

FIGO classification for the clinical diagnosis of placenta accreta spectrum disorders^{+,§}

Eric Jauniaux¹, Diogo Ayres-de-Campos^{2,6}, Jens Langhoff-Roos³, Karin A Fox⁴, Sally Collins⁵; FIGO Placenta Accreta Diagnosis and Management Expert Consensus Panel⁷

¹ EGA Institute for Women's Health, Faculty of Population Health Sciences, University College London (UCL), London, UK.

² Medical School, University of Lisbon, Santa Maria Hospital, Lisbon, Portugal.

³ Department of Obstetrics, Rigshospitalet, University of Copenhagen, Denmark.

⁴ Division of Maternal-Fetal Medicine, Department of Obstetrics and Gynecology, Baylor College of Medicine, Houston, Texas, USA.

⁴ Nuffield Department of Women's and Reproductive Health, University of Oxford, and the Fetal Medicine Unit, John Radcliffe Hospital, Oxford, UK

⁵ FIGO Safe Motherhood and Newborn Health Committee

The authors report no conflict of interest

⁺ Promoted by the FIGO Safe Motherhood and Newborn Health Committee; coordinated by Eric Jauniaux.

[§]The views expressed in this document reflect the opinion of the individuals and not necessarily those of the institutions that they represent.

⁷Expert Consensus panel:

Dr Greg Duncombe	Australia and New Zealand
Dr Philipp Klaritsch	Austria
Dr Frederic Chantaine	Belgium
Professor John Kingdom	Canada
Dr Lene Groenbeck	Denmark
Dr Kristiina Rull	Estonia
Dr Minna Tikkanen	Finland
Professor Loic Sentilhes	France
Professor Tengiz Asatiani	Georgia
Dr Wing Cheong Leung	Hong Kong
Professor Taghreed Alhaidari	Iraq
Dr Donal Brennan	Ireland
Dr Muhieddine Seoud	Lebanon
Professor Ahmed Mahmoud Hussein	Egypt
Dr Ravindran Jegasothy	Malaysia
Dr Kamal Nusrat Shah	Pakistan
Professor Dorota Bomba-Opon	Poland
Professor Corinne Hubinont	Belgium
Professor Priya Soma-Pillay	Republic of South Africa
Asistant Professor Nataša Tul Mandić	Slovenia
Dr Pelle Linqvist	Sweden
Dr Berglind Arnadottir	Sweden
Professor Irene Hoesli	Switzerland
Dr Rafael Cortez	Venezuela

Irving and Hertig are credited for having published, in 1937, the first cohort study of placenta accreta in the international literature [1]. Their article included comprehensive clinical and histopathologic descriptions of 20 cases and a literature review of 86 cases published before 1935. All their cases were described as 'adherenta', which they characterized clinically as a placenta adherent to the uterine wall without easy separation and/or bleeding from the placental bed, and histologically as absence of decidual layer/Nitabuch layer between the placenta and myometrium. These diagnostic criteria were not new at the time and had been in use since the mid-1920s, including by the authors of case reports with histological evidence of villous invasion of the myometrium [2].

Predisposing factors identified in the 1920s and 1930s were previous manual removal of placenta and/or "vigorous" uterine curettage. Only one of the 20 patients included in the Irving and Hertig series had a previous caesarean delivery [1]. Similarly, in their review of the previous 86 case reports, only one woman had a prior caesarean delivery. Before the development of antibiotics, damage to the uterine wall after uterine curettage or manual removal of the placenta was often aggravated by endometritis. This likely resulted in scar tissue forming focally within the superficial myometrium which is not comparable to the extensive myometrial scar caused by multiple caesarean deliveries [4-6]. The low incidence of full-thickness myometrial scarring may explain why very few cases of invasive placentation were reported before the 1950s, when caesarean deliveries became safer and therefore increasingly common. There is now compelling epidemiological evidence that accreta placentation has become essentially an iatrogenic condition, secondary to the modern era caesarean section epidemic [3,4]. In early pathologic studies, the distribution of placenta creta, increta and percreta was found to be 69.5%, 23.7% and 6.8%,

respectively [3]. The incidence of invasive cases has increased in the last two decades but the data are limited due to wide variation in the methodology used in cohort studies.

Placenta accreta was re-defined in the mid-1960's by Lukes et al. [7] as a spectrum of abnormal placentation disorders. These include *placenta adherenta* or *vera* also referred to as *placenta creta* by pathologists, where the villi are attached directly to the surface of the myometrium without invading it; *placenta increta*, where the villi penetrate deeply into the myometrium up to the uterine serosa and *placenta percreta*, where the invasive villous tissue penetrates through the uterine serosa and may reach the surrounding pelvic tissues, vessels and organs. They also showed that different grades of the placenta accreta spectrum (PAS) can co-exist in the same specimens and that an accreta area can be focal or extended (diffuse). This remains the most comprehensive description of placenta accreta published so far, and was largely incorporated in the recent FIGO guidelines [3] and other publications [6].

Similarly, to other clinical conditions, histopathology is now widely considered as the gold standard modality recommended to confirm clinical diagnoses but it is often unavailable in adherent accreta or conservatively managed cases, and was not described by the pioneer pathologists of the 19th and early 20th centuries [3]. Moreover, unlike cancer staging, retrospective clinical and/or pathological grading of PAS has no direct long-term impact on the life of women. All these aspects may explain the apparent lack of interest in accurately differentiating between adherent and invasive forms, both by clinicians and pathologists and/or the lack of trained perinatal pathologists in many centres. As a result, the 1920-1930's criteria, based mostly on adherent cases, continued to be used by several authors of cohort studies. However, this can lead to misleading conclusions, as adherent and invasive accreta placentation

have very different outcomes and require different management. To compound this, although 80-90% of prenatally diagnosed PAS are managed with caesarean hysterectomy [8], around half of the authors fail to report the extent of villous attachment or invasion after peri-partum hysterectomy [9].

Recent variants of the classical clinical description of PAS often include criteria such a “difficult manual, piecemeal removal of the placenta”, “absence of spontaneous placental separation 20-30 minutes after birth despite active management, including bimanual massage of the uterus, use of oxytocin and controlled traction of the umbilical cord”, “retained placental fragment requiring curettage after vaginal birth” and “heavy bleeding from the placentation site after removal of the placenta during cesarean delivery” [10-13]. This has resulted in a multitude of different clinical criteria, which can be easily confused with non-accreta placental retention and secondary uterine atony. With so many different criteria all-purporting to represent PAS, but without any attempt to differentiate between adherent and invasive forms, it is unsurprising that there is a wide variation in the reported prevalence over the last 30 years.

Adding to the confusion is the wide heterogeneity in terminology used to describe the different grades of accreta placentation: these include “placental adhesive disorders”, “abnormal placental adherence”, “advanced invasive placentation” and “abnormal myometrial invasion” [9,14]. A recent popular label used by clinicians reporting on the prenatal diagnosis of PAS has been “morbidly adherent placenta”, which was used in the 19th Century to describe placental retention. It has been recently used by the World Health Organization (WHO) international statistical classification of diseases (ICD-10) (www.who.int/classifications/icd) and has led to some exotic translation such as “*the pernicious placenta*” recently used by Chinese

authors in both local and international journals [15,16]. This point also highlights the limited impact of accreta placentation research on the general scientific literature, as leading medical journals are unlikely to publish articles on diseases that do not have universally accepted diagnostic criteria and unequivocal terminology. Each of the other terminologies used so far are suboptimal and exclusive as they do not describe the different grades of PAS i.e. "adherent" which does not include the invasive grades increta and percreta and "invasive" which can be confused with gestational trophoblastic disease and in particular invasive intra-uterine choriocarcinoma.

Consequences reach far beyond a simple debate on what is the most adequate terminology. So far, the lack of use of standardized clinical criteria for the diagnosis of the condition at birth and the histopathologic differential diagnosis between adherent and invasive accreta placentation has led to wide heterogeneity between studies for all epidemiologic and outcome parameters [18]. Distinguishing between adherent and invasive forms of accreta has a direct impact on the accurate evaluation of epidemiology, on improving the understanding of the underlying pathology, and most importantly on the development of better management strategies. In addition, labelling cases of placenta retention as accreta or morbidly adherent leads to overdiagnosis which can influence treatment decision leading to overtreatment and diagnosis related anxiety for many patients. The process of clarifying the reporting data on placenta accreta in the international literature started recently with the development of a *grading system* for the clinical diagnosis of PAS [19]. The *classification* presented in Table 1 was developed from this grading scheme, and reviewed by the members of the FIGO Placenta Accreta Spectrum Disorders Diagnosis and Management Expert Consensus Panel [20]. Of note, it refers to a classification and not staging system, to differentiate it from the

terminology used for cancer. As an example, for the use of the classification, we have summarised the recommendations of the recent FIGO guidelines for the conservative [21] and non-conservative surgical management [22] of PAS according to the grade of accreta invasiveness defined in the present classification (see appendix 1).

The accreta placentation process has an impact on both the anatomy of a portion of the placenta and on the anatomy of the surrounding deep uterine circulation [6]. The accreta area will not spontaneously deliver at birth and any attempt in doing so may result in rapidly uncontrollable bleeding from the deep uterine vessels or the neovascularisation in the accreta area. The deeper and larger the accreta area inside the uterine wall, the higher the risks of severe haemorrhagic complications and need to perform an emergency hysterectomy. To avoid unnecessary complex surgical procedure, clinicians should differentiate between placenta percreta and a 'uterine window' which is an area of cesarean scar dehiscence with normal placentation underneath (or sometime seen poking through). In the latter, the surrounding uterine tissue appears relatively normal with no neovascularity or placental bulge. If the placenta is eventually delivered manually in whole or in pieces and it is unlikely to have been accreta. The manual removal of a non-accreta retained placenta can also be associated with severe haemorrhage due to secondary uterine atony but in these cases, conservative management techniques such as compressive sutures and intrauterine balloon are often successful in controlling the bleeding. These cases should not be reported as successful management of PAS.

It is pivotal to improve the accuracy of PAS diagnosis in the international literature, and for this purpose we also propose reporting guidelines, which include a

125 standardized basic dataset for future clinical research and to allow comparison
126 between centers with different management strategies (Table 2). This protocol does
127 not replace the general EQUATOR network guidelines, such as the PRISMA guideline
128 for systematic reviews, but rather it serves to elevate the international discourse about
129 PAS to a scientific caliber that matches the gravity of the disease. Adherence to this
130 new FIGO classification will improve future systematic reviews and meta-analysis and
131 provide more accurate epidemiologic data which are essential to improve clinical
132 outcomes.

REFERENCES

1. Irving C, Hertig AT. A study of placenta accreta. *Surgery, Gynecol Obstet*. 1937;64:178-200.
2. Forster DS. A case of placenta accrete. *Can Med Assoc J*. 1927;17:204-7.
3. Jauniaux E, Chantraine F, Silver RM, Langhoff-Roos J; FIGO Placenta Accreta Diagnosis and Management Expert Consensus Panel. FIGO consensus guidelines on placenta accreta spectrum disorders: Epidemiology. *Int J Gynaecol Obstet*. 2018;140:265-73.
4. Jauniaux E, Jurkovic D. Placenta accreta: pathogenesis of a 20th century iatrogenic uterine disease. *Placenta*. 2012;33:244-51.
5. Jauniaux E, Bhide A, Burton GJ. Pathophysiology of accreta. In: Silver, R. ed. *Placenta accreta syndrome*. Portland: CRC Press; 2017:13–28.
6. Jauniaux E, Collins SL, Burton GJ. Placenta accreta spectrum: Pathophysiology and evidence-based anatomy for prenatal ultrasound imaging. *Am J Obstet Gynecol*. 2018;218:75-87.
7. Luke RK, Sharpe JW, Greene RR. Placenta accreta: The adherent or invasive placenta. *Am J Obstet Gynecol*. 1966;95:660–8.
8. Jauniaux E, Bhide A. Prenatal ultrasound diagnosis and outcome of placenta previa accreta after caesarean delivery: a systematic review and meta-analysis. *Am J Obstet Gynecol* 2017;217:27–36.
9. Jauniaux E, Collins SL, Jurkovic D, Burton GJ. Accreta placentation. A systematic review of prenatal ultrasound imaging and grading of villous invasiveness. *Am J Obstet Gynecol*. 2016; 215:712-21.
10. Gielchinsky Y, Rojansky N, Fasouliotis SJ, Ezra Y. Placenta accreta--summary of 10 years: a survey of 310 cases. *Placenta*. 2002;23:210-4.
11. Wu S, Kocherginsky M, Hibbard JU. *Abnormal placentation: twenty-year analysis*. *Am J Obstet Gynecol*. 2005;192:1458–61.
12. Umezurike CC, Nkwocha G. Placenta accreta in Aba, south eastern, Nigeria. *Niger J Med*. 2007;16:219-22.
13. Seet EL, Kay HH, Wu S, Terplan M. Placenta accreta: depth of invasion and neonatal outcomes. *J Matern Fetal Neonatal Med*. 2012;25:2042-5.

14. Collins SL, Chantraine F, Morgan TK, Jauniaux E. Abnormally adherent and invasive placenta: A spectrum disorder in need of a name. *Ultrasound Obstet Gynecol*. 2018;51:165-6.
15. McDonald KN. How to prevent septicaemia in cases of morbidly adherent placenta. *BMJ*. 1885;1:779-80.
16. Huang S, Xia A, Jamail G, Long M, Cheng C. Efficacy of temporary ligation of infrarenal abdominal aorta during cesarean section in pernicious placenta previa. *Zhong Nan Da Xue Xue Bao Yi Xue Ban*. 2017;42:313-19.
17. Dai MJ, Jin GX, Lin JH, Zhang Y, Chen YY, Zhang XB. Pre-cesarean prophylactic balloon placement in the internal iliac artery to prevent postpartum hemorrhage among women with pernicious placenta previa. *Int J Gynaecol Obstet*. 2018 Jun 7. doi: 10.1002/ijgo.12559.
18. Jauniaux E, Bunce C, Grønbeck L, Langhoff-Roos J. Prevalence and main outcomes of placenta accreta spectrum: a systematic review and metaanalysis. *Am J Obstet Gynecol* 2019;220: in press.
19. Collins SL, Stevenson GN, Al-Khan A, Illsley NP, Impey L, Pappas L, et al. Three-Dimensional Power Doppler Ultrasonography for Diagnosing Abnormally Invasive Placenta and Quantifying the Risk. *Obstet Gynecol*. 2015;126:645-53.
20. Jauniaux E, Ayres-de-Campos D; for the FIGO Placenta Accreta Diagnosis and Management Expert Consensus Panel. FIGO consensus guidelines on placenta accreta spectrum disorders: Introduction. *Int J Gynecol Obstet* 2018; 140:261-4.
21. Sentilhes L, Kayem G, Chandrachan E, Palacios-Jaraquemada J, Jauniaux E; FIGO Placenta Accreta Diagnosis and Management Expert Consensus Panel. FIGO consensus guidelines on placenta accreta spectrum disorders: Conservative management. *Int J Gynaecol Obstet*. 2018;140:291-8.
22. Allen L, Jauniaux E, Hobson S, Papillon-Smith J, Belfort MA; FIGO Placenta Accreta Diagnosis and Management Expert Consensus Panel. FIGO consensus guidelines on placenta accreta spectrum disorders: Nonconservative surgical management. *Int J Gynaecol Obstet*. 2018;140:281-90.

Table 1: PAS general classification

GRADE 1	Abnormally adherent placenta (PLACENTA ADHERENTA OR CRETA)
Clinical criteria	<p>At vaginal delivery</p> <ul style="list-style-type: none"> - No separation with synthetic oxytocin and gentle controlled cord traction. - Attempts at manual removal of the placenta results in heavy bleeding from the placenta implantation site requiring mechanical or surgical procedures. <p>If laparotomy is required</p> <ul style="list-style-type: none"> - Same as above. - Macroscopically, the uterus shows no obvious distension over the placental bed (placental 'bulge'), no placental tissue is seen invading through the surface of the uterus, and there is no or minimal neovascularity.
Histologic criteria	<ul style="list-style-type: none"> - Microscopic examination of the placental bed samples from hysterectomy specimen shows extended areas of absent decidua between villous tissue and myometrium with placental villi attached directly to the superficial myometrium. - The diagnosis cannot be made on just delivered placental tissue nor on random biopsies of the placental bed.
GRADE 2	Abnormally invasive placentation (PLACENTA INCRETA)
Clinical criteria	<p>At laparotomy</p> <ul style="list-style-type: none"> - Abnormal macroscopic findings over the placental bed: bluish/purple colouring, distension (placental 'bulge'). - Significant amounts of neovascularity (dense tangled bed of vessels or multiple vessels running parallel cranio-caudally in the uterine serosa). - No placental tissue seen to be invading through the surface of the uterus. - Gentle cord traction results in the uterus being pulled inwards without separation of the placenta (the 'dimple' sign).
Histologic criteria	Hysterectomy specimen or partial myometrial resection of the increta area shows placental villi within the muscular fibres and sometimes in the lumen of the deep uterine vasculature.
GRADE 3	Abnormally invasive placentation (PLACENTA PERCRETA)
GRADE 3a	Limited to the uterine serosa
Clinical criteria	<p>At laparotomy</p> <ul style="list-style-type: none"> - Abnormal macroscopic findings on uterine surface (as above) and placental tissue seen to be invading through the surface of the uterus (serosa). - No invasion into any other organ, including the posterior wall of the bladder (a clear surgical plane can be identified between the bladder and uterus).

Histologic criteria	Hysterectomy specimen showing villous tissue within or breaching the uterine serosa
GRADE 3b	With urinary bladder invasion
Clinical criteria	At laparotomy <ul style="list-style-type: none"> - Same as 3a. - Placental villi are seen to be invading into the bladder but no other organs. - Clear surgical plane cannot be identified between the bladder and uterus.
Histologic criteria	hysterectomy specimen showing villous tissue breaching the uterine serosa and invading the bladder wall tissue or urothelium.
GRADE 3c	With invasion of other pelvic tissue/organs
Clinical criteria	At laparotomy <ul style="list-style-type: none"> - Same as 3a. - Placental villi are seen to be invading into the broad ligament, vaginal wall, pelvic sidewall or any other pelvic organ (+/- invasion of bladder).
Histologic criteria	Hysterectomy specimen showing villous tissue breaching the uterine serosa and invading pelvic tissues/organs.

NB: For the purposes of this classification, 'uterus' includes the uterine body and uterine cervix.

Table 2: Basic dataset for PAS reporting.

Background population

1. Institution-based study:

- Display referred cases and cases from local catchment area in separate data sets.
- Description of background population and cases including number of births, mode of delivery, parity, local CD rate (stratified by numbers of prior deliveries and numbers of prior CD).

2. Regional/network/national-based study:

- Description of local background population including number of births, mode of delivery, parity, CD rates (stratified by numbers of prior deliveries and numbers of prior CD) for referred cases and local cases.

Description of standardized criteria used for prenatal diagnosis:

- Ultrasound signs of PAS including placental location.
- MRI signs of PAS including surface area and depth.

Management strategy:

- **Intended mode of management:** vaginal delivery, scheduled CD, hysterectomy (primary or delayed), focal myometrial resection, leaving the placenta in situ.
- **Actual mode of management:** vaginal delivery, scheduled CD, emergent CD, focal myometrial resection, hysterectomy (primary or delayed), leaving the placenta in situ.

Confirmation of diagnosis:

- Clinical diagnostic criteria and confirmed histopathological diagnosis when possible.
- The final diagnosis (clinical, histopathological) should be clearly stated and made according to the classification in Table 1.

CD= caesarean delivery; MRI= magnetic resonance imaging.

Appendix 1: Example of Management for PAS using the new classification presented in table 1. The content of this table is based on the recommendations of the recent FIGO guidelines for the conservative [20] and non-conservative surgical management [21] and may need to be adapted to local need and access to specialised unit/multidisciplinary team.

FOCAL OR DIFFUSE GRADE 1 ANYWHERE IN THE UTERUS
Manual extraction of the placenta may be attempted if a distinct cleavage plane is found, followed by treatment of postpartum haemorrhage, if necessary with haemostatic stiches in placental bed or tamponade applied to the placental bed eg with an intra-uterine balloon. Hysterectomy may be reserved for ongoing bleeding, should conservative maneuvers fail.
FOCAL GRADE 2 or 3a OUTSIDE THE LOWER UTERINE SEGMENT
Local resection of accreta area and overlying uterus may be attempted, if the operator is certain that there is no placental invasion into the cervix or parametria. With abundant or persistent haemorrhage, mechanical or surgical measures to control haemorrhage may be required, including peri-partum hysterectomy.
DIFFUSE GRADE 2 ANYWHERE IN THE UTERUS or 3a OUTSIDE THE LOWER UTERINE SEGMENT
<p>Intraoperative ultrasound should be used to locate the placental bed and avoid transecting it in the uterine incision, if the exact location of the placenta is uncertain. After fetal extraction, avoid attempts to remove the placenta, ligate and cut the cord near its placental insertion. Close the hysterotomy and review haemostasis.</p> <p>If not bleeding; manage according to the patient's wishes and the experience of the surgical team with either peri-partum hysterectomy or leaving the placenta in situ (conservative management). Conservative management can be either the definitive management or for just a short time until a secondary hysterectomy can be performed by a more experienced team i.e. with interventional radiology.</p> <p>If massive or persistent haemorrhage, mechanical or surgical measures to control haemorrhage are urgently required, with rapid recourse peri-partum hysterectomy.</p>
GRADE 3 or 3a IN LOWER UTERINE SEGMENT (with prenatal diagnosis)
<p>Consider placement ureteral stents and instilling 100 ml of saline with coloured agent into bladder. Consider a median infra-umbilical or a wide transverse (e.g. modified Maylard or a Joel Cohen) skin incision (with vertical fascial incision if required).</p> <p>Upon opening the abdomen, a full assessment of the extent of invasion throughout the pelvis should be made including visualization of the pelvic side walls which may require opening the broad ligament to aid inspection. Intraoperative ultrasound should be used to locate the placental bed and avoid transecting it in the uterine incision. After fetal extraction avoid attempts to remove the placenta, ligate and cut the cord near placental insertion. Uterotonic agents should not be used <u>if conservative management is planned and should only be considered if partial separation of the placenta has resulted in bleeding and the</u></p>

operating team feel that increased uterine contraction may reduce blood loss during the definitive surgery. Close the hysterotomy and review haemostasis.

If no heavy bleeding, manage according to the anticipated complexity of any surgical management considering the experience of the surgical team and patient's wishes and then proceed to either peri-partum hysterectomy or leaving the placenta in situ (conservative management). Conservative management can be either the definitive management or for just a short time until a secondary hysterectomy can be performed by a more experienced team. If there is invasion of the urinary bladder (3b or 3c) and proceeding to peri-partum hysterectomy, deliberate partial cystectomy may be required.

If massive or persistent heavy haemorrhage; mechanical or surgical measures to control hemorrhage are urgently required, with rapid recourse peri-partum hysterectomy.