

Management of Placenta Accreta Spectrum

Aya Mohamed Ali Hassan, Reda Abd El-Aziz Ahmed Mostafa, Mustafa Salah Ahmed Omara

Obstetrics & Gynecology Department, Faculty of Medicine, Zagazig University, Egypt

***Corresponding author:** Aya Mohamed Ali Hassan

Abstract:

Background: Placenta accreta spectrum (PAS) is a severe obstetric condition characterized by abnormal placental adherence or invasion into the uterine wall. The incidence of PAS has increased in recent years, largely due to rising cesarean delivery rates. This condition is associated with significant maternal morbidity and mortality, mainly due to massive obstetric hemorrhage and surgical complications. Early diagnosis, multidisciplinary management, and careful surgical planning are essential to improve maternal outcomes. Various management strategies have been described, including cesarean hysterectomy, conservative uterine-preserving approaches, and adjunctive measures to reduce intraoperative blood loss. Cesarean hysterectomy with the placenta left in situ remains the standard treatment in most cases; however, conservative techniques such as expectant management, resective surgery, and the Triple-P procedure may be considered in selected patients wishing to preserve fertility. Blood conservation strategies and multidisciplinary team involvement play a crucial role in optimizing outcomes. This review discusses current evidence regarding the diagnosis, surgical and conservative management strategies, and maternal outcomes of placenta accreta spectrum disorders.

Keywords: Placenta accreta spectrum; Cesarean hysterectomy; Conservative management; Obstetric hemorrhage; Multidisciplinary management; Maternal outcomes.

Introduction:

Placenta accreta spectrum (PAS) is a pathological condition of placentation in which the villous tissue adheres or invades the uterine wall. PAS is also one of the most dangerous conditions associated with pregnancy, because hemorrhage may result in multisystem organ failure, disseminated intravascular coagulation, need for admission to an intensive care unit, hysterectomy, and even death (**Liu et al., 2023**).

Optimal management of women with MAP requires early recognition of high-risk women based on clinical risk factors, accurate preoperative diagnosis, detailed maternal counselling and planning at the time of delivery. Management should involve a multidisciplinary team of gynecologist, urologist and/or gyne-oncologist (**Parveen et al., 2021**).

Dedicated multidisciplinary team-based care in the diagnosis and management of placenta accreta spectrum disorders to improve outcomes is now recognized as the standard of care. There will, however, be some cases in which diagnoses are missed or are emergently managed with or without the presence of an experienced team. In such cases, outcomes have been shown to be poorer, highlighting the importance of optimizing diagnosis, pre-operative planning, and multidisciplinary care (**Flores-Mendoza et al., 2022**).

The ideal composition of these multidisciplinary teams may consider consultation by the following core specialties: obstetrics, maternal-fetal medicine, surgical gynecology or gynecologic oncology, anesthesia, neonatology, and perinatal mental health services. Additional teams which may also require consultation include hematology, urology, general surgery, vascular surgery, and intensive care (**Hobson et al., 2022**).

The role of pre-operative and proactive patient blood management strategies is essential in all obstetric cases where surgical blood loss is expected to be high. Iron stores and hemoglobin levels should be assessed at diagnosis and optimized, along with screening for hemoglobinopathies and red cell antibodies. Hematology

consultation may be required in such cases where indicated. Our group, and others, also advocate the use of intra-operative cell salvage where available, to reduce the need for allogenic blood transfusion (**Hobson et al., 2022**).

Antenatal anesthesia consultation is paramount, providing expert care in the prevention and management of massive obstetrical hemorrhage. Historically, general anesthesia was utilized in most cases. In recent times, however, contemporary groups are successfully utilizing regional anesthesia epidurals with or without combined spinal anesthesia for the duration of cesarean hysterectomy for placenta accreta spectrum (**Allen et al., 2018**).

Regional compared with general anesthesia, where appropriate, appears to be associated with decreased hemorrhage-related morbidity, blood transfusion requirements, and neonatal respiratory complications. Patient satisfaction may also be improved if they are conscious for the birth experience of their infant (**Nguyen-Lu et al., 2016**).

Optimizing timing of delivery remains a challenging aspect of care, balancing the increasing risk of unplanned emergent delivery at term with the perinatal risks of iatrogenic prematurity if delivered pre-term. Most recently, the International Society for Abnormally Invasive Placenta (IS-PAS) suggested expectant management until after 36 weeks' gestation for asymptomatic patients with no obvious risk factors for pre-term delivery, whereas planned delivery at around 34 weeks' gestation was advised for those with a history of previous pre-term birth, recurrent vaginal bleeding, short cervix, or pre-term pre-labour rupture of membranes (**Collins et al., 2019**).

Non-Conservative Surgical Management (Cesarean Hysterectomy):

Cesarean section followed sequentially by immediate hysterectomy without attempting removal of the placenta (placenta left in situ) is considered the gold standard for definitive treatment of placenta accreta spectrum (**Touhami et al., 2022**).

Type of Incision:

The ideal surgical incision for a planned cesarean hysterectomy allows for sufficient access to the uterus, provides optimal exposure to surrounding structures, and avoids the placenta to reduce potential blood loss. A midline skin incision is recommended by some groups, as this facilitates a high fundal uterine incision, which can avoid the upper margin of anterior placentas which extend superiorly (**Allen et al., 2018**).

A low transverse skin incision may be adequate in situations where the superior margin of the placenta does not enter the upper segment of the uterus, or if uterine conservation is planned, but may not provide sufficient exposure in more severe cases. Other options for abdominal entry include the Joel-Cohen incision, Cherney extended transverse incision, and a modified Maylard (high transverse) incision (**Akbaba, 2021**).

Techniques for Hysterectomy:

- **Total abdominal cesarean hysterectomy with salpingectomy** is the recommended surgical method for emergent peripartum hysterectomy, and the preferred option in the management of placenta increta or percreta if cervical involvement is present. This approach is also typically required if there is significant lower uterine segment or cervical bleeding
- **Subtotal abdominal cesarean hysterectomy with salpingectomy** is another common approach and has been reported to result in shorter operating time, decreased blood loss, reduction in blood transfusions, and lower peri-operative complications (**Allen et al., 2018**). However, as this approach leaves a cervical stump, there remains a potential risk of cervical dysplasia and malignancy, the need for regular cervical cytology, and other associated issues such as bleeding, vaginal discharge, or infection. In addition, there has been no evidence that subtotal hysterectomy provides protection against urinary tract injury when compared with total hysterectomy in surgeries specifically for placenta accreta spectrum disorders (**Tam Tam et al., 2012**).

Internationally, Centers of Excellence have developed additional novel techniques for cesarean hysterectomy to minimize hemorrhage and reduce unintentional urinary tract injury. The gynecologic oncologist A E Selman proposed a posterior retrograde hysterectomy via the pouch of Douglas, which, he suggests, allows for safe resection of the involved urinary bladder in cases of placenta percreta with intraluminal bladder involvement (Selman, 2016).

Shamshirsaz et al described a modified radical hysterectomy (without oophorectomy) technique that includes extensive use of a bipolar cautery device to assist with early surgical devascularization. Their retrospective study compared this approach with a non-standardized approach for severe placenta accreta spectrum, reporting lower median estimated blood loss (2.1 L vs 3.5 L, respectively; $p=0.031$), with a trend to fewer blood transfusions ≥ 4 units (60% vs 87%, respectively; $p=0.056$), and were less likely to be delivered emergently (23% vs 64%, respectively; $p=0.001$) (Shamshirsaz et al., 2015).

The use of disposable devices such as a linear cutting autostapler, a vessel sealing device, or a combination of both have also been suggested as innovative approaches to reduce blood loss and rates of blood transfusion; however, outcomes have not yet been reported comparing these various techniques (Turan et al., 2021).

- **Planned delayed hysterectomy** is an alternative approach to the cesarean hysterectomy. This method may be utilized in circumstances of severe placenta percreta where extensive invasion of surrounding structures would impact the ability to safely perform an immediate hysterectomy. Delayed hysterectomy, which is typically performed between 3 and 12 weeks postpartum (Rupley et al., 2016), may facilitate placental reabsorption, decrease vascularity, and use the normal process of uterine involution which may simplify future surgery, allow the use of minimally invasive surgical approaches, and reduce overall surgical morbidity. However, this approach comes with an associated risk of coagulopathy, hemorrhage, and sepsis in the interim period. Zuckerwise et al compared outcomes between delayed hysterectomy in 14 patients (five before the scheduled date due to complications, 36%) versus 20 patients who underwent immediate cesarean hysterectomy (four due to significant peri-operative bleeding, 20%) (Zuckerwise et al., 2020).

The median (IQR) sum-total estimated blood loss for delivery and delayed hysterectomy was significantly lower than the immediate hysterectomy group (1.3 L (0.1–2.2 L) vs 3.0 L (2.4–4.3 L), respectively; $p<0.01$). Delayed hysterectomy was associated with fewer patients requiring transfusion of ≥ 4 units of blood than the immediate cesarean hysterectomy group (14.2% vs 45%, respectively; $p=0.016$). There was one maternal death in each group (incidence 7% for delayed hysterectomy and 5% for immediate hysterectomy).

Conservative Management:

Women who are candidates for conservative management should be warned of the risks of bleeding and infection. Studies failed to confirm the benefit of methotrexate or arterial embolization to reduce these risks, and as a result, these treatments are not recommended by the current guidelines. A progressive decrease in blood circulation within the uterus and the placenta with necrosis of the villous tissue and a progressive detachment of the placenta from the uterus is expected (Jauniaux et al., 2019).

In certain situations, uterine conservation may be successfully achieved, either leaving the placenta in situ (termed expectant management) or with placental removal combined with partial uterine resection and repair (Touhami et al., 2022).

Potential candidates for uterine conservation include those in three main groups (Hobson et al., 2019):

First, those who strongly prefer to retain their fertility and are adequately counseled regarding the potential risks and chance of successful future pregnancy.

The second group who may be amenable to uterine preservation include those with extremely severe disease on imaging, where there is evidence of extra-uterine invasion into adjacent structures including the bladder lumen, bowel, or broad/deep parametrium. This population is at increased risk of significant surgical complications at the time of delivery including massive hemorrhage and organ damage.

Third, there may be infrequent cases where there is very focal disease detected or placenta accreta spectrum located in the upper uterine segment which may be amenable to wedge resection and approximation of vital myometrium to achieve hemostasis.

FIGO consensus guidelines on placenta accreta spectrum disorders: Conservative management: (Sentilhes et al., 2018)

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 proposed by interventional radiology.

The extirpative technique:

The extirpative method comprises of a forceful attempt of manual removal of the placenta so as to avoid leaving products of conception in the uterus. However, this method is associated with a serious risk of postpartum hemorrhage (Sentilhes et al., 2018).

Expectant approach:

This technique refers to the delivery of the fetus, without delivering the placenta, leaving it partially or completely adherent to the myometrium (in situ), thereby avoiding hysterectomy in 78%-80% of the cases. The progressive decrease in blood supply to the uterus after delivery results in placental necrosis and detachment, followed by placental resorption and expulsion (Patabendige et al., 2020).

The one-step conservative surgery:

This approach is also known as resective-constructive surgery and aims at resecting the placenta along with the invaded myometrium in bloc. The steps of this procedure include ligation of the newly formed blood vessels between the uterus and the surrounding structures, followed by a hysterotomy and removal of the placenta with the affected area until reaching healthy tissue, hemostasis and finally uterine reconstruction in two layers (Palacios-Jaraquemada et al., 2020).

Triple-P procedure:

This uterine preserving technique is a three-step conservative surgery for women with PAS, and it requires the presence of an interventional radiologist. It consists of perioperative location of the upper border of the placenta pelvic devascularization by a pre-placed pelvic arterial balloon catheter in the anterior division of the internal iliac artery after delivery of the fetus in attempt to reduce the blood supply to the placenta, and in bloc resection of the placental and myometrial tissues involved. Finally, the myometrial defect is reconstructed (Piñas Carrillo et al., 2019)

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 (Sentilhes et al., 2013).

Uterine devascularization can be achieved through several techniques such as iliac artery embolization, bilateral uterine or hypogastric iliac ligation and balloon occlusion in an attempt to prevent secondary postpartum hemorrhage and possibly accelerate placental resolution (Sentilhes et al., 2018).

Currently, the International Federation of Gynecology and Obstetrics, the American College of Obstetricians and Gynecologists, and the Royal College of Obstetricians and Gynecologists do not recommend its use in PAS (Jauniaux et al., 2019).

Hysteroscopy has been suggested as an adjunct method to shorten the period of placental elimination after conservative treatment in PAS, especially in women who present with pelvic pain and persistent vaginal bleeding (Legendre et al., 2014).

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. (El Gelany et al., 2015).

Follow up after conservative management:

There is insufficient evidence to recommend magnetic resonance imaging and/or serial evaluation of serum beta-human chorionic gonadotropin (β -hCG) to monitor cases that were managed conservatively. Patients should undergo weekly follow-up visits during the first two months and then monthly visits until complete resorption of the placenta. The follow-up should include a clinical examination (bleeding, temperature, pelvic pain), ultrasound (size of retained tissue), and laboratory tests (hemoglobin and leukocytes count, vaginal sample for bacteriological analysis). Postoperative antibiotic therapy (amoxicillin and clavulanic acid) should be administered to reduce the risk of infection. Subsequent pregnancies are at increased risk for recurrent PAS, uterine rupture, postpartum hemorrhage, and peripartum hysterectomy. The average risk of recurrence of PAS is approximately 22-29%, and the risk of early postpartum hemorrhage is approximately 8.6-19%. Long-term complications include intrauterine adhesions and secondary amenorrhea with secondary infertility (Jauniaux et al., 2019).

Measures to Minimize Surgical Blood Loss:

Multidisciplinary use of measures aimed at minimizing blood loss, which include percutaneous vessel balloon placement, transfusion medicine interventions, and surgical and pharmacological measures, are essential in the surgical management of placenta accreta spectrum disorders. The routine implementation of protocol-based individualized care has led to significantly reduced maternal hemorrhagic morbidity and should be considered the standard of care (Jauniaux et al., 2019).

Infrarenal aortic compression or clamping methods are often last-resort life-saving strategies that have been utilized by many teams if required. To address this risk, some centers have adopted an approach of routinely utilizing an infrarenal aortic balloon with short intermittent inflation, with low rates of surgical blood loss and complications. Because of the favorable outcomes in contemporary Centers of Excellence specializing in placenta accreta spectrum surgery, the routine use of this approach remains a matter of ongoing research and is limited to selected individuals where a demonstrated complex pelvic arterial blood supply is proven or suspected (Chen et al., 2020).

Percutaneous placement of inflatable balloons within the pelvic arteries, most commonly in the anterior divisions of the internal iliac arteries, was a previously popular surgical blood loss reducing measure in many centers. This strategy comes at the expense of increased costs and resources, prolonging surgical care, and with potential risks of vascular injury to blood supply to the lower limbs (Papillon-Smith et al., 2016).

Two randomized controlled trials have been conducted investigating the role of internal iliac artery percutaneous balloons versus control in the surgical management of placenta accreta spectrum. The first, by Salim et al, reported no significant differences between the intervention and control groups in the mean number of packed red blood cell units transfused, 5.2 (± 6.2) and 4.1 (± 3.8), respectively ($p=0.90$), or in surgical blood loss, 4950 (+5051) and 4709 (+3434) mL ($p=0.72$), respectively (Salim et al., 2015).

The second trial, by Chen et al, also reported no difference in the number of packed red blood cell units transfused (5.3 ± 5.3 in the intervention group vs 4.7 ± 5.4 in the control group; $p=0.54$). Importantly, hospitalization costs and incidence of post-operative fever were significantly higher in the intervention group. With evolving surgical expertise aimed at vascular dissection and ligation of these structures as stated above, the benefit of this strategy has come into question (Chen et al., 2020).

Many studies have evaluated the role of prophylactic placement of balloon occlusion catheters to reduce bleeding at the time of cesarean hysterectomy for PAS. However, there is insufficient evidence to demonstrate the real safety and efficacy of these devices and establish which groups of patients with PAS would have more benefit from their use. Other studies analyzed the advantage of ligating the internal iliac arteries and concluded that the efficacy is similar to balloon occlusion devices (Dai et al., 2020).

Blood conservation measures include administration of peri-operative intravenous tranexamic acid (anti-fibrinolytic) at skin incision, and its use has been demonstrated to reduce intra-operative blood loss. Intra-operatively, the return of blood collected via cell salvage during surgery is recommended when possible and available (**Touhami et al., 2022**).

Meticulous surgical dissection at each of the surgery's key steps is paramount to minimizing blood loss. Strategic ultrasound-guided hysterotomy to deliver the fetus, with selective use of an auto-stapler device or efficient single-layer closure may also reduce surgical blood loss at the time of delivery.

Hemorrhage during superior devascularization of the uterus is often minimal with standard suture ligation; the principal risk of bleeding comes from excessive upward traction on the uterus by lateral straight clamps rather than by manual elevation (**Touhami et al., 2022**).

Dissection of the uterovesical plane is often a key step where significant surgical bleeding from large aberrant neovascularization is first encountered; a meticulous lateral-to-medial dissection of this plane is required. Division of these engorged blood vessels and adipose layer down with the bladder is the preferred approach. Careful dissection should be continued inferiorly until the level of the anterior vaginal fornix where colpotomy can be performed. Securing hemostasis of the vaginal vault, followed by prompt vault closure, is often the final surgical step associated with significant blood loss (**Touhami et al., 2022**).

Exposure of the parametrial and pelvic side wall anatomy prior to bladder dissection, a critical surgical step that allows identification of the ureters, has re-popularized the strategy of routine or selective ligation of the anterior divisions of the internal iliac arteries with an associated reduction in blood loss. Recently, members of our group reported that internal iliac artery ligation, as part of a multidisciplinary protocol-based quality improvement initiative, can achieve very low median blood loss (1.0L) in cases of cesarean hysterectomy for severe placenta accreta spectrum (**Kingdom et al., 2020**).

When placenta previa associated with PAS is suspected, surgeons should consider uterine incision at a site distant from the placenta and should deliver the baby without disturbing the placenta in order to enable conservative management or elective hysterectomy with a reduced blood loss (**Jauniaux et al., 2018**).

The abdominal incision must allow sufficient access to the uterus, and hysterotomy should be above the upper placental margin. Preoperative or intraoperative ultrasound examination enables a good visualization of the upper placental margin, and as a result, helps the surgeons to establish both the abdominal and uterine incision (**Jauniaux et al., 2019**).

Maternal outcome in PAS:

PAS is associated with antenatal, intrapartum, and postpartum complications that have increased maternal and foetal morbidity and mortality (**Chaudhari et al., 2017**).

PAS is closely associated with placenta previa, and this may give rise to one or more episodes of antepartum haemorrhage that require prolonged hospital stay (**Shamshirsaz et al., 2018**).

The main risk associated with PAS is severe obstetric hemorrhage, which causes secondary complications including coagulopathy, multisystem organ failure, and death. Surgical risks increase with the depth of placental invasion. Studies report the following incidence of surgical complications in women with PAS--bladder injury: 5-40%, ureteral injury: 0-18%, bowel injury/obstruction: 2-4%, venous thromboembolism: 4%, surgical site infection: 18-32%, maternal mortality: 1-7%, large-volume blood transfusions: 5-40% (**Allen et al., 2018**).

Women with PAS tend to stay in the hospital for longer periods for preoperative optimization, undergo multiple counselling sessions prior to surgery, and attend multi-disciplinary team (MDT) meetings (**Eller et al., 2011**).

Distortion of the normal pelvic anatomy with the presence of large bladder-uterovaginal anastomoses, bulging of part of the placenta into the bladder or laterally into the parametrium and thick pelvic adhesions increase the risk of unintentional damage to the ureter and bladder (**Palacios-Jaraquemada, 2020**).

Poorly controlled haemorrhage related to placenta accrete, increta and percreta is the indication for one-two thirds of peripartum hysterectomies, disseminated intravascular coagulopathy, adult respiratory distress syndrome, renal failure, unplanned surgery and death. (**Abd Elfatah et al., 2017**).

In a multicentre retrospective case series on 452 patients on the management of invasive placenta, Palacios et al. showed that when using the resection-reconstruction approach (one-step conservative surgery), the uterus can be preserved with minimal morbidity and blood loss in almost 80% of cases (**Varlas et al., 2021**).

Subsequent pregnancies after conservative technique (resection-reconstruction) for PAS have shown similar perinatal outcomes to cesarean delivery, with no differences regarding the pregnancy course (**Palacios-Jaraquemada et al., 2021**).

The analysis of outcomes from cases managed expectantly are challenging to interpret from the predominantly retrospective literature as due to the lack of histopathological confirmation, false-positive diagnoses are likely to be included in their analyses. This may potentially lead to more favorable reported outcomes and provide a source of bias. A systematic review of 44 studies reporting outcomes with expectant management of 72 patients found that severe complications were common, developing in 40 (56%), with uterine preservation achievable in 42 (58%) patients (**Steins Bisschop et al., 2011**).

Neither prophylactic uterine artery embolization nor the use of chemotherapy (methotrexate) improved success rates, with one reported case of maternal death directly related to methotrexate use. The mean time for complete placental resorption was lower in the embolization group than in the non-embolization group (22.4 weeks vs 35.3 weeks; $p=0.014$). Either emergency or elective hysterectomy was performed at a mean of 44.6 days after cesarean delivery; and among the 23 patients with hysterectomy-related complications, 18 (78%) experienced bladder injury, intra-operative bleeding ($>2.0L$), or both (**Touhami et al., 2022**).

Sentilhes et al conducted a retrospective study into fertility and pregnancy outcomes following conservative treatment. They reported subsequent amenorrhoea due to severe intrauterine synechiae (Asherman syndrome) in 8.3%, with a further 5.2% describing oligomenorrhoea. Of the 27 (28%) participants who wanted more children, 24 (89%) had 34 pregnancies (21 third-trimester deliveries, one ectopic pregnancy, two terminations, and 10 miscarriages) with a mean time to conception of 17.3 months (range 2-48 months). All 21 deliveries resulted in healthy babies born after 34 weeks of gestation, with placenta accreta spectrum recurring in 6/21 cases (29%) (**Sentilhes et al., 2010**).

With a potentially prolonged course of recovery, frequent follow-up, and requirements to reside in close proximity to emergent care, expectant management can pose significant challenges. Among the potential adverse outcomes reported during the time of placental reabsorption and resolution, severe vaginal bleeding (53%), sepsis (6%), and death (up to 4%) are the most significant risks (**Steins Bisschop et al., 2011**).

Pregnant patients with PAS frequently undergo cesarean delivery followed by immediate hysterectomy. This surgical procedure is associated with significant maternal morbidity and mortality, including hemorrhage, shock, coagulopathy, urinary tract injury, intensive care unit admission, and prolonged hospitalizations (**Matsuzaki et al., 2021**).

The risk of death among cases of severe forms of PAS is as high as one in 71 patients. Thus, any surgical approach to reduce maternal morbidity and mortality is utmost importance in the management of pregnant patients with PAS (**Kingdom et al., 2020**).

Long-term complications can also occur, and these need to be considered when counselling women with PAS disorders. Infertility and psychological disturbances may have a strong and long-lasting impact on women's health (**Ou et al., 2019**).

Future Fertility:

Expectant management of placenta accreta spectrum appears to have minimal effect on subsequent fertility but does carry a high recurrence risk of placenta accreta spectrum. In a large series of women monitored after expectant management, 30% (27/91) desired subsequent pregnancy (Sentilhes et al., 2010).

Three women had been attempting pregnancy for approximately 1 year, and 24 women had 34 pregnancies. Of the 32 continuing pregnancies, 10 were miscarriages, 1 was an ectopic pregnancy, and 21 gave birth after 34 weeks of gestation. Of the third trimester deliveries, 6 out of 21 women (28.6%) had recurrent placenta accreta spectrum. Other series reported similar rates of pregnancy success and also described increased placenta accreta spectrum recurrence rates ranging from 13.3% to 22.8% (Kabiri et al., 2014).

References:

1. Abd Elfatah, E. A., Mohamed Awad, E. E., Abd-Eldaym, T. M., & Ali, Z. H. (2017). Outcome of patients with placenta accreta at El Shatby Maternity University Hospital. *Open Journal of Obstetrics and Gynecology*, 7, 725–733.
2. Akbaba, E. (2021). Can high transverse skin incision (modified Maylard) be a new alternative in placenta accreta spectrum management with cesarean hysterectomy? *Clin Exp Obstet Gynecol*;48:686–90.
3. Allen, L., Jauniaux, E., Hobson, S., et al. (2018). FIGO consensus guidelines on placenta accreta spectrum disorders: Non conservative surgical management. *Int J Gynecol Obstet*. 140:281–290. doi: 10.1002/ijgo-12409.
4. Chaudhari, H. K., Shah, P. K., & D'Souza, N. (2017). Morbidly adherent placenta: Its management and maternal and perinatal outcome. *Journal of Obstetrics and Gynaecology of India*, 67(1), 42–47.
5. Chen, M., Liu, X., You, Y., et al. (2020) Internal iliac artery balloon occlusion for placenta previa and suspected placenta accreta: a randomized controlled trial. *Obstet Gynecol* 135:1112–9. doi:10.1097/AOG.0000000000003792 pmid: [http:// www. ncbi.nlm.nih.gov/32282608](http://www.ncbi.nlm.nih.gov/32282608)
6. Collins, S. L., Alemdar, B., van Beekhuizen, H. J., et al. (2019). Evidence-based guidelines for the management of abnormally invasive placenta: recommendations from the International Society for Abnormally Invasive Placenta. *Am J Obstet Gynecol*.;220(6):511–526.
7. Dai, Y. M., Wei, J., Wang, Z. Q., et al. (2020). Intrauterine balloon tamponade combined with temporary abdominal aortic balloon occlusion in the management of women with placenta accreta spectrum:a randomized controlled trial *Zhonghua Fu Chan Ke Za Zhi*. 55:450–456. doi: 10.3760/cma.j.cn112141-20200225-00135.
8. El Gelany, S. A. A., Abdelraheim, A. R., Mohammed, M. M., Gad El-Rab, M. T., Yousef, A. M., Ibrahim, E. M., & Khalifa, E. M. (2015). The cervix as a natural tamponade in postpartum hemorrhage caused by placenta previa and placenta previa accreta: A prospective study. *BMC Pregnancy and Childbirth*, 15, 295.
9. Eller, A. G., Porter, T. F., Soisson, P., & Silver, R. M. (2011). Maternal morbidity in cases of placenta accreta managed by a multidisciplinary care team. *American Journal of Obstetrics and Gynecology*, 204(1), 12.e1–12.e7.
10. Flores-Mendoza, H., Chandran, A. R., Hernandez-Nieto, C., et al. (2022). Outcomes in emergency versus electively scheduled cases of placenta accreta spectrum disorder managed by cesarean-hysterectomy within a multidisciplinary care team. *Int J Gynaecol Obstet* 2022. doi:doi:10.1002-ijgo.14121. Epub ahead of print: 30 Jan. pmid:<http://www.ncbi.nlm.nih.gov/35094396>
11. Hobson, S. R., Kingdom, J. C. P., Windrim, R. C., et al. (2022). Safer outcomes for placenta accreta spectrum disorders: a decade of quality improvement. *Int J Gynaecol Obstet*; 157.
12. Hobson, S. R., Kingdom, J. C., Murji, A., et al. (2019). No. 383-Screening, diagnosis, and management of placenta accreta spectrum disorders. *J Obstet Gynaecol Can*; 41:1035–49.
13. Jauniaux, E., Alfirevic, Z., Bhide, A. G., et al. (2019). Placenta Praevia and Placenta Accreta: diagnosis and Management: green-top Guideline No. 27a *BJOG Int J Obstet Gynaecol*. 2019; 126(1):e1–48.

14. Jauniaux, E., Ayres-de-Campos, D., Langhoff-Roos, J., Fox, K. A., Collins, S. FIGO (2019). Duncombe FIGO classification for the clinical diagnosis of placenta accreta spectrum disorders. *Int J Gynaecol Obstet* 146(1):20–24. doi: 10.1002/ijgo.12761
15. Jauniaux, E., Collins, S., & Burton, G. J. (2018). Placenta accreta spectrum: pathophysiology and evidence-based anatomy for prenatal ultrasound imaging. *Am J Obstet Gynecol.*; 218(1):75–87. doi: 10.1016/j.ajog-2017.05.067
16. Jauniaux, E., Hussein, A. M., Fox, K. A., & Collins, S. L. (2019). New evidence-based diagnostic and management strategies for placenta accreta spectrum disorders. *Best Pract Res Clin Obstet Gynaecol.*; 61:75–88. doi: 10.1016/j.bpobgyn.2019.04.006
17. Kabiri, D., Hants, Y., Shanwetter, N., Simons, M., Weiniger, C. F., Gielchinsky, Y., et al. (2014). Outcomes of subsequent pregnancies after conservative treatment for placenta accreta . *Int J Gynaecol Obstet*; 127 : 206 – 10 .
18. Kingdom, J. C., Hobson, S. R., Murji, A., et al. (2020). Minimizing surgical blood loss at cesarean hysterectomy for placenta previa with evidence of placenta increta or placenta percreta: the state of play in 2020. *Am J Obstet Gynecol*; 223:322–9.doi: 10.1016/j.ajog.2020.01.044 pmid: <http://www.ncbi.nlm.nih.gov/32007492>
19. Legendre, G., Zoulovits, F. J., Kinn, J., et al. (2014). Conservative management of placenta accreta: hysteroscopic resection of retained tissues. *J Minim Invasive Gynecol*; 21:910–3. doi:10.1016/j.jmig.2014.04.004 pmid: <http://www.ncbi.nlm.nih.gov/24768979>
20. Liu, H., Zhang, B., Wang, W., Li, H., Huang, X., Wang, J., Han, J., & Zhu, H. (2023). Effect of placenta location detected by ultrasound on the severity of placenta accreta spectrum in patients with placenta previa and placenta accreta spectrum. *BMC Pregnancy and Childbirth*. 23(1): 406.
21. Matsuzaki, S., Mandelbaum, R. S., Sangara, R. N., et al. (2021). Placenta accreta spectrum: pathophysiology and clinical management. *American Journal of Obstetrics and Gynecology*
22. Nguyen-Lu, N., Carvalho, J. C. A., Kingdom, J., et al. (2016). Mode of anesthesia and clinical outcomes of patients undergoing cesarean delivery for invasive placentation: a retrospective cohort study of 50 consecutive cases. *Can J Anaesth*; 63:1233–44.doi:10.1007/s12630-016-0695-x pmid: <http://www.ncbi.nlm.nih.gov/27443374>
23. Ou, J., et al. (2019). Management of patients with placenta accreta spectrum disorders who underwent pregnancy terminations in the second trimester: a retrospective study.
24. Palacios-Jaraquemada, J. M., Basanta, N., Labrousse, C., & Martínez, M. (2021). Pregnancy outcome in women with prior placenta accreta spectrum disorders treated with conservative-reconstructive surgery: analysis of 202 cases. *J Matern-Fetal Neonatal Med Off J Eur Assoc Perinat Med Fed Asia Ocean Perinat Soc Int Soc Perinat Obstet.* :1–5.
25. Palacios-Jaraquemada, J. M., D'Antonio, F., Buca, D., Fiorillo, A., Larraza, P. (2020). Systematic review on near miss cases of placenta accreta spectrum disorders: correlation with invasion topography, prenatal imaging, and surgical outcome. *J Matern Fetal Neonatal Med*; 33: 3377-3384.
26. Palacios-Jaraquemada, J. M., Fiorillo, A., Hamer, J., Martínez, M., & Bruno, C. (2020). Placenta accreta spectrum: a hysterectomy can be prevented in almost 80% of cases using a resective-reconstructive technique. *The Journal of Maternal-Fetal & Neonatal Medicine*. 1-8.
27. Papillon-Smith, J., Singh, S. S., & Ziegler, C. (2016). Internal iliac artery rupture caused by endovascular balloons in a woman with placenta percreta. *J Obstet Gynaecol Can*; 38:1024–7.doi: 10.1016/j.jogc.2016.09.001 pmid <http://www.ncbi.nlm.nih.gov/27969555>.
28. Parveen, F., Aijaz, S., Memon, S. A., Memon, F. N., & Enayat, R. (2021). Maternal Outcomes in the Management of Morbidly Adherent Placenta: Multidisciplinary Team vs. Standard Care at a Tertiary Care Hospital. *Pakistan Journal of Medical Research*. 2021; 60(1): 2-7.
29. Patabendige, M., Sanjeeva, J. M. P., Amarasekara, A. M. A. K. G., & Herath, R. P. (2020). Conservative management of placenta percreta: three cases and a review of the literature regarding conservative management of placenta accreta spectrum (PAS) disorders. *Case Reports in Obstetrics and Gynecology*, 2020, Article 9065342.

30. Piñas Carrillo, A., & Chandraharan, E. (2019). Placenta accreta spectrum: Risk factors, diagnosis and management with special reference to the Triple P procedure. *Women's Health*, 15.
31. Rupley, D. M., Tergas, A. I., & Palmerola, K. L., et al. (2016). Robotically assisted delayed total laparoscopic hysterectomy for placenta percreta. *Gynecol Oncol Rep*; 17:53–5. doi:10.1016/j.gore.2016.05.009 pmid: <http://www.ncbi.nlm.nih.gov/27355003>
32. Salim, R., Chulski, A., Romano, S., et al. (2015). Precesarean prophylactic balloon catheters for suspected placenta accreta: a randomized controlled trial. *Obstet Gynecol*; 126:1022–8. doi:10.1097/AOG.0000000000001113 pmid: <http://www.ncbi.nlm.nih.gov/26444128>
33. Selman, A. E. (2016). Caesarean hysterectomy for placenta praevia/accreta using an approach via the pouch of Douglas. *BJOG*; 123:815–9. doi:10.1111/1471-0528.13762 pmid: <http://www.ncbi.nlm.nih.gov/266-42997>
34. Sentilhes, L., Goffinet, F., & Kayem, G. (2013). Management of placenta accreta. *Acta Obstetrica et Gynecologica Scandinavica*, 92(10), 1125–1134.
35. Sentilhes, L., Kayem, G., Ambroselli, C., et al. (2010). Fertility and pregnancy outcomes following conservative treatment for placenta accreta. *Hum Reprod*; 25:2803–10.
36. Sentilhes, L., Kayem, G., Chandraharan, E., Palacios-Jaraquemada, J., Jauniaux, E., Silver, R. M., Fox, K. A., & FIGO (2018) Placenta Accreta Diagnosis and Management Expert Consensus Panel. FIGO consensus guidelines on placenta accreta spectrum disorders: Conservative management. *International Journal of Gynecology & Obstetrics*, 140(3), 291–298.
37. Shamshirsaz, A. A., Fox, K. A., Erfani, H., Clark, S. L., Shamshirsaz, A. A., Nassr, A. A., et al. (2018). Outcomes of Planned Compared With Urgent Deliveries Using a Multidisciplinary Team Approach for Morbidly Adherent Placenta. *Obstet Gynecol*; 131(2):234–241. doi: 10.1097/AOG.0000000000002442
38. Shamshirsaz, A. A., Fox, K. A., Salmanian, B., et al. (2015). Maternal morbidity in patients with morbidly adherent placenta treated with and without a standardized multidisciplinary approach. *Am J Obstet Gynecol*; 212:218.e1–218.e9.
39. Steins Bisschop, C. N., Schaap, T. P., Vogelvang, T. E., et al. (2011). Invasive placentation and uterus preserving treatment modalities: a systematic review. *Arch Gynecol Obstet*; 284:491–502.
40. Tam Tam, K. B., Dozier, J., & Martin, J. N. (2012). Approaches to reduce urinary tract injury during management of placenta accreta, increta, and percreta: a systematic review. *J Matern Fetal Neonatal Med*; 25:329–34.
41. Touhami, O., Allen, L., Mendoza, H. F., Murphy, M. A., & Hobson, S. R. (2022). Placenta accreta spectrum: a non-oncologic challenge for gynecologic oncologists. *International Journal of Gynecologic Cancer*, 32(6).
42. Turan, O. M., Shannon, A., Asoglu, M. R., et al. (2021). A novel approach to reduce blood loss in patients with placenta accreta spectrum disorder. *J Matern Fetal Neonatal Med*; 34:2061–70.
43. Varlas, V. N., Bors, R. G., Birsanu, S., Maxim, B., Clotea, E., & Mihailov, M. (2021). Maternal and fetal outcome in placenta accreta spectrum (PAS) associated with placenta previa: a retrospective analysis from a tertiary center. *Journal of Medicine and Life*, 14(3), 367.
44. Zuckerwise, L. C., Craig, A. M., Newton, J. M., et al. (2020). Outcomes following a clinical algorithm allowing for delayed hysterectomy in the management of severe placenta accreta spectrum. *Am J Obstet Gynecol*; 222:179.e1–179.e9.