

# Surgical management of placenta accreta: to leave or remove the placenta?

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Abnormalities of placentation, including placenta accreta, represent a major source of morbidity and mortality among women. Traditional management consists of peripartum hysterectomy at the time of delivery, although more conservative treatments have also been developed recently. In this review we describe the available literature describing the operative approach

and considerations for management of women with placenta accreta.

**Keywords** Caesarean hysterectomy, haemorrhage, hysterectomy, peripartum hysterectomy, placenta accreta.

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## Introduction

Abnormal placentation is a major cause of maternal morbidity and mortality worldwide.<sup>1–5</sup> Placenta accreta is defined as the abnormal attachment of the placenta to the myometrium. Abnormal placentation can be classified as placenta accreta when the chorionic villi attach to the myometrium, placenta increta when the villi invade the myometrium, and placenta percreta when the villi invade through the myometrium. The most common site of attachment of the placenta outside the uterus is the bladder. Although conservative management of placenta accreta can be attempted, placenta accreta often requires peripartum hysterectomy, which is associated with significant morbidity and mortality.<sup>6–15</sup>

In developed countries the incidence of placenta accreta is increasing.<sup>14,16</sup> Population-based studies have suggested that the incidence of placenta accreta has increased over the last three decades, and now occurs in 1 in 533 deliveries in the USA.<sup>17</sup> Although any procedure or factor that produces a uterine scar is a risk factor for the development of placenta accreta, prior caesarean delivery is the most important factor associated with placenta accreta. The risk of placenta accreta increases with the number of prior caesarean deliveries.<sup>14,17,18</sup> Likewise, the presence of placenta praevia and a prior caesarean delivery appear to be additive risk factors.<sup>18</sup> In the Maternal Fetal Medicine Unit study of women undergoing caesarean delivery, the risk

of placenta accreta in women with one prior caesarean delivery was 3%, and increased sequentially with the number of caesarean deliveries to over 60% in women with placenta praevia and four or more caesarean deliveries.<sup>18</sup> Other risk factors for placenta accreta include uterine curettage, myomectomy and leiomyoma of the uterus, uterine anomalies, maternal age and parity, and smoking.<sup>11,14,17,19–22</sup>

## Surgical technique

Hysterectomy is the most commonly performed procedure for the control of obstetric haemorrhage. Peripartum hysterectomy is generally performed in two scenarios, either to control massive bleeding, most often encountered for uterine atony, or for placenta accreta that was diagnosed antenatally. When peripartum hysterectomy is performed emergently, the rapid mobilisation of the surgical team is essential. Preoperative readiness through standardised protocols facilitates improved outcomes for emergency cases. When emergent peripartum hysterectomy is required, it is essential to have trained operating room staff and proper equipment and instrumentation available. Given that these procedures occur on labour and delivery, it is helpful to have an instrument tray with proper equipment for major gynaecological surgery, as well as a self-retaining retractor. When an unexpected haemorrhage is encountered this information should be rapidly communicated to the anaes-

theshiology team, as well as the blood bank to ensure the availability of appropriate blood products.

When placenta accreta is suspected preoperatively or in women at high risk, preoperative preparation can be undertaken to optimise outcomes. Prior work has shown that outcomes are improved for women with placenta accreta when surgery is undertaken at high-volume centres and at hospitals that have a multidisciplinary team.<sup>23,24</sup> As such, when placenta accreta is suspected preoperatively strong consideration should be given to referral to a tertiary centre with experience in the management of placenta accreta.

Prior to beginning surgery for suspected placenta accreta all resources should be in place to successfully manage these high-risk patients. Many institutions perform these surgeries in the main operating room, as opposed to labour and delivery wards to ensure the availability of appropriate resources. A multidisciplinary team of surgeons should be available if needed. Surgical expertise from vascular surgeons, trauma surgeons, and gynaecological oncologists is essential. Likewise, prior to skin incision all required blood products, including red blood cells, fresh frozen plasma, and platelets, should be available. In addition, cell salvage techniques may be helpful. Blood component therapy is described below. The decision to use balloon occlusion or embolisation catheters should also be determined in advance. Our group and others now routinely use ureteral stents; the data for genitourinary stent placement as well as interventional radiology-placed catheters is reviewed below.<sup>6,12,25</sup>

The choice of anaesthesia for peripartum hysterectomy for placenta accreta is individualised.<sup>26</sup> Although regional anaesthesia may have fetal benefits, it may limit the ability to manipulate the abdominal contents for retractor placement. In contrast, a subset of patients with suspected accreta will not require hysterectomy, and thus general anaesthesia for all women may be unnecessary. After induction of anaesthesia, multiple points of vascular access should be obtained. We place a central venous catheter as well as a peripheral arterial line for blood pressure monitoring in all patients. Placement of a ring forceps on the cervix has also been described to facilitate the identification of the cervix and to limit vaginal blood loss.<sup>25</sup> To facilitate exposure, we place all patients in stirrups and use a midline vertical incision.

Once the abdomen is entered, the entire pelvis should be inspected. The most common site of placental invasion is through the anterior uterine wall to the bladder. The presence of any vascular channels and any evidence of anterior placental invasion should be noted. Similarly, the placenta may invade laterally and encroach upon the parametrium. Lateral placental invasion may hinder identification of the ureters and make isolation of the uterine vasculature diffi-

cult. After identification of placental abnormalities, the hysterotomy site should be chosen. Ideally, hysterotomy is performed away from the placenta. Preoperative sonography to identify the site of placental attachment can help define a placental-free area of the uterus. The use of a placental-free region may require fundal or even posterior uterine wall hysterotomy. After delivery of the infant, the placenta should not be disrupted. Prior work has shown that attempts to extract the placenta increase perioperative morbidity.<sup>6</sup> Although some reports recommend avoiding uterotronics to limit placental disruption, other data suggest that uterotronics reduce uterine atony and limit uterine bleeding.<sup>9,25</sup> Finally, if the intraoperative findings are consistent with placenta accreta the decision should be made expeditiously to proceed with hysterectomy. The use of ancillary procedures, such as prophylactic ligation of the internal iliac artery, are of no benefit.<sup>9</sup>

Once the decision is made to proceed with hysterectomy, the hysterotomy incision should be closed expeditiously and the procedure initiated. When the placenta invades the wall of the uterus the myometrium is typically very thin and friable. If hysterectomy is performed in a standard fashion by placing clamps along the wall of the uterus the uterine wall is often disrupted and substantial bleeding can result. To limit this bleeding we attempt to ligate the vascular channels coursing to the uterus within the retroperitoneum. After the hysterotomy is closed we divide the round ligament and open the retroperitoneum widely. The ureters are visualised, the utero-ovarian ligaments divided, and the ovaries packed. The vesicouterine peritoneum is then gently opened and the bladder dissected away from the uterus to the extent possible without placental disruption. The uterine artery and its collateral channels are then ligated, again attempting to avoid disrupting the wall of the uterus if it is thinned and friable.<sup>12</sup> After the major vascular channels are divided we continue the dissection until we are below the placental tissue. This typically requires additional dissection of the plane between the bladder and uterus/placenta. It is often necessary to perform a cystotomy to fully separate the bladder from the uterus. Once below the placental tissue the lower uterine segment and cervix are gently elevated, and the fundus of the uterus with the placental mass is amputated. If haemostasis is obtained at this point the cervix can be left *in situ*; however, there are often significant vascular channels remaining on the surface of the cervix, and removal of the entire cervix is often required to obtain haemostasis.<sup>7,9,27</sup>

After the uterus and placenta have been completely removed the entire pelvis should be re-inspected. There are often multiple small vascular channels along the posterior wall of the bladder that must be cauterised or ligated to limit bleeding. Numerous haemostatic agents are now available to help control oozing within the pelvis. Indigo

carmine can be given intravenously to detect damage to the ureter or the bladder. If a cystostomy was required, the bladder should be closed in layers after ensuring the integrity of the ureteral orifices.

## Perioperative considerations

Careful preoperative planning can minimise the morbidity of perioperative hysterectomy. The identification of a dedicated, multidisciplinary team is associated with improved outcomes.<sup>24</sup> Preoperative team meetings, with a review of imaging findings and operative planning, may help to optimise outcomes. Women with suspected placenta accreta are at a substantial risk for preterm delivery for bleeding and other complications. A number of reports have shown that outcomes are worse and morbidity is higher in women who deliver emergently or in an unplanned fashion.<sup>6,13,28</sup> Given these findings, many experts argue for scheduled, preterm delivery so the operative procedure can be undertaken in a controlled fashion. A decision analysis suggested that delivery at 34 weeks of gestation without confirmation of fetal lung maturity was the gestational age associated with optimal outcomes.<sup>29</sup>

Prior to the planned surgical procedure, a number of ancillary procedures can be undertaken that may reduce perioperative morbidity. The genitourinary tract is at substantial risk for injury during these procedures.<sup>6,11</sup> Both bladder as well as ureteral injuries are relatively common. Particularly if the placenta invades into the parametrium, ureteral identification can be difficult. To facilitate ureteral identification, retrograde ureteral stents can be placed via cystoscopy. One institutional series noted that the rate of ureteric injury was reduced from 7 to 0% in women who had ureteral stents placed.<sup>6</sup> We place ureteral stents after induction of anaesthesia and prior to opening the abdomen in all women with suspected placenta accreta.

Devices placed by interventional radiology may also be of use in women undergoing peripartum hysterectomy for placenta accreta. Both selective pelvic vessel embolisation and balloon occlusion catheters have been described in a number of reports.<sup>30–44</sup> Which patients derive the greatest benefit from these technologies and when to use these procedures remains an area of active debate.

Pelvic artery embolisation is the most frequently performed radiologic procedure for obstetric haemorrhage.<sup>30–38</sup> Catheters are placed, under fluoroscopic guidance, into the internal iliac artery. If needed, haemostatic substances can then be administered via the catheters. Embolisation catheters can be placed preoperatively, to be used if bleeding ensues or in the case of patients with obstetric haemorrhage after delivery. Additionally, and as discussed below, embolisation is often a component of treatment in women with placenta accreta who are managed conservatively, with

the placenta left *in situ*.<sup>30–36,38</sup> One analysis of 30 women with placenta accreta who underwent embolisation catheter placement reported performing embolisation in 77% of patients, and noted that only 8% required hysterectomy. The mean estimated blood loss in this report was 2000 ml.<sup>34</sup> Pelvic artery embolisation is also useful in women who have continued bleeding after hysterectomy. A retrospective analysis including seven patients who underwent embolisation after hysterectomy reported adequate control of bleeding in six of the seven patients.<sup>35</sup> Complications of embolisation included thrombosis and necrosis of embolised tissue.<sup>35,36</sup>

The second interventional radiologic modality that may be of use in women with placenta accreta is the placement of balloon occlusion catheters.<sup>39–44</sup> Occlusion catheters are catheters that contain small balloons that can be inflated to occlude the lumen of a vessel. Balloon occlusion catheters can be placed prior to hysterectomy under fluoroscopic guidance.<sup>39–44</sup> Placement within the internal iliac artery is most common. At the time of hysterectomy the balloons can be inflated prophylactically or if heavy bleeding is encountered. The utility of balloon occlusion catheters remains controversial. One case-control study of 69 women with placenta accreta, including 19 who had balloon catheter placement, reported no difference in blood loss, transfusion requirements, or length of stay between the groups. Of concern, there was substantial morbidity associated with the use of the catheters: the overall complication rate was 16%, including two patients who required arterial bypass or stenting.<sup>39</sup>

The bleeding at the time of peripartum hysterectomy for placenta accreta is often substantial.<sup>9,10,13</sup> As such, preoperative preparedness for massive transfusion is essential. Communication with blood bank personnel as well as the availability of massive transfusion protocols may improve outcome. There has also been great interest in optimising transfusion protocols at the time of peripartum hysterectomy.<sup>45</sup>

Recent data, largely from the trauma literature, has led to a reassessment of the optimal way to transfuse patients with obstetric haemorrhage. Classically 1 unit of fresh frozen plasma (FFP) is administered after 3 units of packed red bloods (PRBCs), whereas platelets are typically not transfused until 10 units of PRBCs have been administered. Several studies have now demonstrated improved outcomes when a higher ratio of FFP and platelets to PRBCs are administered.<sup>46–51</sup> Multicentre studies of civilian trauma patients who have required massive transfusion have demonstrated that increasing the ratio of FFP and platelets to PRBC (closer to 1:1) reduces mortality.<sup>49</sup> One recent observational study of increasing the ratio of FFP : PRBC among 142 women with postpartum haemorrhage noted that an increased FFP : PRBC ratio was associated with a decreased need for interventional (surgical or radiologic) procedures.<sup>52</sup>

To minimise transfusion requirements, several institutions use cell salvage at the time of peripartum hysterectomy.<sup>53–57</sup> Although cell salvage could theoretically reinfuse fetal debris and possibly result in alloimmunisation, several studies in obstetrics have demonstrated the safety of the technology.<sup>53–57</sup> The last two decades have also seen the introduction of a number of pro-haemostatic agents to assist with the control of operative bleeding. Numerous topical haemostatic agents to facilitate coagulation are now commercially available.<sup>58–62</sup> These products are particularly useful after hysterectomy when numerous raw surfaces often bleed. Finally, there are now a number of reports describing the use of recombinant activated factor VII (rFVIIa) in patients with obstetric haemorrhage.<sup>57,63–68</sup> Recombinant factor VIIa is approved for bleeding associated with haemophilia A and for patients with inhibitors of coagulation. The administration of rFVIIa induces coagulation at all of the sites of active bleeding in the presence of tissue factor. Recombinant factor VIIa is expensive and associated with a significant thrombotic risk, and should only be used as a last resort.

## Complications of peripartum hysterectomy

Morbidity and mortality after peripartum hysterectomy are significant.<sup>6–10,13,18,24,69,70</sup> A nationwide sample of women in the USA who underwent obstetric hysterectomy reported a mortality rate of 1.0%, whereas other studies have described perioperative death rates of 1–6%.<sup>9,10,71,72</sup>

Massive blood loss is perhaps the most important complication of peripartum hysterectomy. An institutional series noted that the median blood loss for women with placenta accreta undergoing peripartum hysterectomy was 3000 ml, whereas the median transfusion requirement was 5 units of PRBC. In this report, 13% of patients had a blood loss of over 10 000 ml.<sup>73</sup> Of concern, there are few reliable predictors for which women will require a massive transfusion.<sup>73</sup>

Perioperative complications are also common for peripartum hysterectomy. Injuries to the genitourinary tract are most common, with reported rates of cystotomy of 6–29% and ureteric injuries in up to 7% of women.<sup>6,8–10,13,18,24,69,70</sup> Postoperatively, febrile complications and bowel dysfunction are relatively frequent. Re-operation is required in up to a third of women who undergo peripartum hysterectomy.<sup>6,9–11</sup> Among women who require re-exploration, approximately three-quarters of cases are to control bleeding, whereas the remainder are procedures for the repair of operative injuries.<sup>9</sup> The average postoperative hospital stay following peripartum hysterectomy ranges from 4 to 8 days.<sup>11,13,70</sup>

## Conservative management of placenta accreta

Conservative, uterine-sparing approaches for the management of placenta accreta have been described to both reduce the morbidity of peripartum hysterectomy as well as allow for future fertility in selected women.<sup>30,74–79</sup> For women with placenta accreta managed conservatively, the uterus is closed after delivery and the placenta is left *in situ*. A number of different approaches including uterine artery embolisation, methotrexate therapy, haemostatic sutures, pelvic devascularisation, and balloon tamponade have been described, with varying rates of success.<sup>75</sup> One large series reported a success rate of 78%, with a rate of maternal morbidity of 6%.<sup>77</sup> In that study, which included 167 women from 25 hospitals in France, 78% retained their uterus, just 18 women required a hysterectomy within 24 hours of delivery because of haemorrhage, and 18 women underwent hysterectomy within 3 months of delivery because of complications. Ten women experienced severe morbidity, including sepsis, vesicouterine fistula, and/or uterine necrosis. In women who retained their uterus, placental reabsorption was observed upon follow-up at a median of 13.5 weeks.<sup>77</sup> There are few data to help select which patients are best served with conservative management and how best to manage these women.

Studies examining pelvic artery embolisation in combination with conservative management have reported success rates of 85–95%.<sup>79</sup> After delivery, embolisation is performed either in the operating room or in an interventional radiology suite. A review of 45 patients treated in the Netherlands noted that hysterectomy was required in only 18% of the women, and 62% had resumption of menses.<sup>79</sup> Patients who undergo embolisation are at risk for postembolisation syndrome, which consists of nausea, malaise, and low-grade fevers for 2–7 days following the procedure.<sup>30</sup> These women require close follow-up.

Methotrexate has also been proposed as an adjunctive treatment for placenta accreta. Methotrexate is an antifolate drug that acts by inhibiting the folic acid pathway. This chemotherapeutic agent affects the rapidly dividing cells such as trophoblasts. To date there are no standard dosing regimens or protocols. Some studies have questioned the benefit of methotrexate, and noted little benefit in enhancing placental reabsorption.<sup>76,79</sup> Although rare, life-threatening complications, including pancytopenia and nephrotoxicity, have been reported.

Other more controversial approaches to uterine conservation have also been described. Chalandrahan and co-workers performed the ‘Triple-P procedure’ on four patients with placenta accreta. With this technique the uterine blood supply is reduced with balloon occlusion catheters, the myometrial wall underlying the placental bed

is excised, and the defect is closed. Although success was reported in four patients, all of whom had placenta percreta, caution should be used in patient selection.<sup>74</sup>

Future fertility remains controversial in women with placenta accreta. In a review of the published literature of women managed conservatively, Timmermans and colleagues identified 60 women, including 80% in which uterine conservation was successful. Subsequent pregnancies were reported in one-sixth of these women.<sup>79</sup> In a series of 96 patients who underwent conservative management, 27 ultimately desired more children. Within this cohort there were 34 pregnancies and 21 infants born after 34 weeks of gestation. The mean time to conception was 17.3 months after treatment; however, there was a 28.6% recurrence of placenta accreta.<sup>77</sup>

## Conclusion

Abnormal placentation and obstetric haemorrhage are leading causes of maternal morbidity and mortality. With the rising rate of caesarean delivery the incidence of placenta accreta is likely to continue to rise over the next decade. Continuing studies are clearly needed to provide evidence-based guidance for the management of these women. Ultimately, improvements in diagnosis and a better understanding of the molecular pathogenesis underlying placenta accreta are needed. All hospitals should develop management protocols for women with or at risk for placenta accreta to help reduce morbidity.

## Disclosure of interests

The authors have no financial disclosures or conflicts of interest.

## Contribution to authorship

All authors contributed to the design, literature review, and writing of the article.

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## Commentary on 'Surgical management of placenta accreta: to leave or remove the placenta?'

The incidence of placenta accreta has increased ten-fold in the last 50 years, primarily because of the rise in caesarean section rates. Imaging using mainly ultrasound with colour Doppler and magnetic resonance imaging (MRI) can identify accreta tissue antenatally in more than 90% of cases. As discussed by Delboy et al., a multidisciplinary team approach, including skilled surgical and anaesthetic specialists, and an adequate availability of blood and blood products is pivotal in the successful management of placenta accreta. Wherever feasible, caesarean hysterectomy still remains the gold standard in the management of placenta accreta; however, an elective second step or delayed hysterectomy, especially in cases of placenta percreta, is safer, technically easier, with favourable dissection planes, and results in less blood loss (Guleria et al. *Acta Obstet Gynecol Scand* 2013;92:461–4).

Conservative options to preserve fertility can also be used in selective cases. Conservative surgery as a one- or two-step procedure includes an upper segment hysterotomy, ligation of newly formed vessels, resection of the myometrium and whole placenta, and anterior myometrial reconstruction in two layers (Palacios-Jaraquemada *Best Pract Res Clin Obstet Gynaecol* 2013;27:221–32). Similarly, the Triple-P procedure also includes myometrial excision and reconstruction, but advocates the use of ultrasound just before caesarean to delineate the upper border of the placenta, in order to avoid a midline uterine incision, and the use of balloon occlusion uterine arterial catheters, to reduce blood loss (Chandrachan *Int J Gynaecol Obstet* 2012;117:191–4). Conservative surgery is challenging, but its routine use is restricted by the requirement of surgical expertise and limited data from trials. In settings where interventional radiology is not available, besides internal iliac artery ligation, external or internal compression of abdominal aorta and

pelvic pressure packing during surgery significantly reduces distal flow, and allows time for haemodynamic stability, the correction of coagulopathy, and the completion of surgery. In cases of focal placenta accreta or inadvertent removal of adherent placenta, the placement of deep myometrial square compression sutures (Cho sutures) in the lower uterine segment can arrest haemorrhage.

Leaving the placenta *in situ* for spontaneous involution or expulsion is supplemented by oxytocics and/or balloon tamponade for the initial control of haemorrhage; however, the woman should be counselled on the complications of placental involution, such as haemorrhage, infection, septic shock, disseminated intravascular coagulopathy, and need for hysterectomy. Additionally, as described in the review, pelvic devascularisation, uterine artery embolisation, compression sutures, and methotrexate therapy have been found to be associated with variable success. The routine use of methotrexate is no longer recommended as it does not always facilitate resorption; moreover, there is an association with increased infection rates and risk of anaemia. The failure of arterial embolisation in arresting haemorrhage is mainly caused by extensive pelvic collateral circulation. Follow-up can be performed by serial ultrasound and measuring the level of  $\beta$ -hCG ( $\beta$ -subunit of human chorionic gonadotropin); however, the frequency of monitoring has not yet been standardised. The success of conservative management is reported to be as high as 80%.

The article correctly states the urgent need for the development of evidence-based guidelines and individual hospital management protocols for the management of this ever-increasing problem.

### Disclosure of interests

There are no conflicts of interest to disclose. ■

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