

Management Options of Placenta Accreta Spectrum

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Abstract

Placenta accreta is a serious pregnancy condition that occurs when the placenta grows too deeply into the uterine wall. Typically, the placenta detaches from the uterine wall after childbirth. With placenta accreta, part or all of the placenta remains attached. This can cause severe blood loss after delivery. It's also possible for the placenta to invade the muscles of the uterus (placenta increta) or grow through the uterine wall (placenta percreta). Placenta accreta is considered a high-risk pregnancy complication. If the condition is diagnosed during pregnancy, you'll likely need an early C-section delivery followed by the surgical removal of your uterus (hysterectomy). All treatments designed to prevent peripartum hysterectomy and its associated morbidity and consequences are referred to as "conservative management" of both abnormally adherent (placenta accreta) and invasive placenta (placenta increta and percreta). Four different primary methods of conservative management have been described in the international literature: (1) the extirpative technique (manual removal of the placenta); (2) leaving the placenta in situ or the expectant approach; (3) one-step conservative surgery (removal of the accreta area); and (4) the Triple-P procedure (suturing around the accreta area after resection). These methods have been used alone or in combination and in many cases with additional procedures such as those suggested by interventional radiology. In contrast to the extirpative technique, leaving the placenta in situ primarily aims to reduce the risks of severe maternal morbidity during cesarean delivery.

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Introduction:

Placenta accreta is defined as abnormal trophoblast invasion of part or all of the placenta into the myometrium of the uterine wall (Usta et al.,2005). Placenta accreta spectrum, formerly known as morbidly adherent placenta, refers to the range of pathologic adherence of the placenta, including placenta increta, placenta percreta, and placenta accreta. Maternal morbidity and mortality can occur because of severe and sometimes life-threatening hemorrhage, which often requires blood transfusion. Rates of maternal death are increased for women with placenta accreta spectrum (Usta et al.,2005) and (Shellhaas et al.,2009). Additionally, patients with placenta accreta spectrum are more likely to require hysterectomy at the time of delivery or during the postpartum period and have longer hospital stays (Shellhaas et al.,2009). In 2015, the American College of Obstetricians and Gynecologists (ACOG) and the Society for Maternal–Fetal Medicine developed a standardized risk-appropriate maternal idealized care system for facilities, based on region and expertise of the medical staff, to reduce overall maternal morbidity and mortality in the United States (Obstetric Care Consensus 2015). This designation is referred to as “levels of maternal care,” and exists for conditions such as placenta accreta spectrum. Placenta accreta spectrum is considered a high-risk condition with serious associated morbidities; therefore, ACOG and the Society for Maternal–Fetal Medicine recommend these patients receive level III (subspecialty) or higher care. This level includes continuously available medical staff with appropriate training and experience in managing complex maternal and obstetric complications, including placenta accreta spectrum, as well as consistent access to interdisciplinary staff with expertise in critical care (ie, critical care subspecialists, hematologists, cardiologists, and neonatologists). The general resources needed to be able to attain improved health outcomes in the setting of a known or suspected placenta accreta include planning for delivery with appropriate subspecialists and having access to a blood bank with protocols in place for massive transfusion.

Management of placenta accreta spectrum

All treatments designed to prevent peripartum hysterectomy and its associated morbidity and consequences are referred to as "conservative management" of both abnormally adherent (placenta accreta) and invasive placenta (placenta increta and percreta). Four different primary methods of conservative management have been described in the international literature: (1) the extirpative technique (manual removal of the placenta); (2) leaving the placenta in situ or the expectant approach; (3) one-step conservative surgery (removal of the accreta area); and (4) the Triple-P procedure (suturing around the accreta area after resection). These methods have been used alone or in combination and in many cases with additional procedures such as those suggested by interventional radiology. In contrast to the extirpative technique, leaving the placenta in situ primarily aims to reduce the risks of severe maternal morbidity during cesarean delivery (Kayem et al.,2004) and (Teixidor et al.,2015).

Conservative management of placenta accrete spectrum

A- THE EXTIRPATIVE TECHNIQUE

This procedure consists of forcibly removing the placenta manually in an attempt to empty the uterus at delivery. The aim of this approach is to avoid leaving retained placental tissues in the uterine cavity and it is recommended by established worldwide guidelines as one of the first steps to manage postpartum hemorrhage (ACOG .,2006) and (Fitzpatrick et al.,2014). However, in cases of PAS disorders, this procedure often results in massive obstetric hemorrhage. Overall, most experts in the management of PAS disorders consider that attempts at manual removal of the placenta should be avoided in cases of planned cesarean hysterectomy (O'Brien et al.,1996) and (Belfort et al.,2010).

B- “LEAVING THE PLACENTA IN SITU” APPROACH

This approach consists of leaving the placenta in situ and waiting for its complete spontaneous resorption. It was initially called the “conservative treatment of placenta accreta” (Sentilhes et al.,2013).

By leaving a placenta accreta in situ after the delivery of the fetus, one can expect a progressive decrease in blood circulation within the uterus, parametrium, and the placenta. This will result in secondary necrosis of the villous tissue and theoretically the placenta should progressively detach itself from the uterus and the percreta villi from the adjacent pelvic organs. In cases of invasive PAS disorders diagnosed prenatally, the exact position of the placenta should be determined by preoperative ultrasound and the required surgical equipment for an emergent hysterectomy should available in the operating theatre (Sentilhes et al.,2018).

A low transverse skin incision allowing access to the lower half of the uterus can be performed if the upper margin of the anterior aspect of the placenta does not rise into the upper segment of the uterus. If the placenta is anterior and extending toward the level of the umbilicus, a midline skin incision may be needed to allow for a high upper-segment transverse uterine incision above the upper border of the placenta. The opening of the uterus should be by a transverse incision at a distance from the placental bed (Sentilhes et al.,2018).

After delivery of the fetus, and only if there is no clinical evidence of percreta placentation (i.e. no placental tissue seen invading through the surface of the uterus), the surgeon may carefully attempt to remove the placenta by a controlled cord traction and the use of uterotonics. Failure to do so suggests the diagnosis of a PAS disorder and in these cases, the cord should be cut close to its placental insertion and the uterine cavity should be closed. Postoperative antibiotic therapy is usually administered prophylactically to minimize the risk of infection. A literature review performed up to 2007, including 48 case reports describing the outcome of 60 women presenting with PAS disorders and managed by leaving the placenta in situ, found that of the 26 women managed without the use of additional therapies, 22 (85%) had a favorable outcome.²⁴

Expectant management failed in 4 (15%) cases and secondary hysterectomy had to be performed owing to massive obstetric hemorrhage or infection (Timmermans et al.,2007).

Additional procedures (i.e. embolization or vessel ligation, temporal internal iliac balloon occlusion, methotrexate, hysteroscopic resection of retained tissues) have been used in a conservative approach with the placenta left in situ to decrease morbidity or to accelerate placental resorption (Fox et al.,2015).

***Methotrexate adjuvant treatment**

Some authors have proposed the use of methotrexate to hasten placental resolution (Mussalli et al.,2000). Only case reports and small case series with no control group have been reported.(Timmermans et al.,2007) A recent observational case series including 24 women with PAS disorders left in situ after birth and treated with methotrexate reported placental delivery in 33.3% of the cases (spontaneously in 55% and 45% by means of dilatation and curettage) (Lin et al.,2015).

In women with a placenta in situ who are successfully treated with methotrexate, the beta-human chorionic gonadotropin (β -hCG) levels and Doppler vascular resistance indices of the uteroplacental arterial circulation decrease faster than in those with treatment failure (Lin et al.,2015).

Overall, the use of methotrexate is not recommended until further evidence is available on its efficacy and safety (Sentilhes et al.,2018).

***Preventive surgical or radiological uterine devascularization**

There are also very limited data on the use of these adjuvant techniques (Sentilhes et al.,2008) and (Salim et al.,2015). Preventive devascularization can be achieved by surgical or interventional radiology procedures also used in the management of severe postpartum hemorrhage, such as stepwise uterine surgical devascularization, bilateral uterine or hypogastric artery surgical ligation, iliac artery embolization, or balloon occlusion. Embolization before performing hysterectomy may reduce the risk of intraoperative blood loss (Angstmann et al.,2010) and prophylactic devascularization may prevent the occurrence of secondary hemorrhage (Bouvier et al.,2012) and could also accelerate placental resorption (Soyer et al.,2013). Overall, these uterine-sparing procedures seem to be less effective in cases of PAS disorders (Sentilhes et al.,2008) and (Sentilhes et al.,2009).

***Systematic hysteroscopic resection of retained accreta tissue**

In a small series of 23 women with PAS disorders with the placenta left in situ, 12 hysteroscopies were performed under ultrasound guidance owing to pain and/or bleeding with retained tissues. The use of bipolar energy was limited to avoid any potential uterine perforation. The median size of the retained placenta was 54 mm (13–110 mm). No complication occurred.

Complete removal (11/12) was achieved after one, two, and three hysteroscopic procedures in 5 (41.7%), 2 (16.7%), and 4 (33.3%) cases, respectively. These results suggest that hysteroscopic resection could shorten the recovery time without major adverse effects (Legendre et al.,2014).

***Monitoring of leaving the placenta in situ approach**

The pattern of follow-up after leaving the placenta in situ in cases of PAS disorders is not supported by randomized controlled trials. The residual villous tissue in the uterine wall may require up to 6 months to be completely absorbed (soyer et al.,2011). In rare cases, a coagulopathy or septicemia may develop, requiring an emergent secondary hysterectomy (Judy et al.,2015). Measuring serum β -hCG on a weekly basis to check it falls continuously can reassure to some extent, but low levels do not guarantee complete placental resorption and so this should be supplemented by expert ultrasound imaging. There is insufficient evidence to recommend the use of MRI (Soyer et al.,2013).

Subsequent management usually requires weekly follow-up visits during the first 2 months and then in the absence of complications, monthly visits until complete resorption of the placenta. The follow-up consultation should include a clinical examination (bleeding, temperature, pelvic pain), pelvic ultrasound (size of retained tissue), and laboratory tests for infection (hemoglobin and leukocytes count, vaginal sample for bacteriological analysis) (Sentilhes et al.,2010).

***Long-term obstetric and fertility outcomes**

Successful conservative treatment for PAS disorders does not appear to compromise subsequent fertility or obstetric outcome, but data are limited. Pregnancies following prior PAS disorders are at increased risk for adverse maternal outcomes including recurrent PAS disorders, uterine rupture, postpartum hemorrhage, and peripartum hysterectomy (Alanis et al., 2006) and (Sentilhes et al.,2010). Overall, the risk of recurrence of PAS disorders ranges between 22% and 29% whereas the risk of early postpartum hemorrhage ranges between 8.6% and 19%. Long-term complications also include intrauterine adhesions and secondary amenorrhea, which both have a direct effect on fertility (Sentilhes et al.,2010).

C- ALTERNATIVE CONSERVATIVE SURGICAL PROCEDURES

***One-step conservative surgery**

This surgical procedure has been described primarily by one author (Palacios-Jaraquemada .,2012). It consists of resecting the invasive accreta area (partial myometrial resection) followed by immediate uterine reconstruction and bladder reinforcement (Palacios-Jaraquemada .,2008). This strategy aims to combine the advantages of both the “leaving in situ approach” of preserving the uterus and cesarean hysterectomy with minimal risk of secondary bleeding or infection. The main steps in this uterine-sparing technique can be performed via a modified Pfannenstiel or midline incision (Palacios-Jaraquemada.,2012). It is advantageous for low- and

middle-income countries where expensive additional treatments such as interventional radiology may not be available.

- One-step conservative surgery approach for placenta accreta spectrum (PAS) disorders include the following:

1. Vascular disconnection of newly-formed (feeder) vessels and the separation of invaded uterine tissues from invaded vesical tissues.
2. Upper-segmental hysterotomy and delivery of the fetus.
3. Resection of all invaded myometrial tissue and the entire placenta in one piece with previous local vascular control.
4. Surgical procedures for hemostasis.
5. Myometrial reconstruction in two planes.
6. Bladder repair if necessary. Modified from Palacios-Jaraquemada. (Palacios-Jaraquemada .,2012)

* **Stepwise surgical approach for placenta accreta spectrum (PAS) disorders.**

1. Combined early intravenous uterotonics just before delivery of the fetus.
2. Transverse “high” uterine incision at the upper border of the placenta without cutting through the placenta.
3. Fetal delivery.
4. The uterus is exteriorized and compressed against the symphysis pubis by assistant (transient bilateral kink of uterine arteries).
5. Bilateral anterior division of internal iliac artery ligations.
6. Placental extraction (delayed after pelvic devascularization).
7. Proper identification of lower uterine segment by index and ring fingers after identification of internal cervical os by middle finger of left hand.
8. Repair of uterine incision. Modified from Shabana et al (Shabana et al.,2015).

***The Triple-P procedure**

A novel uterine-sparing procedure for PAS disorders called the “Triple-P procedure” was recently proposed (Chandharan et al.,2012) and (Teixidor et al.,2015). The aim of this procedure is to avoid incising through the vascular placental venous sinuses, and to excise the myometrium

with PAS disorder tissue and to reconstitute the uterine defect. The main steps of this procedure include:

- (1) Perioperative placental ultrasound localization of the superior edge of the placenta;
- (2) Pelvic devascularization involving preoperative placement of intra-arterial balloon catheters (anterior division of the internal iliac arteries); and
- (3) No attempt to remove the entire placenta with large myometrial excision and uterine repair. If the posterior wall of the bladder is involved, the placental tissue invading the bladder is left in situ to avoid cystotomy.

***Tamponade techniques**

Small case series have also reported the successful use of compression sutures, (Shazly et al.,2012) and (Li et al.,2016) using the cervix as a natural tamponade by inverting it into the uterine cavity and suturing the anterior and/or the posterior cervical lips into the anterior and/or posterior walls of the lower uterine segment. The latter technique of cervical inversion was successful in stopping bleeding in 38 out of 40 patients (El Gelany et al.,2015).

Non conservative surgical management of placenta accrete spectrum

- preparation for the operative management of invasive placentation

Cesarean hysterectomy in the setting of PAS disorders can be challenging because multiple cesarean deliveries often present with pelvic adhesences, a thin and hypervascular lower uterine segment, a bulky in-situ placenta, and deep pelvis neovascularization, as well as possible invasion to bladder, bowel, cervix, and parametrium in cases of placenta percreta. The main risk associated with any form of PAS disorder is massive obstetric hemorrhage, which leads to secondary complications including coagulopathy, multisystem organ failure, and death (Walker et al., 2013) and (Wright et al.,2010).

Surgical risks increase with the depth of placental invasion, with women presenting with placenta percreta more likely to require additional blood products, have urologic injury, and require intensive care unit admission than women with placenta creta (vera or adherenta) (Grace et al., 2013), (Brookfield et al.,2014) and (Woldu et al.,2014). Accurate prenatal diagnosis, careful planning, and close communication are essential, including the creation of specialized surgical teams to execute a safe care plan for patients with PAS disorders.

- Multidisciplinary team care

Multiple retrospective cohort studies of PAS disorders have documented reduced maternal morbidity when care is provided in centers of excellence (CoE) (Smulian et al.,2017). The hallmark features of a CoE are consisted of

- * Radiologic expertise for diagnosis in Ultrasound and/or MRI
- * Experienced obstetrician/maternal–fetal medicine specialist For prenatal diagnosis, prepartum, intrapartum, and postpartum management
- * Surgical expertise for complex surgery (Gynecologic oncology, pelvic surgeon, urogynecologist) Skills for retroperitoneal dissection, ureterolysis, internal iliac artery ligation, ureteral stent placement *Anesthetist (obstetrical or trauma) Experienced in management of massive hemorrhage as well as perioperative management of pregnant women
- *Neonatal intensive care unit and neonatologists To manage both planned late preterm delivery and unplanned preterm delivery
- * Adult intensive care unit and intensivists Surgical and medical intensive care unit for postoperative care as required
- * Massive transfusion capacity Access to blood products/bank, massive transfusion protocol, transfusion medicine specialists/blood bank pathologists
- * Additional surgical expertise when required: urology, vascular surgery, general surgeon, trauma surgeon Management of complications: ureteral reimplantation, bowel resection, vascular injury
- *Interventional radiology (Silver et al.,2015).

- Timing of delivery

Studies reporting actual timing of delivery are conflicting and the optimal timing of delivery for women with suspected PAS disorders remains uncertain. At present, there remains insufficient evidence to determine the exact optimal age for planned delivery. Different centers have published varying protocols with recommendations ranging from 34 to 36 weeks to 36–38 weeks of gestational age for planned delivery (Camuzcuoglu et al.,2016).

- Maximizing hemoglobin preoperatively

Owing to the anticipated risk of hemorrhage at delivery, preoperative optimization of hemoglobin is essential. The prevalence of anemia in pregnancy may be as high as 38%, with the majority caused by iron deficiency. Women in low-income countries are at even higher risk due to malnutrition and/or pre-existing diseases such as malaria or sickle cell anemia. Prenatal correction of iron deficiency anemia is an important consideration in management of PAS disorders. Oral or intravenous iron therapy if available should be administered if iron deficiency anemia is confirmed. Intravenous iron therapy is safe in pregnancy and has been demonstrated to correct anemia in more women than oral iron. In addition, efficacy with a single dose intravenous therapy is possible (Breymann et al.,2017).

- Minimizing unintended urologic injury

In a systematic review of surgical techniques used for PAS disorders, the overall rate of unintentional urinary tract injury at peripartum hysterectomy was 29% (83/285)—higher than rates for hysterectomies for other gynecologic indications. Seventy-eight percent of injuries involve the bladder, whereas 17% involve the ureter. Modification of surgical technique has the ability to reduce urinary tract injury compared with standard hysterectomy. In particular, placement of ureteric stents preoperatively can reduce the risk of urinary tract injury from 33% to 6%. At ureteric stent placement, cystoscopic assessment can also evaluate for evidence of bladder invasion by the placenta (Tam Tam et al., 2012).

- **Intraoperative considerations**

The choice of anesthesia technique for cesarean delivery where there is a suspected PAS disorder with high risk of significant hemorrhage must be made by the attending anesthesia team. This decision between general and neuraxial/regional anesthesia can be aided through active consultation with the wider MDT. The international literature reports an 8%–45% risk of the need to convert from regional to general anesthesia for cases of PAS disorders (Taylor and Russell., 2017) and (Nguyen et al.,2016).

- **Type of incisions for access**

Avoiding the placenta at planned cesarean hysterectomy reduces blood loss; therefore, the abdominal incision must allow sufficient access to the uterus to choose a location for hysterotomy above the upper placental margin. Preoperative or intraoperative ultrasound can allow the team to visualize the upper placental margin, which facilitates planning both the abdominal and uterine incision (Al-Khan et al.,2014).

A low transverse skin incision that allows access to the lower half of the uterus may be adequate if the upper margin of the placenta does not rise into the upper segment of the uterus and no hysterectomy is planned. However, it may not provide sufficient exposure in cases of placenta percreta. If the placenta is anterior and extending toward the level of the umbilicus, and/or a hysterectomy is planned, a midline skin incision allows for a high upper-segment transverse uterine incision above the upper margin of the placenta or more commonly a fundal transverse hysterotomy for delivery of the infant. Thus, a midline incision is recommended by most authors for PAS disorders diagnosed prenatally or at the time of cesarean delivery (Walker et al.,2016).

- **Blood conservation techniques as:**

* Tranexemic acid

A recent meta-analysis of nine trials involving 2365 patients confirmed these findings, demonstrating that the administration of tranexamic acid before cesarean delivery significantly reduces intraand postoperative blood loss and blood transfusion with no increase in thromboembolic events (Simonazzi et al.,2016).

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* prophylactic placement of balloon occlusion catheters into the aorta, common iliac, internal iliac, or uterine arteries under fluoroscopic guidance and are inflated when hemorrhage is encountered (Chou et al.,2015) and (Clausen et al.,2013).

* Internal Iliac artery ligation when interventional radiology is not available, results similar to those for balloon occlusion devices (Esper and Waters .,2011).

* Cell salvage

Autologous cell salvage offers a way to minimize allogenic red blood cell transfusion in select patients, such as those with high risk of massive obstetric hemorrhage, low preoperative hemoglobin concentrations, rare blood types (e.g. Bombay), and/or those who refuse such products including Jehovah's witnesses (Neb et al.,2017).

-TECHNIQUES FOR HYSTERECTOMY

Total hysterectomy is the recommended surgical method for emergent peripartum hysterectomy owing to the potential risk of malignancy developing in the cervical stump, the need for regular cervical cytology, and other associated problems such as bleeding or discharge. Proponents of subtotal hysterectomy report decreased blood loss, blood transfusions, perioperative complications, and shorter operating time. However, subtotal hysterectomy may not be effective in the management of placenta increta or percreta if cervical involvement is present and a total hysterectomy should be the preferred option in these cases. In addition, subtotal hysterectomy has not been shown to provide protection against urinary tract injury compared with total hysterectomy in surgeries for PAS disorders (Tam Tam et al., 2012).

- **Planned delayed hysterectomy**

Planned delayed or secondary hysterectomy is an alternative “definitive” surgical management strategy for PAS disorders. Delayed hysterectomy may be undertaken where extensive invasion (percreta) of surrounding structures would render immediate cesarean hysterectomy extremely difficult. Allowing some resorption of the placenta, decrease in vascularity and involution of the uterus is postulated to facilitate later surgery. However, there is an associated risk of coagulopathy, hemorrhage, and sepsis during the interim period. Patients must be compliant with follow-up and resources to manage patients urgently if complications arise should be available 24 hours a day. Delayed hysterectomies are performed between 3 and 12 weeks postpartum (Arendas et al.,2012) and (Rossetti et al., 2015).

Outcome of placenta accrete spectrum

Morbidity of placenta accrete spectrum

Although rare, early pregnancy complications have been described in association with PAS disorders. Several case reports can be found in the scientific literature, describing spontaneous

uterine rupture during the first and second trimesters, there are reports of this complication occurring as early as the 7th week of pregnancy (Cho et al., 2017).

Profuse maternal bleeding after termination of pregnancy and retained products of conception after first trimester abortion. Most cases of PAS disorders are diagnosed during the second and third trimesters, but suggestive markers can be found on ultrasound, even before 11 weeks, and they may be particularly useful in high risk women (D'Antonio et al.,2018).

In late pregnancy or during delivery , PAS disorders are an important risk factor for adverse maternal outcomes related to delivery (Booker et al .,2019). A population-based study from Australia reported a nearly 18-fold increase in maternal morbidity, after adjusting for confounders (Baldwin et al.,2017). Attempts to separate the placenta after delivery usually lead to severe bleeding from the uteroplacental circulation and to disruption of the deep uterine vasculature extending to other organs (Jauniaux et al .,2018). Additional blood loss may arise from inadvertent surgical injury and coagulopathy. Estimated blood loss in PAS disorders has been reported to range from 2000 mL to 7800 mL (Wright et al.,2011).

A recent meta-analysis including data from over 7000 cases of PAS disorders reported a 46.9% incidence of haemorrhage requiring transfusion (Thurn et al.,2019). Previous haemoglobin optimization may improve maternal outcomes and reduce the need for transfusion. Transfusion of blood products may be lifesaving, but it can be associated with important maternal morbidity. Febrile non-haemolytic transfusion reaction is a common and benign complication, with an incidence ranging from 0.3% to 6%. Haemolytic transfusion reaction has a much lower incidence, but it has been associated with maternal death (Gatta et al.,2018).

Other potentially fatal reactions include transfusion-associated circulatory overload and transfusion-related acute lung injury, both causing pulmonary oedema. Infection conveyed by transfused blood products is another rare complication (Obstetric care consensus 2018). Coagulopathy in the setting of major blood loss is a serious complication that needs to be prevented when possible, or identified early and treated aggressively (Gatta et al.,2018). In a retrospective study, over 30% of women who underwent Caesarean hysterectomy developed coagulopathy, with a blood loss above 1500 mL being the best predictor of this complication (Shamshirsaz et al.,2019).

Caesarean hysterectomy, with no attempt to detach the placenta from the uterine wall, has become the recommended treatment for placenta increta and percreta, when preservation of fertility is not an issue. However, this operation is technically challenging, and the adjusted OR for adjacent organ injury is 8.2 (Upson et al.,2014). Unintentional urinary tract injuries are described in 29% of Caesarean hysterectomies, with 76% of these being bladder lacerations, 17% ureteral injuries, 5% genitourinary fistulas, and 2% combined bladder and ureteral injuries (TamTam et al.,2012). The adjusted OR for bladder repair or cystotomy is 38.5 (95%CI 21.8e68.1) (Upson et al.,2014).

The depth and extension of placental invasion, intraoperative blood loss and the number of previous Caesarean sections all seem to be risk factors for urinary tract injury . On the other hand, bilateral ureteral stenting appears to reduce the risk for urinary tract injury (OR 0.05, 95%CI 0.01e0.28) (TamTam et al.,2012). Other abdominal organs, such as the bowel, pelvic vessels and nerves can also be injured, but these complications are rarer. Recent data suggest that delaying hysterectomy by a few days is associated with better maternal outcomes, lower estimated blood loss and a reduction in transfusion needs (Zuckerwise et al.,2020).

Long term morbidity

Studies on the psychological impact of severe postpartum haemorrhage and emergency postpartum hysterectomy show significant morbidity, including sexual dysfunction and changes in socio-professional life, with over half of women reporting symptoms suggestive of post-traumatic stress disorder (Michelet et al.,2015).

Mortality of placenta accrete spectrum

Maternal mortality in PAS disorders is largely a consequence of massive bleeding, coagulopathy, and multi-organ failure (Allen et al.,2018). Earlier reports on maternal mortality in the setting of PAS disorders estimated mortality rates of around 7%, reaching 30% in the absence of antenatal diagnosis (Richa et al.,2012). Recent data suggest that rates in the range of 0.05% are achievable, when prenatal diagnosis and multiprofessional expert management is available (Jauniaux et al.,2019).

Mortality rates are mostly dependent on the depth and extension of invasion, the availability of antenatal diagnosis, and the ability to plan management in an expert center. Management by a multidisciplinary team was shown to improve outcomes, when compared with standard care (Shamshirsaz et al.,2018). An OR of 0.22 (95% CI 0.07e0.70) was reported for composite early morbidity, when comparing a multidisciplinary team approach with standard care (Eller et al.,2011).

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