placenta or placenta praevia?

Table 1 Epidemiologic factors associated with placentation in the LUS

Risks factors	Evidence level
Previous caesarean birth	2++
Multiple pregnancies	2+
Pregnancy resulting from IVF	2++
History of endometriosis	2+
Maternal smoking	1+
Uterine fibroid	1+
Short pregnancy interval (< 1 year)	1+
Advanced maternal age	2-

A 2018 systematic review and meta-analysis found that, compared to vaginal birth, a caesarean birth was associated with an odds ratio (OR) of 1.74 (95% CI 1.62–1.87; *n* = 7 101 692; 10 studies) of placenta praevia in the next pregnancy.[32] *[Evidence level 2++]*

In 1997, a meta-analysis of the association of placenta praevia with history of caesarean birth 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 births compared with vaginal birth.[33] A systematic review and meta-analysis of 22 studies including over two million births indicated that the incidence of placenta praevia increases from 10 in 1000 births with one previous caesarean birth to 28 in 1000 after more than 3 caesarean births.[34] A 2014 meta-analysis confirmed these findings and reported an overall OR of 1.47 (95% CI 1.44–1.51) for placenta praevia after caesarean birth.[35] *[Evidence level 2++]*

Cohort studies have also reported that a second pregnancy within one year of a caesarean birth is associated with an increased risk of placenta praevia as compared to intervals longer than one year.[36] A systematic review found that compared with vaginal birth, a previous prelabour caesarean birth is associated with an increased risk of placenta praevia in the second birth.[37] *[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.[38] A retrospective cohort of 67 895 singleton and twin pregnancies found that dichorionic and monochorionic twin pregnancies had an increased risk of placenta praevia compared with singletons.[39] *[Evidence level 2+]*

Over the last decade, there has been increasing evidence for an association between ART in general and IVF in particular, and a higher incidence of pregnancies with a placenta praevia, independently of the high rate of multiple pregnancies generated by the technique used.[39-46] In 2019, a systematic review and meta-analysis of 33 low/moderate quality studies evaluating 124 215 ART and 6 054 729 non-ART singleton pregnancies reported an increase risk (OR 3.76, 95% CI 3.09–4.59) in ART pregnancies compared to spontaneous conceptions[42], confirming the findings of previous systematic reviews.[40,41] A Scandinavian population-based cohort study including data on 146 998 pregnancies resulting from ART over 20–25 years found that over time, the risk of placenta praevia increased in pregnancies after ART among both singletons and twins, but remained stable in spontaneously

conceived pregnancies.[43] A retrospective multicentre cohort study in Massachusetts of 1939 pregnancies conceived with ART found an incidence of 2.9% of placenta praevia at birth.[44] *[Evidence level 2++]*

In 2018, a systematic review of the perinatal outcomes of endometriosis of 33 observational studies including 3 280 488 pregnancies found that women with endometriosis are at higher risk placenta praevia (OR 3.31, 95% CI 2.37–4.63) in pregnancies resulting from both spontaneous conception and ART.[47] This finding was confirmed by a 2021 systematic review of 7 184 313 pregnancies without endometriosis compared with 98 463 pregnancies with endometriosis (aOR 3.17, 95% CI 2.58–3.89).[48] When stratified according to histologic confirmation, the risk increased in women with confirmed endometriosis (aOR 4.23, 95% CI 1.74–10.30).[48] New data support an association between endometriosis and the risk of placenta praevia. A French nationwide cohort of 4 121 767 singleton births, including 38 035 diagnosed with endometriosis, has reported an overall increased the risk of placenta praevia in women with endometriosis including in those with pregnancies resulting from ART.[49] *[Evidence level 2+]*

A 2017 meta-analysis of the impact of maternal smoking on placental position[50] (OR 1.42, 95% CI 1.30–1.50) has found an increased risk of placenta praevia and a 2019 meta-analysis found an increased risk (2.21; 95%CI 1.48–2.94) in women with fibroids.[51] *[Evidence level 1+]*

Advancing maternal age (35+) has been also associated with a slight increase in the risk of placenta praevia in spontaneous conceptions in a large population-based study[52] but this effect is likely to be confounded by the association between increased parity and increased maternal age. *[Evidence level 2–]*

5. Antenatal diagnosis and care of women with low-lying placenta or placenta praevia

5.1 Antenatal screening and diagnosis

5.1.1 Screening for a low-lying placenta or placenta praevia and follow-up

Recommendation	Evidence quality	Strength	Rationale for the recommendation
The fetal anomaly screening scan at 18^{+0}–20^{+6} weeks of gestation should include placental location.	**4**	**A**	Undiagnosed placenta praevia is associated with a high maternal and neonatal morbidity.
The placental location should be recorded as praevia if the lower edge reaches or covers (partially or completely) the IO and low-lying if its edge is < 20 mm from the IO, after 16 weeks of gestation.	**4**	**B**	The use of standardised protocol for the diagnosis and follow-ups of women presenting with low placentation is essential to optimise maternal and perinatal outcomes.
A follow-up ultrasound examination including a TVS is recommended at 32 weeks of gestation to diagnose a persistent low-lying placenta or confirm a placenta praevia and the corresponding management should be discussed with the obstetric team in charge of the patient care.	**4**	**D**	Between mid-gestation and 37 weeks, over 90% of placenta recorded as low-lying are no longer low-lying.

The use of ultrasound imaging in antenatal care has been pivotal in diagnosis of placenta praevia before birth, an obstetric condition which up to 50 years ago was a main cause of perinatal morbidity and mortality worldwide.[53,54] Ultrasound imaging has rapidly become essential in the care of women and pregnant people presenting with an APH,[55] however, the UK National Screening Committee (UK NSC) has never recommended a national screening program for placenta praevia. The national guidance, information and processes for the NHS England Fetal Anomaly Screening Program (FASP) state that the examination of placental position and amniotic fluid at the 18^{+0}–20^{+6} week FAS scan is not part of the NHS FASP but is good clinical practice (https://www.gov.uk/guidance/fetal-anomaly-screening-programme-overview). The National Institute for Health and Care Excellence (NICE) Guideline [NG201] *Antenatal care* recommends offering all pregnant women and people a screen for fetal anomalies and to determine the placental location at the routine mid-pregnancy scan (https://www.nice.org.uk/guidance/ng201). *[Evidence level 4]*

A prospective study of 381 singleton pregnancies with a live fetus at 11–14 weeks attending for routine antenatal care found that when the placental edge overlaps the IO by 23 mm or more at 11–14 weeks the probability of placenta praevia at term is 8% with a sensitivity of 83.3% and specificity of 86.1%.[56] This strategy is not sustainable in routine obstetrics antenatal care as it would require all women to have a TVS at the 11–14 weeks ultrasound examination by an expert operator. The recent guideline of Society of Obstetricians and Gynaecologists of Canada (SOGC) on the diagnosis and care of placenta praevia recommends that a diagnosis of placenta praevia or low-lying placenta should not be made <18 weeks of gestation.[57] *[Evidence level 4]*

The development of the LUS during the second half of pregnancy results in the resolution (also called "placental migration") of over 90% of placentas identified as low-lying on transabdominal ultrasound at the mid-trimester scan before 37 weeks.[58–60] A 2019 systematic review and meta-analysis of 11 eligible studies including 3586 women with a low-lying placenta (placental edge ≤ 20mm from the IO) in the second trimester found over two thirds will be fully located within the upper segment in the third trimester.[61] *[Evidence level 2++]*

In twin pregnancies, the likelihood of persistent placenta praevia is also dependent on the gestational age at sonographic detection. Retrospective cohort studies of twin pregnancies with placenta praevia diagnosed in the second trimester, reported that the majority will have resolved by 32 weeks of gestation.[38,62] After 32 weeks of gestation around 50% of the remaining placenta praevia will resolve, with no further changes after 36 weeks of gestation.[38] *[Evidence level 2–]*

The high resolution of TVS imaging and proximity of the transvaginal ultrasound probe to the regions of interest allows for the detailed examination of the cervix, lower uterine segment and urinary bladder that would otherwise be difficult to see on TAS, in particular in women with a high BMI. TVS has a higher accuracy at 32-36 weeks than TAS in the differential diagnosis between a low-lying placenta and a placenta previa.[13] Traditionally recommendations on the timing of a confirmatory ultrasound examination in the third trimester for a low-lying placenta or asymptomatic placenta praevia on transabdominal ultrasound at the mid-trimester fetal anatomy scan have been 32[13,63] or after 32 weeks[57] of gestation. If the placental edge is still low-lying or praevia, a follow-up TVS should be performed at 36 weeks for the delivery management (appendix II). *[Evidence level 4]*

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

Recommendation	Evidence quality	Strength	Rationale for the recommendation
A TVS examination should be included in the third-trimester ultrasound follow-up(s) of asymptomatic women or pregnant people presenting with a low-lying placenta	**2+**	**C**	TVS is more accurate than transabdominal ultrasound to differentiate between low-lying placenta and placenta praevia and

or placenta praevia at the 18^{+0}–20^{+6} week FAS scan and for all women presenting with bleeding in the second or third trimester.			is safe even in symptomatic women or pregnant people.
The timing of the follow-up ultrasound examinations and informed discussion about mode of birth in persistent low-lying placenta should be tailored according to the woman's symptoms and TVS findings.	**2+**	**C**	Individualising women's follow-up and birth planning allows proactive management of risks.

Ultrasound examination to determine the placental location can be done transabdominally, transvaginally, transperineally or transrectally.[64] TVS was first used in the diagnosis of placenta praevia 35 years ago and shown to be safe in women presenting with bleeding.[65] The high resolution of TVS imaging and proximity of the transvaginal ultrasound probe to the regions of interest allows for the detailed examination of the pelvic anatomy that would otherwise be difficult on transabdominal ultrasound, in particular for women or pregnant people presenting with a posterior placenta and/or a high body mass index (BMI). The majority of pregnant women who have TVS reported finding the experience acceptable[66] and TVS is safe in women suspected of having a placenta praevia on transabdominal ultrasound.[67,68] The data of one small (n = 38) RCT[69] and one small quasi RCT (n = 13)[70] comparing transabdominal scan and TVS for placenta praevia support the safety of TVS profile and reports superior views, especially for posterior placentas. *[Evidence level 2+]*

TVS will re-classify up to 60% of placentas diagnosed as low-lying at the routine fetal anomaly transabdominal scan.[71–78] 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 diagnosed with 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%.[67] A Dutch prospective cohort study of 958 women with a low positioned placenta confirmed on TVS found that only 5% of those diagnosed with a low-lying placenta at 18–24 weeks of gestation still have a low-lying placenta at 32–36 weeks.[76] A secondary analysis of the data of 313 women from the same cohort with a placenta praevia in the second trimester found that 14% still had a placenta praevia in the third trimester.[77] *[Evidence level 2+]*

TVS also allows accurate measurement of the distance between the placental edge and the IO.[14,76-81] A retrospective study of 658 women with a low-lying placenta or placenta praevia at mid-trimester anatomy scan, with known distance from the IO, found that the probability of resolution was inversely proportional to the distance from the IO. Resolution is near universal in women with an initial distance from the IO $\geq$ 10 mm.[81] The findings of this study also indicated that the distance between the placental edge and the IO on TVS, as a threshold to recommend follow-up sonograms, could be reduced from 20 mm to 5 mm without missing any high-risk women.[76] A retrospective multicentre study of births between 2007–2012, including 171 women with low-lying placenta, found that the vaginal birth rate in the trial-of-labour group (n=70) was 50.0% in those with an internal os distance of 11–20 mm and 18.5% in those with a distance of 1–10 mm.[14] *[Evidence level 2+]*

TVS has been increasingly used to measure the cervical length (CL) and cohort studies with low risks of confounding bias have shown that the CL is a predictor of antepartum bleeding and emergency preterm caesarean birth in placenta praevia.[82–85] A recent systematic review and meta-analysis of 13 observational studies reported that a CL ≤30 mm at 28 to 34 weeks of gestation is associated with antenatal bleeding (OR; 3.62 95%CI 2.09-6.26), preterm birth (OR 8.46; 95%CI 3.05-23.44) and PPH (OR 6.89; 95%CI 4.51-10.53) suggesting that measurements of CL can assist in predicting the risk of perinatal complications in women with persistent placenta previa at follow-up scans.[86] *[Evidence level 2+]*

5.2 Antenatal care

The goals for the care of women and pregnant people with a low-lying or placenta praevia should be tailored according to clinical symptoms, mainly antenatal bleeding and preterm labour, local protocols and the personal goals and social circumstances of pregnant women. Women and pregnant people with a low-lying or placenta praevia their family members should be informed and have clear understanding of signs and symptoms that warrant an immediate visit to hospital for evaluation and possible antenatal admission.

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

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Women with a symptomatic (bleeding, including spotting, contractions or pelvic) pain) low-lying placenta or placenta praevia should be provided with antenatal care, including hospitalisation, tailored to their individual clinical need and social circumstances such as distance between home and maternity hospital and availability of transportation.	**4**	**GPP**	Women should be informed of the symptoms of the risks associated with a low-lying placenta and placenta previa and be provided with emergency plan including emergency contact numbers.
Women with an asymptomatic placenta praevia confirmed at the 32-week follow-up scan can be cared for as outpatients but should be encouraged to ensure they have safety measures in place, including access to help at home and ready access to the hospital.	**4**	**GPP**	Women and pregnant people presenting with a low-lying placenta or placenta praevia should be informed about the risks of antenatal bleeding and preterm labour as major haemorrhage is more likely as pregnancy advances.

A systematic review and meta-analysis of the 29 studies including 4687 pregnant women with placenta praevia reported a pooled overall prevalence of antepartum haemorrhage of 51.6% (95% CI 42.7–60.6).[87] There was a high heterogeneity between studies (I^2 = 97.9) due to differences in distribution of obstetric, social and lifestyle confounding factors associated with antenatal bleeding as identified by the authors, but also probably due to differences in gestational age at diagnosis, in definition of the different grade of low placentation, description of the placental position on ultrasound imaging and the use of TVS. *[Evidence level 1–]*

Two large retrospective studies have reported on the obstetric outcomes of women presenting with a placenta praevia. The first study included 513 women diagnosed antenatally with a low-lying placenta or placenta praevia after 28 weeks of gestation, of whom 67.3% gave birth at term. The authors found that APH was associated with an increased risk of blood transfusion, emergency caesarean birth and PTB after 32 weeks of gestation.[88] The second study included women diagnosed at the time of birth and compared major (complete and partial praevia) with minor (marginal and low-lying) cases. The authors found that major cases had an increased risk of APH, birth at an earlier gestational age (36.1 versus 37.4 weeks) and greater incidence of unscheduled (51% versus 40%) caesarean births.[89] *[Evidence level 2–]*

5.2.1.1 Women and pregnant people with recurrent bleeding

The retrospective analysis of the antenatal data of 250 women presenting with placenta praevia at the routine fetal anomaly scan found that the risk of emergency caesarean birth is increased if the first (sentinel) vaginal bleeding episode occurs before 29 weeks of gestation, and with the occurrence of three or more episodes of APH.[90] Similarly, a retrospective study of 214 women with singleton pregnancies found that the risk of preterm emergency caesarean birth increases with the number of antepartum bleeding episodes.[91] A recent retrospective case-control study including 125 singleton women with placenta praevia found an association between APH, premature contractions and CL < 2.5 cm.[92] In summary, the risk of unscheduled birth increases with earlier gestational age of the first episode of antepartum bleeding, number of bleeding episodes and shorter length of the cervix. *[Evidence level 2+]*

The Cochrane systematic review 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 2003 and includes only one small RCT (n = 53) comparing hospital versus home care for symptomatic placenta praevia.[93] 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.[94] *[Evidence level 1–]*

5.2.1.2 Asymptomatic women and people

Most women and pregnant people with asymptomatic placenta praevia (no bleeding or contractions) can be cared for as outpatients with similar outcomes compared with hospitalisation and at lower cost.[95] There is a need for further prospective clinical studies including ultrasound parameters such as the distance between the placental edge and the IO, the lower placental edge thickness and CL to evaluate the risks of third trimester bleeding and premature labour (Appendix II). The woman's obstetric history and in particular, a history of previous caesarean births and/or preterm birth is also essential in tailoring the antenatal care of individual women. *[Evidence level 4]*

5.2.2 Is there a place for preventive interventions of preterm birth (PTB) in women diagnosed with a low-lying placenta or a placenta praevia?

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Routine use of cervical cerclage is not recommended in women and pregnant people presenting with low-lying placenta or placenta praevia alone.	**1+**	**B**	Cervical cerclage does not prolong gestation in women with a low-lying placenta and there is insufficient evidence on its efficacy and safety in women with a placenta praevia.

The most important impact on neonatal morbidity associated with low-lying or placenta praevia is PTB.[96] A systematic review and meta-analysis found that the PTB rates for low-lying/marginal placenta and placenta praevia are 26.9% and 43.5%, respectively. Based on comparative studies using controls with normal placental location, placenta praevia is associated with an increased risk for PTB (RR 5.32, 95% CI 4.39–6.45) and related complication i.e. NICU admissions (RR 4.09, 95% CI 2.80–5.97), neonatal death (RR 5.44, 95% CI 3.03–9.78) and perinatal death (RR 3.01, 95% CI 1.41–6.43).[97] *[Evidence level 2++]*

A systematic review on the use of tocolytics in women with symptomatic preterm placenta praevia including two retrospective studies (total, n = 217) and one RCT (n = 60) reported inadequate outcomes.[98] The RCT reported 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 double-blind, placebo-controlled multicentre RCT including 109 women at 24^{+0} to 33^{+6} weeks with at least one episode of bleeding due to placenta praevia 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.[99] Adverse perinatal outcomes were comparable between groups. *[Evidence level 1+]*

The 2003 Cochrane systematic review[93] on the impact of cerclage in women diagnosed as having, or being likely to have, a 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–]*

A systematic review and meta-analysis of 34 observational studies reporting on preterm birth and preventive intervention in women with low placentation found that those with a placenta praevia were more likely to have a PTB before 37 weeks of gestation compared to those with a low-lying placenta (OR 1.69, 95% CI 1.35;2.11).[100] The pooled effect of the three RCTs reporting on gestational age at birth after cerclage in women with a low-lying placenta showed no significant difference. By contrast, intramuscular progesterone showed a significant prolongation of gestation in favour of women with a placenta praevia treated with progesterone in two out of three RCTs. *[Evidence level 1+]*

Overall, existing data do not support the use of cerclage in women with a low-lying or placenta praevia and highlight the need for larger RCTs on the use of progesterone in this context. *[Evidence level 4]*

5.2.3 In what circumstances, and at what gestation, should women diagnosed with a placenta praevia or a low-lying placenta be offered antenatal corticosteroids?

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Corticosteroids should be offered to women between 24^{+0} and 34^{+6} weeks' gestation in whom imminent PTB is anticipated (either due to established preterm labour or planned preterm birth for vaginal bleeding) and the benefit of corticosteroids after 35^{+0} weeks discussed with the individual pregnant women.	**2++**	**A**	Recommended in RCOG Green-top guideline No 74.[102]

Data on the use of corticosteroids in women presenting with low-lying placenta are limited. A retrospective cohort study of 202 women admitted to a tertiary referral center at 24–34 weeks' gestation with vaginal bleeding due to placenta praevia or low-lying placenta reported that 15 and 22% gave birth within 7 and 14 days from admission, respectively .[101] A complete placenta praevia, severe bleeding at presentation, uterine contractions at presentation, and CL less than 25 mm at presentation were independently associated with birth within 14 days from admission suggesting that these risk factors could allow selective (rather than routine) administration of antenatal corticosteroids. *[Evidence level 2+]*

There are currently no data on the use of repeat doses of antenatal corticosteroids in women presenting with low placentation and recurrent bleeding episodes. Within this context we will refer to the recent Green-top Guideline No. 74 *Antenatal corticosteroids to reduce neonatal morbidity and*

mortality[102] and NICE guideline No 25 *Preterm labour and birth* (www.nice.org.uk/guidance/ng25). *[Evidence level 4]*

Intravenous magnesium sulphate for a maximum of 24h is recommended for neuroprotection of the premature newborn in pregnant women between 24+0 and 29+6 weeks in established labour or having a planned delivery within 24 h (www.nice.org.uk/guidance/ng25). *[Evidence level 4]*

6. Optimising the birth of women with low-lying placenta or placenta praevia

6.1 At what gestation should planned birth occur?

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Timing of birth should be tailored according to antenatal symptoms. Planned birth should be considered no later than 37^{+6} weeks of gestation for women presenting with asymptomatic low-lying placenta or placenta praevia.	**2+**	**C**	The risk of haemorrhage associated with low-lying placenta or placenta praevia increases with advancing gestation.

The risks of APH and or PTB leading to the need for emergency birth increase with advancing gestational age, whereas the risks of morbidity associated with prematurity decrease.[57,63,103-106] 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 birth at 36 weeks of gestation optimises maternal and neonatal outcomes.[103]

A US population-based cohort study of 4 118 956 births including 5675 women with placenta praevia (0.13%) has evaluated the effects of birth with placenta praevia at 35, 36 and 37 weeks of gestation on the risk of several neonatal outcomes.[107] Compared with neonates born at 38 weeks of gestation, those born 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+]*

As the risk of major APH increases rapidly after 35 weeks of gestation, expert opinions have previously highlighted that decisions regarding timing of birth must be individualised and suggested that on the basis of limited data available, women with uncomplicated low-lying placenta or placenta praevia should give birth by caesarean section no later than 37^{+6} weeks of gestation.[57,63] *[Evidence level 4]*

6.2 What are the risks of trial of labour in women and people with a low-lying placenta?

Recommendation	Evidence quality	Strength	Rationale for the recommendation
The option of a trial of labour should be discussed with women who have a third trimester asymptomatic low-lying placenta with placental edge-IO distance between 11 and 20 mm after 36 weeks of gestation.	**2++**	**B**	Women in this situation have more than 80% successful vaginal birth with no increased in morbidity and should be informed of their options.

A systematic review and meta-analysis of 10 articles on birth outcomes in 592 women with a low-lying placenta in the third trimester found that successful vaginal birth depends on the IO distance (IOD),

with 43% vaginal birth at an IOD of 1–10 mm in, 85% at an IOD of 11–20 mm in, and 82% at an IOD of more than 20 mm. A shorter IOD had a higher chance of antepartum haemorrhage, whereas a longer IOD needed postpartum blood transfusion more often.[108] A recent retrospective multicentre study of 128 233 births including 171 (0.13%) who had low-lying placenta found similar rates of PPH and maternal and neonatal morbidity in the trial-of-labour (n=70) and planned caesarean birth (n=101) subgroups.[14] An IOD of 1–10 mm after 36 weeks of gestation reduces the likelihood of vaginal birth considerably compared with 11–20 mm, but without increasing the incidence of intra-partum haemorrhage or severe maternal morbidity. *[Evidence level 2++]*

7. Planning of caesarean birth in women with a placenta praevia

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Women or pregnant people presenting with a placenta praevia carry a higher risk of intraoperative haemorrhage, PPH and hysterectomy and birth should be arranged in a maternity unit with on-site blood transfusion services and access to critical care. There should be careful pre-operative planning with optimisation of haemoglobin.	**2+**	**C**	Recommended in RCOG consent advice No 12: Caesarean section for placenta praevia.[125] Haemoglobin should be optimised to mitigate the maternal effects of any additional operative blood loss.
All women with placenta praevia and their partners should have a discussion with a senior obstetrician (ST 6-7, experienced non-training grade obstetrician or consultant) regarding birth and should be provided with information on risks and indications for blood transfusion, hysterectomy and maternal mortality. Concerns or plans to decline blood products should be discussed, including the risk of maternal mortality.	**4**	**GPP**	Caesarean section in case of low-lying or placenta praevia are the risk of intra-operative haemorrhage, in particular when the placenta is anterior and may require additional surgical procedures including emergency hysterectomy for haemostasis.
Women with atypical antibodies form a particularly high-risk group and the care of these women should involve local haematology and blood transfusion services.	**4**	**GPP**	Recommended in blood Transfusions in Obstetrics. Green-top Guideline No. 47.[119]

Physiologically, the LUS is much thinner, contains fewer myofibers and more elastic connective tissue than the upper segment[117] and thus more prone to uterine atony after placental delivery. Placentation in the LUS will also be associated with extensive dilatation of the corresponding utero-placental circulation and women and pregnant people having a caesarean birth for placenta praevia are at increased risk of blood loss of more than 1000 ml compared with women having a caesarean birth for other indications.[118] Overall, the risk of MOH together with the possibility of needing a blood transfusion has been estimated to be approximately 12 times higher in caesarean birth for placenta praevia than in caesarean birth for other indications.[119,120] [*Evidence level* 4]

Women with a placenta praevia covering the internal cervical os[88,89] and women with an anterior placenta regardless of type of placenta praevia are at increased intra-operative blood loss and need for blood transfusion.[119] Placenta praevia covering the IO and anterior placentation are independent risk factors for MOH during caesarean birth. Placenta praevia is also associated with a higher risk of

atony requiring uterotonics, red blood cell transfusion, and hysterectomy *[Evidence level 2+]*

Women and pregnant people with placenta praevia should be screened for anaemia and iron supplementation should be implemented if indicated. For women at high risk of emergency transfusion, such as those presenting with placenta praevia and with no clinically significant allo-antibodies, 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 birth. However, this should be at the discretion of the team responsible and cared for according to local facilitites.[120] [*Evidence level* 4]

The LUS is more vulnerable to the development of scar defect and myometrial disruption at the surgical site than the upper segment.[31] In women with a history of multiple caesarean births, the LUS often becomes dehiscent with inability to effectively re-approximate hysterotomy edge and repair at birth.[123] Independently of accreta placentation, a placenta praevia under a scarred, thinned partially disrupted LUS, covered by thick adhesions with the posterior wall of the bladder poses a surgical risk and requires fine dissection and surgical expertise adding to the complexity of the procedure and the risk of peri-partum haemorrhage and need for hysterectomy.[123] *[Evidence level 4]*

General procedures for discussing and obtaining consent for caesarean birth are described in detail in RCOG Consent Advice No.7: *Caesarean section*[124] and RCOG Consent Advice No.12: *Caesarean section for placenta praevia.*[125] *[Evidence level 4]*

7.1 What grade of obstetrician and anaesthetist should attend the caesarean birth for a placenta praevia or low-lying placenta?

Recommendation	Evidence quality	Strength	Rationale for the recommendation
In cases of planned caesarean birth for placenta praevia, a senior obstetrician (consultant) and senior anaesthetist (consultant) should be present within the operating theatre suite.	**4**	**GPP**	Placenta praevia is often associated with fetal malpresentation requiring expertise in performing complex intraoperative delivery manoeuvres
When an emergency arises, a senior obstetrician and senior anaesthetist should be alerted immediately and attend urgently, but birth should not be delayed if maternal or fetal health is compromised.	**4**	**GPP**	Women and pregnant people with a low-lying placenta or placenta praevia presenting with an APH and/or labour symptoms may require emergency delivery and are at high risk of intra- and post-operative haemorrhage

Maternal complications at caesarean birth increase when the primary surgeon is a trainee/resident rather than an experienced surgeon.[90] Placenta praevia is often associated with additional issues including fetal malpresentation (transverse or breech presentation) requiring complex intraoperative manoeuvres to give birth to the baby. *[Evidence level 4]*

7.2 What anaesthetic method is most appropriate for caesarean birth in placenta praevia or low-lying placenta?

Recommendation	Evidence quality	Strength	Rationale for the recommendation

Choices around mode of anaesthesia should follow routine obstetric anaesthetic practice and women 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.	**4**	**GPP**	Regional anaesthesia is considered safe and associated with lower risks of haemorrhage than general anaesthesia for caesarean birth in women with placenta praevia or a low-lying placenta.

The anaesthetic method used should be discussed with the patient including the possibility of converting to a general anaesthetic partway through the procedure if complications arise and the procedure is likely to be prolonged.

An RCT of regional (neuraxial) versus general anaesthesia for placenta praevia, including women with PAS, has indicated that blood transfusion requirements (although not estimated blood loss) are greater in the general anaesthetic group.[127] A 4-year observational study at 19 US academic centres of women undergoing caesarean birth found that the risk factors for haemorrhage-related morbidity is increased in those undergoing general anaesthesia.[128] A retrospective cohort study of 1234 women with placenta praevia has shown that estimated blood loss, neonatal asphyxia and admission to NICU were lower with regional than general anesthesia.[129] *[Evidence level 1–]*

7.3 What blood products should be available?

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Close liaison between the maternity ward and the hospital transfusion service is essential for women and pregnant people presenting with an anterior placenta praevia or a low-lying placenta.	**4**	**GPP**	Recommended in blood Transfusions in Obstetrics. Green-top Guideline No. 47.[119]
Rapid infusion and fluid warming devices should be immediately available.	**4**	**GPP**	Recommended in blood Transfusions in Obstetrics. Green-top Guideline No. 47.[119]
Cell salvage is recommended for women where the anticipated blood loss is great enough to induce anaemia	**2++**	**B**	**Cell salvage increases postoperative haemoglobin levels and decreases the length of hospital stay and the incidence of donor blood transfusion-related adverse events.**

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.[120] In an extreme situation and when the blood group is unknown, group O rhesus D-negative red cells should be given.[120] Further recommendations are provided in Green-top Guideline No.52: *Prevention and Management of Postpartum Haemorrhage*.[119] *[Evidence level 4]*

The 2023 Cochrane systematic review of 106 RCTs on the use of cell salvage, incorporating data from 14 528 adults undergoing surgery found that in some types of elective surgery, intra-operative cell salvage may reduce the need for and volume of allogeneic transfusion, alongside evidence of no difference in adverse events, when compared to no cell salvage.[130] A systematic review and meta-

analysis of 11 RCTS and 13 observational studies including 5872 women at high risk of PPH undergoing a caesarean birth, of whom 2989 had intra-operative cell salvage with autologous blood transfusion and 2883 controls received an allogenic blood transfusion.[131] They found that postoperative haemoglobin levels were higher, hospital stay shorter and the incidence of transfusion-related adverse events lower among women who had intra-operative cell salvage. *[Evidence level 2++]*

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

Recommendation	Evidence quality	Strength	Rationale for the recommendation
If the placenta is transected during the uterine incision, immediately clamp the umbilical cord after fetal birth to avoid excessive fetal blood loss.	**4**	**GPP**	Intra-operative fetal blood loss due to damage to umbilical cord vessels increases the risk of neonatal complications.
If pharmacological measures (uterotonics and tranexamic acid) fail to control haemorrhage, intrauterine balloon tamponade should be initiated and compression sutures considered.	**2++**	**B**	The success rate of intrauterine hydrostatic balloon in controlling PPH during the birth of women with placenta praevia is high (> 80%).
Early recourse to hysterectomy is recommended if conservative medical and surgical interventions prove ineffective.	**4**	**GPP**	Massive maternal haemorrhage is associated with high morbidity and mortality.

Overall, the main complications associated with caesarean birth are intraoperative obstetric haemorrhage and PPH[1] due to bleeding from the placental bed and/or uterine atonia. In addition, in cases of anterior placenta praevia, cutting through the placenta can be associated with increased maternal and fetal bleeding but is often necessary for the baby to be born through the LUS. These parameters can be evaluated preoperatively with ultrasound imaging[123] and thus facilitate the planning of the surgical procedure and corresponding logistical support. Recommendations for the use of uterotonics and antifibrinolytic agent tranexamic acid (TXA) in preventing PPH in high-risk women and intraoperative blood transfusion protocol, during caesarean birth are provided in RCOG Green-top Guideline Nos. 47[120] and 52.[119,] *[Evidence level 4]*

Intrauterine balloon tamponade, different types of compression sutures and uterine artery occlusion techniques have been increasingly used, since the previous versions of this guideline, to control, reduce or stop intraoperative bleeding from the LUS and PPH. Cohort studies on the use of intrauterine hydrostatic balloon catheters in controlling PPH associated with placenta praevia have reported success in over 80% of the cases.[132-135] Factors associated with the failure of Bakri balloon tamponade for placenta praevia include prior caesarean birth, anterior placentation, placenta praevia accreta, thrombocytopenia and/or coagulopathy at the time of insertion, and a PPH volume of more than 500 ml within the first hour of placement. A systematic review and meta-analysis of 91 studies including six RCTs and involving 4729 women cared for with uterine balloon tamponade for PPH reported a success rate of 85.9% (95% CI 83.9–87.9%).[136]

Intrauterine hydrostatic balloon alone may not control bleeding from the LUS in placenta praevia. 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.[137] A combined method of B-Lynch suture and the intrauterine balloon[138] or a cervical-lifting suture[139] has also been successfully used in preventing PPH in placenta praevia. Surgical bilateral uterine ligation has been proposed in preventing excessive intraoperative bleeding with placenta

praevia.[140] *[Evidence level 3]*

Interventional radiological (IR) techniques, including prophylactic uterine artery embolisation[141,142] and temporary balloon occlusion of the internal iliac arteries,[143] have also been proposed to prevent and control excessive bleeding in placenta praevia. Small follow-up cohort studies[145–146] and a systematic review[147] of women who have undergone arterial embolisation for control of PPH suggest that IR does not impair subsequent menstruation and fertility. Overall, the number of studies and the quality of the available evidence on both the efficacy, post-operative vascular complications and long-term outcome is still too limited to justify the routine use of IR in women with placenta praevia. *[Evidence level 3]*

8. Care of ongoing live caesarean scar ectopic pregnancies

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Women with a history of caesarean birth are at risk of caesarean scar ectopic pregnancy (CSEP), and should be offered an early pregnancy scan by an operator with experience in diagnosing this condition.	**4**	**GPP**	Caesarean birth is associated with a risk of caesarean scar defect and development of the gestational sac inside the niche in subsequent pregnancies.
Women diagnosed with a viable caesarean scar ectopic pregnancy (CSEP) at the end of the first trimester of pregnancy must be informed by an expert consultant of the high risk of developing major complications, such as placenta praevia and placenta praevia accreta, in the second and third trimester.	**2++**	**B**	Placentation inside a caesarean scar defect is associated with a high risk of placenta praevia and placenta praevia accreta.

In the last two decades, there has been mounting evidence indicating that a gestational sac developing in the scar area of a prior LUS caesarean section can evolve into an accreta placentation.[148-150] There are two main types caesarean scar pregnancies (CSP): Type 1 or A where the gestational sac develops on top of a well-healed scar and Type 2 or B where the gestational sac develops inside or immediately next to a caesarean scar defect (CSD) also called an isthmocele or niche.[151] In type 2, as pregnancy advances, the gestational sac grows into the niche protruding progressively (bulging) outside the normal uterine anatomical boundaries.[152] A new classification was recently proposed[152]: Type 1 CSP in which the largest part of the gestational sac protrudes towards the uterine cavity; Type 2 CSP in which the largest part of the gestational sac is embedded in the myometrium but does not cross the serosal contour; and type 3 CSP in which the gestational sac is partially located beyond the outer contour of the cervix or uterus also referred to as caesarean scar ectopic pregnancy (CSEP). The type of CSP may change with advancing gestation, in particular type 2 which is likely to become a CSEP. In the last decade, the number of reported cases of CSEP 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 births. *[Evidence level 4]*

The first trimester diagnosis and care of caesarean scar ectopic pregnancies (CSEP) are presented and discussed in the 2016 joint RCOG/AEPU Green-top Guideline No. 21.[153]

8.1 What are the risk factors for caesarean scar ectopic pregnancies

A national cohort study using the UK Early Pregnancy Surveillance Service (UKEPSS) reported, an

incidence of 1.5 CSEP per 10 000 (95% CI 1.1:1.9) maternities between November 2013 and January 2015.[154] This incidence is likely to have increased with the increasing rate of caesarean births after 2015. *[Evidence level 2++]*

Retrospective cohort studies have shown that the incidence of CSDs increases with the number of previous caesarean births and are more common with retroverted uteruses, suggesting that these women are at higher risk of CSEP in their next pregnancy.[155,156] A systematic review, found nine studies that reported on the risk factors and found that probable risk factors are single-layer myometrium closure, multiple caesarean births and uterine retroflexion.[157] The development of a CSD may also vary according to the suture material used, and type of caesarean birth (i.e. planned versus emergency). Overall, recent systematic reviews and meta-analyses of RCTs comparing single-layer to double-layer myometrial closure have found a similar incidence of CSD suggesting that type of uterine closure has little influence on uterine scarification after caesarean birth.[159,160] There are no prospective data on the risks of CSEP according to the development and morphology of CSD. *[Evidence level 2+]*

8.2 Natural history of caesarean scar ectopic pregnancies and prediction of late pregnancy complications

Around 2/3 of CSEPs miscarry before the end of the first trimester[161] and data on the outcomes of ongoing CSEP after the first trimester are limited to small cohorts, case reports and case series. For those CSEP that continue into the second and third trimester the outcome can be a low-lying/placenta praevia, a placenta praevia accreta or very rarely a complete uterine rupture.[162,163] A systematic review of 17 case reports and case series including 69 cases of CSEP managed expectantly, 52 with and 17 without embryonic/fetal heartbeat, found that those with a fetal heart activity had a uterine rupture during the first or second trimester in 9.9% (95% CI, 2.9–20.4%) of cases, 39.2% (95% CI, 15.4–66.2%) experienced severe bleeding in the second or third trimester and 74.8% (95% CI, 52.0–92.1%) were diagnosed with PAS at birth.[163] Two recent case-control studies have suggested that the development of PAS in ongoing CSEP is associated with a remaining myometrial thickness less than 2 mm in the first-trimester ultrasound examination.[151,162] *[Evidence level 2++]*

9. Antenatal evaluation of women and people at risk of placenta accreta spectrum

At least 90% of women and pregnant people presenting with a PAS at birth have a history of one or more caesarean births and are diagnosed during pregnancy with a low-lying placenta or placenta praevia.[164] However, the interpretation of epidemiology and management outcome data is limited by the lack of evidence-based data describing the intra-operative and clinical findings at birth and the recent use of clinical descriptions previously used to report uterine atony and/or placental retention.[19] In addition, in around half of the cohorts on diagnosis and management of placenta praevia accreta, the authors do not describe or use variable definition for the ultrasound signs used for the antenatal ultrasound diagnosis of placenta praevia.[28] Overall, except for the small risk of antenatal uterine rupture, which cannot be accurately evaluated due to the lack of prospective data, women with placenta praevia accreta at birth are at similar risk of antenatal complications (bleeding, premature labour) than a non-accreta placenta praevia. *[Evidence level 4]*

9.1 What are the risk factors for placenta accreta spectrum?

Table 2 Epidemiologic factors associated with PAS at birth

Risks factors	Evidence level
Previous LUS caesarean birth	2++
Anterior low-lying or placenta praevia	2++
Uterine surgery or trauma	2+

Advanced maternal age	2-
Pregnancy resulting from IVF	2-

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Women and pregnant people requesting planned caesarean birth for non-medical indications should be informed of the risk of PAS and its obstetric consequences for subsequent pregnancies.	**2++**	**B**	Both planned and emergency caesarean births increase the risk of PAS is subsequent pregnancies.

Most epidemiological studies of the last two decades have shown a direct association between the increase in caesarean birth rates and the incidence of PAS in subsequent pregnancies worldwide.[3,165–170] A 2018 systematic review and meta-analysis of 29,928,274 participants from 79 cohort studies and one RCT found that compared to vaginal birth a caesarean birth was associated with an OR of 2.95, (CI 1.32–6.60; n = 705,108; 3 studies) of PAS in the next pregnancy.[32] A previous caesarean birth is the only risk factor showing a significant concomitant rise in the prevalence of PAS in obstetric population.[1,27] *[Evidence level 2++]*

The risk of PAS increases with the number of previous caesarean births. A prospective observational cohort of 30,132 women who had caesarean birth without labour in 19 academic centres in the US over 4 years (1999–2002) reported that PAS was diagnosed in 15 (0.24%), 49 (0.31%), 36 (0.57%), 31 (2.13%), 6 (2.33%), and 6 (6.74%) after one, two, three, forth, five and six or more caesarean births.[166] A 3-year (2009 to 2012) Nordic Obstetric Surveillance Study of clinical reports from 205 women with PAS found that the risk of accreta placentation increases seven-fold after one prior caesarean birth.[168] *[Evidence level 2++]*

Placentation in the LUS is another important risk factor for PAS. A large multicentre US cohort study noted that for women presenting with placenta praevia and prior caesarean births, the risk of accreta placentation was 3%, 11%, 40%, 61% and 67% for one, two, three, four, and five or more caesarean births, respectively.[166] A population-based descriptive study using the UK Obstetric Surveillance System including 134 women identified with PAS, found that the incidence of PAS increases from 1.7 per 10 000 to 577 per 10 000 in pregnant women with both a previous caesarean birth and placenta praevia.[167] Similarly, the Nordic Obstetric Surveillance Study reported a 640-fold increased risk (OR 614, 95% CI 372–844) compared to pregnancies with a previous caesarean birth but no placenta praevia.[168] *[Evidence level 2++]*

PAS is not exclusively a consequence of caesarean birth. Other surgical trauma to the integrity of the uterine endometrium and/or superficial myometrium, such as those following uterine curettage, postpartum endometritis, hysteroscopic surgery, endometrial ablation and uterine artery embolization and myomectomy have been associated with accreta placentation in subsequent pregnancies.[30,164,171] A multicentre case-control study of 176 women with prior myomectomy found no case of PAS in subsequent pregnancies,[172] suggesting that the proportion of PAS at birth following major uterine surgical procedures requiring hysterotomy, other than caesarean birth is small (below 10%). The UK Obstetric Surveillance reported an aOR for PAS after previous uterine surgery of 3.40 (95% CI 1.30–8.91)[167] whereas Nordic Obstetric Surveillance Study found that around a third of nulliparous women with PAS reported a previous surgical procedure i.e. surgical abortions, myomectomy, hysteroscopy and trachelectomy.[168] A population-based data linkage study including all primiparous women who delivered in New South Wales, Australia, between 2003 and 2012 found that the RR of PAS is 1.5 (99% CI 1.1–1.9) after one minor gynaecologic procedure, 2.7 (99% CI 1.7–4.4) and 5.1 (99% CI 2.7–9.6) after two and three procedures, respectively.[171] Overall, these data can explain the rare development of PAS in upper uterine segment, in particular in primiparous. However, some procedures (in particular uterine curettage for pregnancy termination), may not always be accurately

reported[174], limiting the interpretation of these data. *[Evidence level 2+]*

Maternal age (≥ 35 years) is another commonly additional risk factor reported by large epidemiologic studies. [164-168] Compared to women below 35 years, those ≥ 35 years without a previous caesarean birth have a 4.6-fold higher risk [168] of PAS and the risk increases the aOR by 1.30 (95%CI 1.13–1.50) for every 1-year increase in age.[167] Like for placenta praevia, this effect is probably due to the association between increasing maternal age and parity but also due to a higher likelihood of previous minor uterine surgical procedures. *[Evidence level 2–]*

The development of accreta placentation has also been reported in case reports or case series of women with no surgical history (unscarred uterus) but presenting with a uterine pathology, such as bicornuate uterus, adenomyosis, submucous fibroids and myotonic dystrophy.[30,164,175] More recently pregnancies resulting from ART, and in particular IVF, have been reported to have a higher risk of PAS at birth. A population study of 48 240 pregnancies after ART reported an increased risk of PAS and placenta praevia accreta.[176] A systematic review and meta-analysis of 33 low/moderate quality studies evaluated 124,215 ART and 6,054,729 non-ART singleton pregnancies reported an increased risk (OR 2.27, 95% CI 1.79–2.87) of PAS in ART compared to spontaneous pregnancies. Similarly, the risk of placenta praevia non-accreta was increased (OR 3.76, 95% CI 3.09–4.59) in ART pregnancies.[177] The data of the corresponding studies were not adjusted for maternal age, parity and previous uterine surgery, including previous caesarean births, placental position and do not provide detailed description on type of infertility nor on the confirmation of the diagnosis of PAS at birth, suggesting that the increased risk of PAS in ART pregnancies could be due to the strong association between IVF and low placentation.[39-44] *[Evidence level 2–]*

9.2 Screening for women at high risk of placenta accreta spectrum

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Women with a high probability of PAS at birth should be identified at the first antenatal appointment and provided with a care plan including screening for ultrasound signs associated with PAS at the 18^{+0}–20^{+6} weeks FAS scan.	**2+**	**C**	Antenatal screening of women at high-risk of PAS allow referral to specialized centres for ultrasound follow-ups and surgical management by an MDT reduces the burden of antenatal and intraoperative complications.
Previous caesarean birth and the presence of an anterior low-lying placenta or placenta praevia should alert the antenatal care team and ultrasound operator of the high risk of PAS at birth.	**2++**	**A**	Caesarean scars are the main clinical factors leading to low placentation and the development of accreta placentation in subsequent pregnancies.
Women with ultrasound features suggestive of PAS should be referred to a specialist fetal medicine unit with the corresponding imaging expertise.	**4**	**GPP**	Ultrasound imaging by expert reduces the risk of false positive and false negative diagnosis of PAS.

Multidisciplinary (MDT) care in a maternity unit with access to maternal and neonatal intensive care is essential for women and pregnant people with PAS. For such care to be organised, women with a high probability of PAS must be identified before birth.[4-8] Overall, women who are identified antenatally at high risk for PAS have less blood loss during surgery and required fewer units of RBC and FFP, compared with those with an intrapartum diagnosis.[4] The high incidence (43.9%) of women classified on ultrasound and/or MRI as having a so-called "placenta percreta" and the lack of intra-

operative and/or histopathologic confirmation in six studies limits the interpretation of the results. A recent systematic review and meta-analysis of 31 studies with the same limitations found similar results.[7] A recent report by the Society for Maternal-Fetal Medicine (SMFM) expert group,[178] indicates that most studies on the prenatal ultrasound evaluation of PAS are retrospective in design, lack control "low-risk" comparison groups and do not provide clear definitions of the PAS ultrasound signs studied. There has also been considerable variability in these studies regarding ultrasound criteria used for the diagnosis of low-lying/placenta praevia and the gestational age at which the diagnosis is confirmed.[28] *[Evidence level 4]*

Numerous ultrasound imaging techniques have been reported over the last two decades, including greyscale imaging (GSI) and colour Doppler imaging (CDI), three-dimensional (3D) power Doppler sonography, 3D and 4D colour volumes/volume rendering ultrasound (Crystal vue/realistic vue) and High acoustic Radiation Force Impulse (ARFI) Elastography.[179] A recent expert consensus study, through a modified Delphi process[180] of conventional[181,182] and new ultrasound signs associated with PAS at birth, has confirmed the role of standardised signs (loss of the "clear zone", myometrial thinning, bladder wall interruption and the presence of a placental bulge, exophytic mass, uterovesical hypervascularity, placental lacunae and bridging vessel).[182] For other ultrasound features associated with an increase probability of PAS at birth, there is a consensus for the finding of an anterior placenta praevia or a placenta praevia with cervical involvement. Only the quantification of placental lacunae using the score proposed by Finberg and Williams[183] obtained a strong consensus.[180] *[Evidence level 2+]*

No consensus was reached among the panellists involved in the Delphi study, regarding the optimal gestational age at which to identify the different ultrasound signs associated with PAS at birth.[180] When performed by skilled operators, the pooled performance of ultrasound in the second trimester for the prenatal identification of women with a PAS at birth is over 90%.[178-181,184,185] The highest level of interobserver agreement for the signs previously reported in the literature[179] is for the loss of clear zone, myometrial thinning on GSI, and on CDI for the presence of lacunar feeder vessels, bridging vessels, and lacunae,.[186] A multivariate analysis found that true positives cases of PAS at birth are likely to be identified after 16 weeks of gestation with loss of clear zone, myometrial thinning, irregular bladder wall, placental lacunae and utero-placenta vascular abnormalities.[187] A recent systematic review of 37 studies, including 1348 confirmed cases of PAS, has shown that at < 14 weeks of gestation, the sensitivity of ultrasound imaging is 86% (95% CI 78–92%) with specificity of 63% (95% CI 55–70%), compared to 88% (95% CI 84–91%) and 92% (95% CI 85–96%) during the second/third trimester.[188] These data suggest that pregnant women at high-risk of PAS at birth could be first screened for at the routine 11–13^{+6} ultrasound examination. *[Evidence level 2++]*

Placental lacunae are formed by the distortion of one or more placental lobule developing inside a uterine scar high volume, high velocity flows from the radial/arcuate arteries and this sign, is the most strongly associated with PAS at birth.[184] Anomalies of the uterine contour and uteroplacental interface[178] are secondary to uterine remodelling following scarification and lead to progressive myometrial thinning and placental bulge as pregnancy advances. These changes are often found in women with a history of previous multiple caesarean births and are indicative of LUS dehiscence, independently of the presence of accreta lesions at birth.[189-192] These data suggest that the main ultrasound features used for the screening of women at risk of PAS are better separated for reporting into anomalies of uterine contour or uteroplacental interface i.e. loss of clear zone, myometrial thinning and placental bulge; and abnormalities of the utero-placental circulation including subplacental hypervascularity and placental lacunae (see Appendix III).[190] *[Evidence level 4]*

Population studies have shown the presence of PAS at birth remains undiagnosed before birth in one-half[167,169] to two-thirds of cases.[168] The diagnosis of placenta creta/adherenta at birth is often confused with that of uterine atony and partial placental retention, which cannot be predicted antenatally with imaging whereas many cases previously referred as "percreta" have been misdiagnosed as PAS[24-26] on

the basis of placental bulging (herniated placental tissue through a large uterine dehiscence) at laparotomy.[191] Large national and international epidemiologic studies[167,168,170] have used variable clinical definitions for the diagnosis of PAS at birth and do not provide details on how the diagnosis of PAS was confirmed at birth, beyond a basic description such as "confirmed by histopathology". Overall, these data suggest that between one third and half of the cases reported in these studies and many similar studies are not PAS and can explain why these cases were not identify antenatally. *[Evidence level 2–]*

As the upper uterine segment is thicker and thus less prone to scarring, the ultrasound signs associated with non-praevia PAS at birth are less pronounced and thus less likely to be identified antenatally[172], in particular if the accreta lesion is small.[31] Similarly, cases of simple partial placental retention are often recorded as PAS[192], adding to the number of false positive cases of PAS and thus to its prevalence at birth.[27] *[Evidence level 4]*

Recent studies have suggested that preoperative ultrasound examination in women with a high probability of PAS at birth can identify women with higher odds of intraoperative bleeding and need for hysterectomy.[189,191,194] A recent prospective cohort study of 90 women at high risk of PAS at birth cared for by a specialist MDT, including 58 cases with confirmed PAS at birth found higher odds of hysterectomy associated with subplacental hypervascularity, high lacunar scores (2+ and 3+), lacunar feeder vessels or bridging vessels on preoperative ultrasound at 32–36 weeks of gestation.[189] As the vast majority of cases of PAS are now the consequence of low placentation into a previous caesarean section scar, TVS has an important role in the early diagnosis, follow-up and preoperative assessment of women at high risk of placenta praevia accreta.[193,194] *[Evidence level 4]*

9.3 Is there a role for magnetic resonance imaging (MRI) in the prenatal evaluation of women at high risk of placenta accreta spectrum?

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Where expert ultrasound imaging including transvaginal scan is available, MRI is not recommended in routine antenatal evaluation of women and pregnant people with a high probability of PAS at birth.	**2+**	**C**	MRI (without contrast agent) does not allow mapping of the circulation and expertise in MRI of the placenta is limited.

MRI has been increasingly used for the prenatal diagnosis of placenta accreta. 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.[195] A recent systematic review and meta-analysis of 17 studies including 457 women with PAS and comparing MRI and ultrasound data found no statistically significant difference in diagnostic accuracy between the two imaging techniques.[196] The main features associated with PAS at birth provided by regular MRI include placental bulging, dark intraplacental bands on T2-weighted imaging, heterogeneous signal intensity within the placenta and disruption of the uteroplacental zone are all signs of uterine remodelling post-caesarean birth[197] and thus are not specific of accreta placentation. The interobserver agreement is almost perfect for the diagnosis of placenta praevia; substantial for myometrial interruptions and placental bulging; and moderate to slight for other signs of PAS but the accuracy and predictive value are modest and lower than previously reported.[198] Furthermore, MRI results in a change in diagnosis that could alter clinical care of PAS in more than one third of cases, but when changed, the diagnosis is often incorrect.[199] *[Evidence level 2+]*

The use of intravenous gadolinium-based contrast agent improves visualisation of the utero-placental vasculature, may increase the sensitivity and specificity of MRI[200] but the agents cross the placental-fetal barrier and its use is therefore not recommended during pregnancy in many settings as evidence

on long-term fetal safety is limited.[201] The experience of the radiologists in interpreting PAS-related MRI[202] remains an essential factor in the diagnostic accuracy of MRI and access to expert radiologists is highly variable in both low- and high-resources countries. MRI and in particular super-resolution reconstruction MRI[203], may contribute to surgical planning in women and pregnant people with high probability of PAS at birth but evidence supporting its routine use in PAS management is currently limited. *[Evidence level 4]*

10. Antenatal care

Women with a high probability of placenta praevia accreta at birth have similar frequency of antenatal complications to those associated with placenta praevia non-accreta, but a much higher risk of severe intrapartum/intraoperative complications in particular when the condition is undiagnosed and the birth unplanned or if the issue of termination of pregnancy arises during the second trimester. There are no data on the antenatal care of women with a PAS of the upper uterine segment as antenatal imaging findings are limited to a few case reports.

10.1 Where should women identified as high-risk of placenta accreta spectrum be cared for during pregnancy?

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Pregnant women identified locally as having a high probability of PAS at birth should be assessed by the nearest specialised centre with a MDT with expertise in regularly diagnosing and managing for placenta praevia accreta and an individualised referral pathway should be agreed.	**2++**	**B**	MDT management improve maternal outcomes and reduced risk of intra and post-surgical complications.

PAS has become the obstetric condition with highest risk of maternal co-morbidity in high-resource countries[204,205] and maternal mortality in low-resource countries.[206] A retrospective, observational study of severe maternal morbidity, defined using the Centers for Disease Control (CDC) and Prevention index, and non-transfusion severe maternal morbidity from discharge data from 919 546 birth hospitalizations in California during 2016–2017 found that the highest risk comorbidity was PAS (aRR of 30.5 for severe maternal morbidity and 54.7 for non-transfusion severe maternal morbidity).[204] A US population-based retrospective, observational study of 2,727,477 women who had caesarean birth between October 2015 to December 2017, reported that compared to caesarean birth without PAS, caesarean birth complicated by PAS (n= 8030) was associated with an increased risk of any surgical morbidities (78.3% versus 10.6%), including haemorrhage (54.1% versus 3.9%), coagulopathy (5.3% versus 0.3%), shock (5.0% versus 0.1%), urinary tract injury (8.3% versus 0.2%), and death (0.25% versus 0.01%).[205] Like the authors of many previous population studies[27], the above studies used the Tenth Revision World Health Organization (WHO) international classification of diseases (ICD-10) (www.who.int/classifications/icd) which provides no clinical/histopathologic description of the PAS and no category to report on placenta praevia accreta. These studies highlight the inaccuracy of epidemiology data when the ICD is used to report on pregnancies and births complicated by PAS, limiting the interpretation of the corresponding data. *[Evidence level 4]*

Women and pregnant people with a high probability of PAS at birth should be cared for according to the risks of severe maternal bleeding and PTB associated with a low-placentation.[207-210] There has been mounting evidence after the publication of the last version of this guidelines that women with PAS identified antenatally as high risk of PAS at birth and cared for by a MDT in a specialist centre are less

likely to require emergency surgery, large-volume blood transfusion and reoperation within 7 days of birth for bleeding complications compared with women cared for by standard obstetric care without a specific protocol[211-213], even in case of unexpected PAS.[214] Women admitted at 34 weeks of gestation and who give birth between 34 and 35 weeks of gestation under the care of a specialist MDT have a significantly lower emergency surgery rate than those not cared for by such a team (23% versus 64%) despite a similar median gestational age at birth.[211] Although, there is no evidence for an ideal minimal number of cases of PAS managed per month or year, maternal outcomes are improved over time with increasing experience within a well-established MDT performing 2–3 cases per month.[212] A systematic review and meta-analysis of six studies including 461 women with PAS showed that, compared to standard care, care by an MDT significantly reduce the perioperative estimated blood loss (mean difference -1.1 L, 95% CI -1.9 to -0.4) and transfusion requirements (mean difference -2.7 units, 95% CI -4.1 to -1.2).[215] *[Evidence level 2++]*

10.2 When should birth be planned for women with suspected placenta accreta spectrum?

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Timing of birth and use of corticosteroids should be tailored according to antenatal symptoms and placental location. In the absence of risk factors for PTB and/or antenatal bleeding, planned birth at 35^{+0} to 36^{+6} weeks of gestation provides the best balance between fetal maturity and the risk of unscheduled birth.	**2++**	**B**	Early iatrogenic near-term birth in women with a high probability of PAS at birth allows for elective surgery by a MDT is associated with a lower risk of perinatal complications compared to emergency delivery.

As for women and pregnant people diagnosed with a placenta praevia with no ultrasound sign of accreta placentation, clinical factors should be considered when determining the timing of administration of antenatal corticosteroids and the optimal gestational age for birth. In cases of antenatally suspected PAS, where significant blood loss and caesarean hysterectomy is anticipated, a planned preterm birth at 34 and 35 weeks of gestation is recommended by the ACOG in order to avoid emergency birth, which still occurs about 20% of the time even in scheduled cases.[216] This recommendation was based on decision analysis study showing increasing likelihood of emergency birth as pregnancy goes beyond 34 weeks of gestation.[217] A recent retrospective multicentre review of data from 744 women with PAS has found that less than half of women with PAS had a scheduled birth within the ACOG recommended gestational age of 34^{+0} to 35^{+6}.[218] Women who gave birth at 36 weeks or above included 41% classified as placenta creta/accreta and 59% as increta/percreta and 25% of the total did not have a placenta praevia. *[Evidence level 2++]*

Retrospective cohort studies of women identified antenatally with a high probability of placenta praevia accreta have indicated that in the absence of risk factors for PTB, the risk for an unscheduled birth prior to 36 weeks of gestation is low.[219,220] A retrospective multicentre review of data from 356 women including 26 (7%) women with no evidence of PAS at birth and 56 (16%) women with placenta creta/accreta confirmed that the single greatest risk factor for emergency birth is antenatal bleeding.[221] A retrospective study of 125 women with more than one prior caesarean births, presenting with a low-lying placenta or placenta praevia found that those with PAS at birth had a shorter CL than those with a placenta praevia non-accreta.[222] These findings did not correlate with higher rates of vaginal bleeding and PTB before 36 weeks. There are currently no RCTs or well-controlled prospective studies stratified for the placental position (low-lying versus praevia; anterior versus posterior) or the CL on TVS to guide best practice in timing of birth of women with PAS in general and those with placenta praevia accreta in particular but all women with a high probability of PAS should be informed of the risk of emergency delivery. *[Evidence level 4]*

11. Optimising the birth of women with suspected placenta accreta spectrum

Recommendation	Evidence quality	Strength	Rationale for the recommendation
For women with a high probability of PAS at birth, birth should take place in a maternity with a MDT with expertise in complex caesarean delivery and logistic support for immediate access to blood products, adult intensive care unit and NICU.	**2++**	**B**	Due to the high risk of intra-operative bleeding and damage to the urinary tract, women with a placenta praevia accreta may need additional support for these complications.
A contingency plan for emergency birth should be in place, including the use of an institutional protocol for the management of maternal haemorrhage for all women at risk of PAS.	**4**	**GPP**	Women with a high probability of PAS at birth are at increasing risk of antenatal bleeding as pregnancy advances and higher risk of intra- and post-operative complications in case of emergency delivery.

There are some generally agreed strategies, but comparison of the different guidelines shows that even those recommendations graded as strong, in particular regarding different care strategies for birth, are not supported by RCTs or high-quality prospective case-control studies.[201]

The main perinatal maternal complications of PAS are primarily the consequence of intra- or post-operative bleeding.[216,223] When unsuspected at birth, attempts to remove accreta placental tissue or incise through the accreta area typically provoke rapid MOH.[224] MOH and its associated complications, such as coagulopathy can lead to multisystem organ failure and accounted for 7% of the causes of maternal death in the UK between 2019 and 2021.[225] PAS associated MOH was directly associated with four maternal deaths in the UK during that period. Many women with PAS at birth require massive blood transfusion (8 units or more) and their median platelet count is lowest compared with other causes of massive PPH.[226,227] Women and pregnant people with a placenta praevia accreta are at the highest risk of intraoperative bleeding due to the hypervascularity of the utero-bladder interface and surrounding pelvic tissues and damage to the urinary tract.[228] *[Evidence level 2++]*

Similarly to placenta praevia, transfusions in case of PAS should be guided by a national and/or institutional protocol for management of PPH.[88,89] *[Evidence level 4]*

11.1 What should be included in the consent form for caesarean birth in women with suspected placenta accreta spectrum?

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Any woman with a high probability of PAS at birth giving consent for caesarean birth should understand the risks associated with caesarean birth in general, and the specific risks associated with PAS including MOH with the need for blood transfusion, lower urinary tract damage, and hysterectomy.	**4**	**GPP**	Pregnant women with a high probability of PAS at birth should be provided with a detailed plan for the surgical procedure and informed on the different care options.
For women who do not accept blood products, additional possible interventions	**4**	**GPP**	Cell salvage increases postoperative haemoglobin levels and decreases the length of

should also be discussed, including cell salvage.		hospital stay and the incidence of donor blood transfusion-related adverse events

Any woman with a high probability of PAS at birth should meet with the lead obstetrician of the MDT when identified in the antenatal period. The different risks and care options should have been discussed with the pregnant women before 34 weeks 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[124] and about the specific risks associated with PAS i.e. heavy blood loss requiring replacement of blood products, lower urinary tract damage, emergency hysterectomy and need of admission to intensive care unit. Cell salvage and interventional radiology should be discussed with women and pregnant people who refuse donor blood transfusion, where available. *[Evidence level 4]*

Launched by the World Health Organization in June 2008 the checklist (www.who.integrated health services › patient safety› Safe surgery) was mandated for use in the NHS in January 2009 (www.england.nhs.uk › surgical-safety-checklist). It is now in standard use across the UK as well as worldwide and team time-outs for PAS-surgery are recommended both preoperatively and intraoperatively. *[Evidence level 4]*

A clear written contingency plan should be discussed with the pregnant women and be available in the woman's antenatal notes for the situation of unscheduled emergency birth for any reason at local maternity other than the specialist centre so that the local team can follow this agreed plan.

11.2 What anaesthetic method is most appropriate for birth?

Recommendation	Evidence quality	Strength	Rationale for the recommendation
The choice of anaesthetic procedure should be discussed with the pregnant woman who 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.	**4**	**GPP**	General anaesthesia can be required in cases of major blood losses and/or longer than expected surgical procedure.

As for women presenting with a placenta praevia non-accreta, both general and regional (neuraxial) anaesthetic techniques have been shown to be safe for surgical procedures required for the birth of women and pregnant people with a high risk of PAS at birth. The judgment of which type of technique to be used should be made on an individual basis following discussion with the pregnant who should be informed that it may be necessary to convert to general anaesthesia if required and asked to consent. The likelihood of conversion from regional to general anaesthesia increases (above 50%) as blood loss increases and thus a combination of neuraxial and planned secondary general anaesthesia can maximize both comfort and safety of the woman.[229] *[Evidence level 4]*

A recent international survey of 171 anaesthetists showed that 69 (42%) recommend neuraxial only whereas 58 (35%) used a combined approach of neuraxial and general anaesthesia. When a midline laparotomy is planned there was a preference for general anaesthesia for the duration of the surgery.[230] *[Evidence level 3]*

11.3 What surgical approach should be used?

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Attempting to separate the placenta from the uterine wall or incising through the placenta to give birth to the baby should be avoided in women with a high probability of PAS at birth and the baby should be delivered via an hysterotomy above the upper placental edge.	**2++**	**B**	Damage to the abnormally attached area in PAS can lead to uncontrollable pelvic bleeding with rapid deterioration of maternal hemodynamic parameters and hypovolemic shock.
The choice of surgical technique is left to the operator judgement and experience but uterus-preserving surgical techniques are preferable and should only be attempted by expert surgeons and after appropriate counselling regarding risks and with informed consent of the woman.	**4**	**GPP**	There are no well-controlled prospective studies stratified for the different pre-and intra-operative features.
The routine use of prophylactic ureteric stents is not recommended. Collaboration with a urologic surgeon is advisable in cases presenting with major uterine remodelling and hypervascularity of the bladder-uterine interface on pre-operative imaging.	**2+**	**C**	Major uterine remodelling and thick adhesions between the uterine and bladder serosa are associated with a high risk of urinary tract damage.

Overall, care strategies will be determined by the local expertise available, the preoperative position of the placenta and other imaging findings (remodelling of LUS, vascularity of the LUS and surrounding pelvic tissue, involvement of the cervix),[180,191,193,194] the depth and lateral extension of the accreta portion of the placenta and its association with major dehiscence of the LUS at laparotomy.[189,231] A systematic review and international surveys of experts on the care of PAS has found that between 55% and 90% opt for a primary caesarean hysterectomy in case of placenta praevia accreta.[185,232,233] The ACOG guideline indicate that the most generally accepted approach to PAS is caesarean hysterectomy[216] and not surprisingly the highest rates of caesarean hysterectomy in women with PAS have been reported in north-America.[233] The choice of surgical care should be left to the judgement of the local MDT but uterus-preserving surgical techniques should be considered if possible as they are less traumatising for the woman and their partner.[234] However, there are no well-controlled prospective studies comparing the outcomes of caesarean hysterectomy versus uterine preservation techniques stratified for different pre- and intra-operative features and thus uterine preservation should only be attempted by expert surgeons *[Evidence level 4]*

When the accreta lesion is outside the LUS and is small, a partial myometrial resection should be possible in most cases.[235] By contrast, women with a history of prior multiple caesarean births presenting with a low-lying placenta or placenta praevia identified antenatally with a high probability of PAS at birth are also at high risk of major LUS dehiscence and thick pelvic adhesions.[123] In this case, the surgical team must be prepared for complex dissection of the vesico-uterine interface and additional intra-operative bleeding.[189,191] The main intraoperative risks in these cases are damage to the bladder and to the thin but highly vascularised shell of scarred myometrium separating the placental basal plate from the bladder wall. The procedure may be further complicated by a large placental bulge or herniation through the LUS, in particular when lateral, further limiting access to the lower pelvis.[235] *[Evidence level 4]*

Numerous surgical techniques, starting with the type of skin incision, have been described[216,228,236,237]

with no consensus including:

1. Primary hysterectomy following birth of the fetus through a hysterotomy above the placental implantation site, without attempting placental separation.
2. Birth of the fetus through a hysterotomy above the abnormal implantation area, followed by partial excision of the accreta area (partial myometrial resection) and repair of the uterus.
3. Birth of the fetus without disturbing the placenta, and leaving it in situ, followed by planned secondary hysterectomy 3–7 days following the primary procedure.
4. Birth of the fetus through an incision above the placental implantation site, leaving the placenta in situ, followed by expectant management.

As there are no well-controlled prospective studies stratified for the different pre- and intra-operative features, the choice of surgical technique is left to operator judgment. *[Evidence level 4]*

One of the most important steps is the birth of the fetus and the hysterotomy incision should be performed above the placental upper edge to avoid the placental tissue. Attempts at manual placental removal is strongly discouraged and if the diagnosis of PAS is uncertain, a period of intraoperative observation to allow for spontaneous uterine placental separation, without the administration of oxytocic drugs, is appropriate.[6,206,208,213,216,224,228,236] *[Evidence level 2++]*

A recent systematic review and meta-analysis including 11 618 women undergoing surgery for PAS found that genitourinary tract injury occurred during the surgical delivery in 15.2% (95% CI 12.9–17.7%) of women with PAS.[238] The majority (13.5%) is due to damage to the bladder (cystotomy) of which 7.7% were intentional to facilitate access to the accreta area in the LUS and avoid the bladder trigone and 7.2% unintentional. International survey of experts on the care of PAS have reported that between 6% and 75% of operators reported the use of prophylactic ureteric stents. A recent systematic review and meta-analysis of nine studies including 848 women with PAS, of which 523 (61.7%) had prophylactic ureteric stents placed and 325 (38.3%) did not, found no difference in the rates of genitourinary tract injury.[239] *[Evidence level 2+]*

Internal iliac artery ligation has been used in obstetrics and gynaecology for over 70 years to reduce the risks of intra-operative bleeding.[240] A systematic review and meta-analysis of 795 women undergoing surgery for PAS found that that prophylactic internal iliac artery ligation has no significant effect on intraoperative bleeding control.[241] Similarly, a small RCT of bilateral internal iliac artery ligation (n= 29 cases) versus controls (n= 28 cases) reported no significant difference between the two groups regarding the intraoperative estimated blood loss.[242] *[Evidence level 2+]*

11.4 Is there a role for interventional radiology?

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Interventional radiology procedures are not recommended in the routine care of PAS by an expert surgical team.	**2+**	**C**	Based on data from small RCTs on the use of preoperative prophylactic internal iliac artery balloon occlusion. There is a lack of RCTs dedicated to the use of balloon occlusion of the aorta.
Resuscitative endovascular balloon occlusion of the aorta may be useful in women and pregnant people diagnosed with PAS who decline donor blood transfusion and these women should give	**4**	**GPP**	There are no studies on the use of interventional radiology in women who decline donor blood transfusion.

Since the publication of the last version of this guideline there have been many more retrospective cohort studies, describing the use of interventional radiology (IR) with variable success in reducing the risks of intraoperative bleeding in the care of PAS. Various combinations have been proposed, including intraoperative internal iliac artery and/or postoperative uterine artery embolisation and immediate pre-operative insertion of internal iliac artery or abdominal balloon for intra-operative occlusion also called resuscitative endovascular occlusion of the aorta (REBOA).

A systematic review and meta-analysis of all papers published in the international literature up to December 2017 on the use of the different IR techniques in the care of PAS at birth, found lower mean estimated blood loss and the risk of blood loss ≥ 2.5 L in women who underwent IR before surgery compared to those who did not.[243] However, the overall quality of evidence, as assessed by the GRADE methodology, was very low, with many studies including a small number of cases, dissimilarity of the populations and lack of stratification according to the severity of PAS, type of surgical approach adopted and gestational age at surgery.[243] A retrospective study including 15 women diagnosed with PAS cared for with intraoperative multivessel embolization compared with 30 matched historical cases reported a decrease in blood transfusion requirements and estimated blood loss with no increase in operative complications.[244] Around a quarter of the women included in each study groups were described as having a placenta "percreta without invasion", suggesting that many cases did not have PAS at birth. A recent retrospective study of women with PAS cared for by a specialist MDT over the 10-year time period has compared the outcome of 30 women cared for with uterine artery embolization and tranexamic acid and 34 women who were not.[245] The authors reported a reduction in blood loss, blood transfusion rates and massive blood transfusion (>10 units transfused) with similar postoperative complication and neonatal outcomes. All cases included in both groups of this study were diagnosed as PAS if >50% disruption of the underlying myometrium at the site of placental attachment was noted intraoperatively with no description of areas of abnormal placental attachment and no description of the histopathologic criteria used to confirm the diagnosis of PAS. *[Evidence level 2-]*

Three RCTs of women presenting with imaging features suggesting PAS at birth were randomised to either preoperative prophylactic internal iliac artery balloon occlusion or no occlusion have been published. The first included 13 cases and 14 controls,[246] the second 50 cases in each group[247] and the third 20 in each group.[248] None of the three studies found any significant differences between the intervention and control groups for mean number of packed RBC units transfused and and/or in the calculated blood loss. The largest of the three studies also reported higher hospitalization costs and incidence of postoperative fever in the balloon group. A recent systematic review and meta-analysis confirmed these findings.[249] *[Evidence level 2+]*

Balloon occlusion of the descending aorta has been increasingly used in some countries (China in particular) but the methodology of these studies is very heterogeneous with little data confirming the diagnosis of PAS at birth and confounding factors such as placental position, number of previous caesarean births and surgical experience of the team in performing complex caesarean births.[250] There is also wide variation between studies in clinical selection criteria and intraoperative IR methodology, including intraoperative balloon inflation/deflation time, the size of the balloon used and the need for transfer between the IR room and the operative theatre. *[Evidence level 4]*

The most commonly reported post-operative complication associated with IR are arterial thrombosis of the external iliac or the femoral artery. There are no data on the long-term follow up of the children born after IR and therefore one major concern is the risks-benefit ratio of the use of IR for both women and their fetuses. IR may be useful for women and pregnant people presenting with an anterior

placenta praevia with ultrasound signs suggestive of PAS who decline blood products. *[Evidence level 4]*

11.5 How are women with unexpected placenta accreta spectrum at birth best cared for?

Recommendation	Evidence quality	Strength	Rationale for the recommendation
If at planned repeat caesarean birth, it is apparent at laparotomy that there are anomalies of the uterine contour and vascularisation associated with PAS, the caesarean birth should be delayed until the appropriate staff and adequate resources have been assembled and blood products are available, provided the woman and her fetus are stable. This may involve closure of the maternal abdomen and urgent transfer to a specialist unit for birth and surgical management.	**4**	**GPP**	Based on one small retrospective study from the US.

If the PAS is only discovered at planned caesarean birth based on the uterus appearance at laparotomy and/or the placenta is bulging laterally within the parametrium and/or there are thick adhesions between the placental bulge and the vasculature of the lower pelvis requiring complex dissection, the surgical procedure should be temporary paused until surgical expertise is available. Delayed hysterectomy may represent a strategy for minimizing the degree of haemorrhage and need for massive blood transfusion in women.[251] *[Evidence level 4]*

11.6 Non-surgical or expectant management

Recommendation	Evidence quality	Strength	Rationale for the recommendation
Leaving the entire placenta in situ after delivery of the fetus can be considered when peripartum hysterectomy is unacceptable to the woman or pregnant person for personal reasons or judged inappropriate by the surgical team.	**2-**	**D**	Based on a large retrospective observational study from France.
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.	**2–**	**D**	Based on good clinical practice for women at risk of PPH and endometritis similar to those observed following accidental partial placental retention.
Methotrexate adjuvant therapy should not be used for expectant management as it is of unproven benefit and is associated with maternal morbidity and mortality.	**3**	**D**	Based on evidence from retrospective observational studies and know side effects associated with the use of MTX in oncology.

Leaving the placenta in situ after the birth of the baby, avoiding the placenta with repair of the hysterotomy incision, was discussed in the previous version of the guidelines but the evidence supporting this care strategy is still limited and it is not recommended in women and pregnant people

presenting with major bleeding as it is unlikely to be successful and risks delaying definitive treatment, thus increasing their morbidity.[216] The success of uterine balloon tamponade for PPH associated with retained placental tissue (accreta or not) is low (less than 20%) at both caesarean and vaginal births,[136] and is therefore not recommended. *[Evidence level 4]*

A retrospective multicentre study examined 167 women with possible PAS treated by leaving the placenta in situ in tertiary university hospital centres in France between 1993 and 2007.[252] Conservative expectant management with whole or part of the placenta left in situ was successful in 131 out of 167 cases (78.4%). 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%), with a median delay from birth of 13.5 weeks (range 4–60 weeks).[252] The same authors reported recently on the outcome 86 women who were treated conservatively compared with that of women who had a caesarean hysterectomy. The women in the conservative group had less total estimated blood loss, blood product transfusions and adjacent organ injury at birth but higher rates of arterial embolization, endometritis, and re-admission within 6 months.[253] As attempt at delivering the placenta in PAS is inevitably associated with haemorrhage often requiring emergency hysterectomy and histologic examination is only possible when a partial myometrial resection or hysterectomy is performed, it is impossible to ascertain the number of cases that truly had PAS in the conservative group, limiting the interpretation of the data in both studies. *[Evidence level 2–]*

The woman who opts for a conservative management with the placenta left in situ should be informed of the risks of chronic bleeding, sepsis, septic shock, peritonitis, uterine necrosis, fistula, acute pulmonary oedema, acute renal failure, deep venous thrombosis or pulmonary embolism.[252] Prophylactic antibiotics may be helpful in the immediate postpartum period to reduce the risk of infective complications.[254] A recent case series and systematic review has found that conservative management of PAS with the placenta in situ poses a risk of coagulopathy and keeping the placenta in situ after delivery prolongs the risk factors that are integral to PAS.[255] *[Evidence level 4]*

An observational case series, including 24 women with PAS where the placenta was left in situ after birth and treated with MTX, reported placental delivery in 33.3% of the cases (spontaneously in 55%, and in 45% following surgical evacuation).[256] There was no control group of women who did not receive MTX and so it is unknown whether or not the MTX was clinically helpful. Furthermore, one woman did suffer liver damage and it is unlikely that in those cases where the placenta was delivered, that it was abnormally adherent at birth. The risks of this therapy must be balanced against the unproven benefit and international guidelines recommend against the use of MTX in women with PAS.[201] *[Evidence level 3]*

12. Post-birth support and long-term outcome of women with pregnancies complicated by PAS

Recommendation	Evidence quality	Strength	Rationale for the recommendation
The woman or pregnant person and their partner should be involved in the pre-operative decision concerning the mode of anaesthesia and post-operative discussion about pain control and informed of the availability of psychological support before and after birth.	**2+**	**C**	Recent cohort studies have shown that involvement of the patient and her partner in discussion regarding anaesthesia and post-operative pain control improve the overall experience of women with PAS at birth.

Identifying the psychological impact of traumatic birth and its long-term consequences should be part of the integrated care pathways of specialist PAS MDT.	**4**	**GPP**	Adequate support to women and their partners in complex obstetric cases are associated with a lower risk of post-traumatic stress disorder.
Women and pregnant people with PAS who were managed conservatively (uterine preservation surgery or placenta left in situ) should be informed of the high risk of recurrence in subsequent pregnancies.	**2+**	**C**	Based on the evidence from small observational studies and a recent meta-analysis.

There is limited literature on the patient experience during the perioperative period and postpartum pain management for PAS. A recent study has explored the patient experience of anaesthesia for PAS using a survey questionnaire agreed by consensus by international experts on the care of PAS, confirmed that the decision concerning the mode of anaesthesia for the birth was central to patient's experience.[257] The majority of women (82%) want to be awake for the birth of their baby, however, only 60% reported that this actually happened and only 56% felt they were given enough information to make an informed decision. Very poor or poorly managed pain control during the postpartum period was reported by 40% with 17% reporting severe pain. Poor pain control was more common in women who did not have an anaesthesiology consult and who had a caesarean hysterectomy *[Evidence level 2+]*

There is mounting clinical evidence that women and their partners may suffer psychological consequences following the diagnosis of PAS and the experience of a traumatic birth.[234,258-261] Surviving PAS can be considered a traumatic event, which can lead to serious postpartum mental health problems such as depression and post-traumatic stress disorder.[262] A US qualitative study of semi-structured interviews of 25 women with PAS contacted at random, of whom 17 agreed to participate in interviews found that many experienced birth-related trauma, mourned the loss of future fertility and were dissatisfied with the lack of options for treatment.[258] A follow-up study from Ireland including 17 women with pregnancies complicated by PAS, of whom 16 were managed by caesarean hysterectomy, reported a profound, long-lasting impact on their physical and emotional health and their relationship with their partner.[259] Participants shared the frustration and difficulty of being cared for as if they had had a routine caesarean birth in the postnatal period and how this was unsatisfactory in meeting their needs, both immediately after birth and in the long term. There are currently no formal recommendations for mental health intervention for woman and pregnant people with pregnancy complicated by PAS and availability of mental health support varied widely. The above findings support a need for interventions such as decision tools and education materials together with an integrated care pathway, delivered as part of the specialist PAS MDT care, including mental health professionals, specialist midwives and referral to a local support group for peer support when available.[261] *[Evidence level 2+]*

Conservative management of PAS, including uterine-sparing surgery and leaving the placenta in-situ carry a recurrence risk of PAS ranging between 10% and 30% and a risk of spontaneous uterine rupture of 3.3% in subsequent pregnancies.[263-266] A national retrospective multicentre French study of 96 women managed with the placenta left in situ reported that PAS recurred in six of the 21 women (28.6%) who became pregnant, four of whom were diagnosed with placenta praevia accreta. The study group included eight women (8.3%) who were subsequently diagnosed with severe intrauterine synechiae and secondary amenorrhea. A retrospective population study from New South Wales, Australia, using a modified version of the WHO ICD-10, identified PAS in 27/570 (4.7%, 95% CI 3.0–6.5%) of second and 9/119 (7.6%, 95% CI 2.8–12.3%) of third pregnancies after PAS in the preceding birth.[267] Only, 17 (3%) and 6 (5%) of the corresponding women were recorded as having placenta

praevia accreta and only 138 (24.2%) and 28 (23.5%) had a previous caesarean birth suggesting that the majority of women included in this study, did not have a true PAS in their previous pregnancy and highlighting the limitation associated with the use of the WHO ICD-10 in epidemiologic studies. A recent systematic study and meta-analysis including the above studies confirmed a PAS recurrence rate in the subsequent pregnancy of 11.8% (95% CI: 1.1–60.3) with high heterogeneity between studies.[268] *[Evidence level 2–]*

13. Clinical governance

13.1 Debriefing

Postnatal follow-up should include debriefing with an explanation of what happened and why it happened. Women presenting with symptoms of depression and post-traumatic stress disorder should be provided with adequate support. Where conservative management of PAS has been successful, women and people should be informed of the risk of recurrence. Debrief is also useful for the PAS team for improving future care.

13.2 Training

Raising the awareness about the clinical risk factors of associated with placenta praevia and placenta praevia accreta at birth should be pursued nationally and locally, including organizing integrated care pathways for women and pregnant people with a high probability of PAS at birth and arranging for them to be referred to a specialist MDT for further investigations.

There should be appropriate training for all ultrasound staff (sonographers and obstetrician-gynaecologists) in diagnosing placenta praevia and identifying the antenatal ultrasound signs associated with PAS at birth and obstetric trainees and junior consultants in performing complex caesarean birth.

13.3 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 and planning of further care of women presenting with a placenta praevia and for those suspected to have PAS.

14. Recommendations for future research

- Adequately powered prospective study comparing the impact on the care and outcome 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 first trimester (11–14 weeks) ultrasound in women and pregnant people with a history of >2 previous caesarean births.
- Prospective studies are needed to assess the role of third trimester ultrasound and in particular changes in cervical length with advancing gestation in evaluating the risks of haemorrhage and emergency caesarean birth.
- Prospective comparative ultrasound imaging including transvaginal ultrasound and MRI studies are needed to evaluate the role of both techniques for evaluation of surgical outcomes in women presenting a placenta praevia with signs associated with a high probability of accreta placentation and anomalies of the uterine contour indicating a dehiscence of the LUS.
- Prospective case-control or RCTs of the impact of progesterone on the risk of preterm birth for both conditions (placenta praevia and placenta accreta) stratified for the risks of preterm birth

including the cervical length are needed.

- Prospective case-control or RCTs of optimal timing of birth for both conditions (placenta praevia and placenta accreta) stratified for the risks of preterm birth including the cervical length are needed.
- Prospective studies of the psychological consequences following the diagnosis of both conditions (placenta praevia and placenta accreta) and the experience of a traumatic birth.
- A prospective study is required to evaluate the access to specialist care for women and pregnant people at higher risk of these placental conditions in different ethnic groups and evaluate the impact of a raising awareness campaign on giving the corresponding women access to care from the first trimester of pregnancy.

15. Auditable topics

15.1 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 birth 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 birth (100%).
- Appropriate site for birth (100%).
- Appropriate surgical approaches performed (100%).
- Planned early-term birth between 37^{+0} and 37^{+6} weeks of gestation for asymptomatic women with placenta praevia and no other risk factors (100%).
- Women and pregnant people requesting planned caesarean birth for nonmedical reasons are informed of the risk of placenta praevia and accreta spectrum, and its consequences in future births (100%).

15.2 Placenta accreta spectrum

- Antenatal imaging performed according to hospital policy with diagnosis confirmed at birth (100%).
- Appropriate antenatal birth plan made and documented, to include discussion with the woman and their 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 planned surgery in women with placenta accreta spectrum (100%):
  - consultant obstetrician planned and directly supervising birth
  - consultant anaesthetist planned and directly supervising anaesthetic at birth
  - blood and blood products available
  - multidisciplinary involvement in preoperative planning
  - discussion and consent should include 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.

16. 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].
- The Birth Trauma Association – [https://www.birthtraumaassociation.org/]
- Tommy's – [https://www.tommys.org/]

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Appendix 1: Explanation of grades and evidence levels

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 review 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++

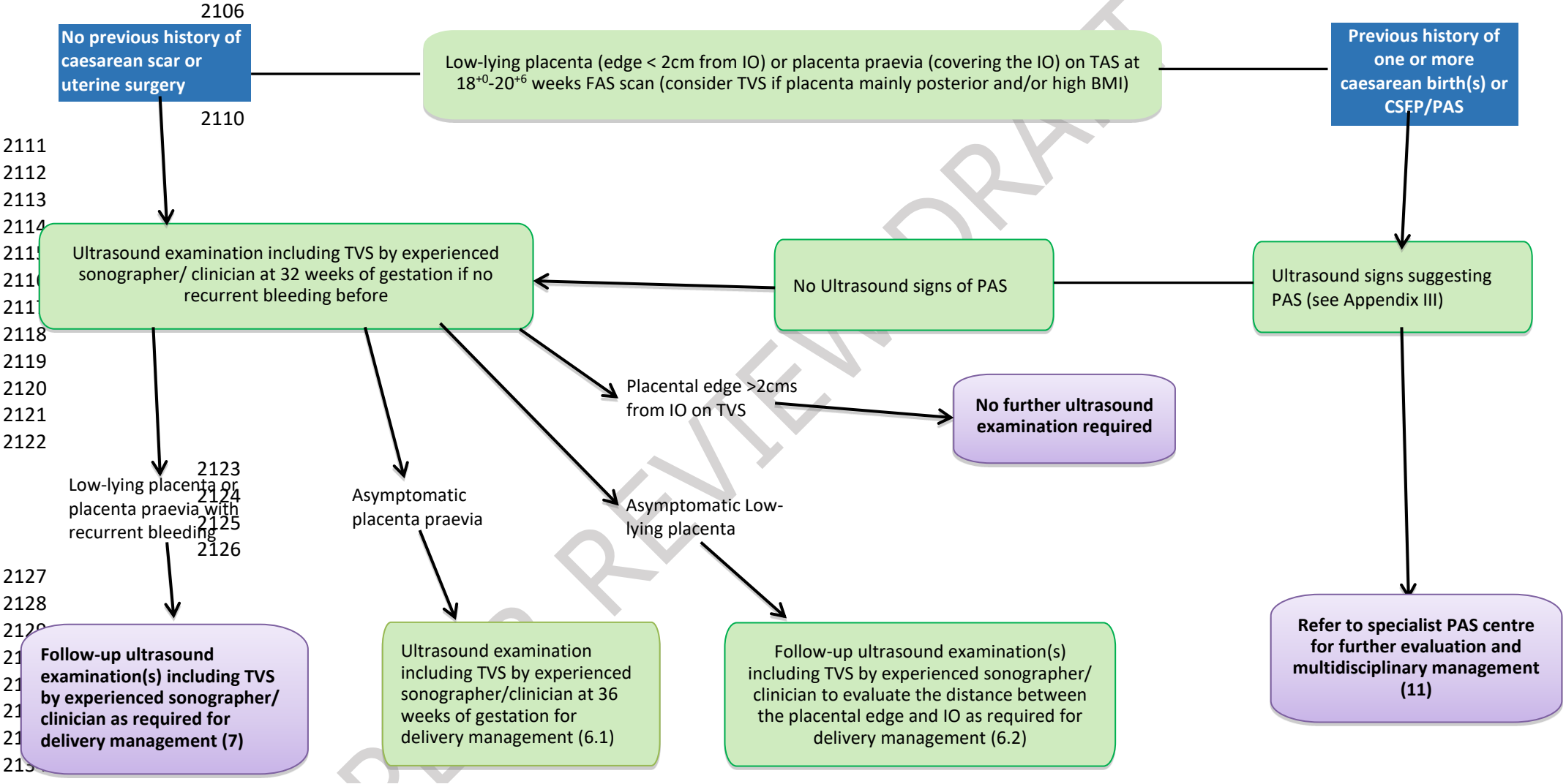
D Evidence level 3 or 4; or
Extrapolated evidence from studies rated as 2+

Good Practice Points (GPP)

✓ Recommended best practice based on the clinical experience of the guideline development group.*

*on the occasion when the guideline development group find there is an important practical point that they wish to emphasise but for which there is not, nor is there likely to be any research evidence. This will typically be where some aspect of treatment is regarded as such sound clinical practice that nobody is likely to question it. These are marked in the guideline, and are indicated by ✓ **or GPP**. It must be emphasised that these are NOT an alternative to evidence-based recommendations, and should only be used where there is no alternative means of highlighting the issue.

Appendix 2: Flow diagram for ultrasound diagnosis and follow-up of placenta praevia and placenta accreta spectrum (PAS)



Abbreviations: TAS= transabdominal scan; **BMI=** body mass index; **TVS=** transvaginal scan; **IO**= Internal os; PAS**= Placenta accreta spectrum; CSEP**= Caesarean ectopic pregnancy; **FAS**= fetal anomaly screening.

2137 **Appendix 3. Ultrasound imaging signs commonly used to identify PAS stratify according to their main features (modified from Jauniaux et al)[190]**
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Ultrasound imaging signs	Ultrasound descriptions	Anatomical descriptions
<u>Anomalies of uterine contour</u>		
Loss of the 'clear zone'	**GSI**: Loss or irregularity of the normal hypoechoic plane in the uterine wall underneath the placental bed.	The thickness of this layer, which probably corresponds to the decidua decreases with advancing gestation and is altered by remodelling of the uterine wall during the scarification process.
Myometrial thinning	**GSI**: Myometrial thickness <1mm or undetectable.	Area of the myometrium lost during the scarification process of the LUS. The myometrial thickness also decreases with advancing gestation and number of prior caesarean births.
Bladder wall interruption	**GSI**: Partial or complete interruption, loss or irregularity of the bladder wall or of the hyperechoic line between uterine serosa and bladder lumen.	Anatomical artifact associated with the remodelling of the uterine wall during the scarification process and the increase in subplacental vascularity.
Placental bulge	**GSI**: 'Ballooning' of the uterus containing the placenta into the surrounding pelvic structure.	Hernia of one or more placental lobules (cotyledons) through a dehiscent uterine wall scar (often only made of fibrotic tissue covered by the uterine serosa) following myometrial thinning and stretching of the LUS with advancing gestation.
Exophytic mass	**GSI**: Focal area of the myometrium where the placenta appears to protrude outside the uterine wall.	Focal placental tissue hernia through a small defect of the uterine wall following scarification.
<u>Anomalies of the utero-placental and intraplacental circulation</u>		
Subplacental hypervascularity	**CDI**: Striking amount of colour Doppler signal seen under part of the placental bed demonstrating multidirectional flow and aliasing artefact.	Excessive dilatation of the deep uterine circulation (radial and arcuate) resulting from development of part of the definitive placenta inside and around a scar defect.
Placental lacunae	**GSI & CDI**: Large, irregular hypoechoic intra-placental spaces located above large feeder vessels, giving the placenta a "moth-eaten" appearance.	Distortion of a placental lobule due to chronically high velocity maternal blood flow entering the intervillous space directly from a radial or arcuate artery.

Bridging vessels	**CDI**: Vessels appearing to extend from the placenta bed, across uterine wall into bladder or other pelvic organs.	Dilated radial or arcuate arteries between the accreta area and the uterine serosa often associated with anastomosis between the uterine and bladder circulation.

GSI= Grey-scale imaging; CDI= Colour Doppler imaging; LUS= lower uterine segment

Appendix 4: Abbreviations

ACOG= American College of Obstetricians and Gynecologists
APH= Antepartum haemorrhage
ART= Artificial reproduction technology
BMI= body mass index
CDI= Colour Doppler imaging
CL= Cervical length
CSD = Caesarean scar defect
CSEP = Caesarean scar ectopic pregnancy
DH = Delayed hysterectomy
FAS= fetal anomaly screening
GSI= Grey-scale imaging
ICU= Intensive care unit
IO= Internal os
IVF= In-vitro fertilisation
LUS= Lower uterine segment
MDT= Multidisciplinary team
MRI= Magnetic resonance imaging
MOH= Major obstetric haemorrhage
NICU= neonatal intensive care unit
OR & CI = Odds ratio and confidence intervals
PAS= Placenta accreta spectrum
PH= Primary hysterectomy
PMR= Partial myometrial resection
PPH= Post-partum haemorrhage
PTB= Preterm birth
RCT= Randomised controlled trial
RR= relative risk
TAS= Transabdominal scan
TVS= Transvaginal scan

Appendix 5: Glossary

Caesarean scar defect: Defect of the myometrium that develops following incomplete closure of the incision of caesarean section.

Caesarean scar ectopic pregnancy: Development of a pregnancy following the implantation of the blastocyst inside a caesarean scar defect.

Decidua: Transformed endometrial layer during pregnancy which provides nutrition support to the early placenta and fetus, and regulates trophoblast migration.

Internal os: Opening between the uterine cervix and the corpus or upper uterine segment.

Interventional radiology: Sub-specialty of radiology that uses image-guidance to perform procedures in obstetrics such vascular embolisation or insertion of a ballon into the aorta, iliac artery or uterine artery.

Low-lying placenta: When the lower placental edge is < 20 mm from the IO of the uterine cervix at any gestation > 16 weeks on ultrasound examination.

Major (massive) obstetric haemorrhage: leading cause of direct maternal morbidity and mortality worldwide, variably defined as a blood loss > 1500 ml, or a fall in haemoglobin of more than 4 g/dl after acute blood loss during delivery or need transfusion of four or more units of blood.

Massive PPH refers to a blood loss of > 2000 ml (or >30% of blood volume).

Lower uterine segment: part of the uterus between the cervix in the upper thicker uterine segment which undergoes circumferential dilatation during labor.

Placenta increta: Placenta with one or more lobule(s) where the villous tissue is abnormally attached inside a scar area of the uterine wall.

Placental cotyledon (lobule): The globular arrangement of placental villi centred over the opening of a spiral artery.

Placenta praevia: When the placental edge reaches or covers the IO of the uterine cervix at any gestation > 16 weeks on ultrasound examination.

PPH (Primary) is defined a blood loses $\geq$ 500 ml within the first 24 hours after the birth.

Residual myometrial thickness: Thickness of the uterine wall of a caesarean scar defect between the placenta and the serosa of the bladder.

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DISCLAIMER

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