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The Management of Placenta Accreta at Queen's Hospital, Romford, UK

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GENERAL COMMENTS

Introduction

Placenta accreta, increta and percreta are all forms of morbidly adherent placenta (MAP) with abnormally invasive placentation. Histologically defined by trophoblastic invasion of the myometrium in the absence of intervening decidua, superficial myometrial invasion is classed as accreta, deeper myometrial invasion as increta, and invasion through the serosa or into adjacent pelvic organs as percreta[1]. The condition was of such rarity 60 years ago that many experienced practicing obstetricians had never encountered a case, and the associated maternal mortality rate was extremely high (37–67% of cases managed)[2]. Although associated maternal mortality is now significantly lower (7–10% of cases)[3,4], it remains a much dreaded obstetric complication primarily because of the risk to the mother. Although awareness of the condition and its attendant risks is increasing, no consensus exists regarding the best management strategies to maximize outcomes. This paucity of information hampers service planning and decisions on optimal management strategies and presents difficulties in conducting meaningful research, particularly comparative studies (see Chapter 1).

Clinical significance

Women with placenta accreta or any of its variants are at high risk of life-threatening massive obstetric hemorrhage, bladder or ureteric injury, uterine perforation and rupture, peripartum hysterectomy and maternal death[1]. The prevalence is apparently on the increase globally due to the increasing cesarean delivery rates and advancing maternal age[5]. Reported prevalence in the 1930s was less than 1 in 30,000 deliveries, increasing to 1 in 2510 deliveries in the 1980s and up to 1 in 540 deliveries as reported in some centers by 2006[5,6].

Local significance

The Maternity Unit at Queen's Hospital, Romford, is the high-risk section of one of the largest acute hospital trusts in the UK, with an average annual delivery rate of 10,000 births. The Trust serves a population of 750,000 from a wide range of social and ethnic groups. Active screening for MAP commenced after a maternal death from a morbidly adherent placenta in 2006. In the subsequent 4-year period, a positive antenatal diagnosis was made in 17 of the 39,120 pregnancies. There was one false positive diagnosis, giving an annual prevalence of 1:2445 deliveries for MAP. This chapter reviews the medical literature on MAP and draws on the experience provided by these cases.

Diagnosis

Traditionally, a diagnosis of MAP was made either clinically following difficult or failed attempts at manual placental removal of a MAP or histopathologically following peripartum hysterectomy or autopsy (Figure 1). In our unit, as is the case in many centers worldwide, antenatal diagnosis is now increasingly made using a combination of ultrasound and magnetic resonance imaging (MRI).

Diagnosis of a MAP in the first trimester is exceedingly rare. It is usually encountered acutely following unexpectedly severe uterine bleeding during pregnancy[7], termination or evacuation of retained

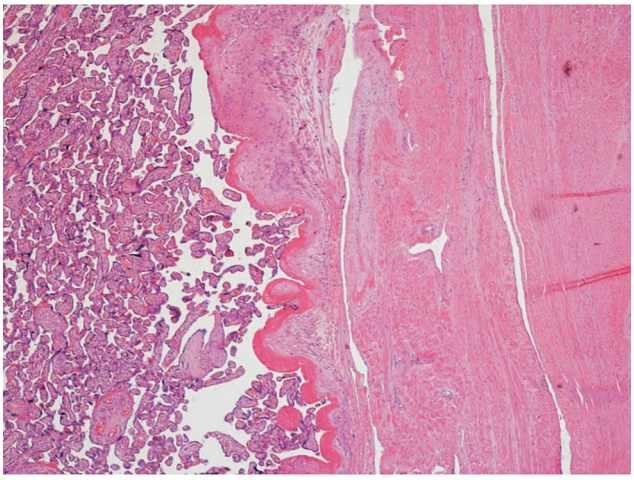

Figure 1 Histological slide showing placenta accreta

products of conception. Some cases present with heavy genital tract bleeding a few weeks or months after the evacuation of a spontaneous, missed or incomplete miscarriage and the diagnosis of a retained placenta accreta, increta or percreta is made only after histological examination following surgery[8–10].

Currently, most cases are detected in the second trimester, although the diagnosis may remain inconclusive until the later stages of pregnancy if or when there are no symptoms of vaginal bleeding to prompt earlier investigation. When vaginal bleeding occurs early on in the first and second trimesters, however, near-catastrophic blood loss is the usual result in most cases. As a consequence, there have been calls to commence ultrasound screening for MAP early, as part of the 11–14 week nuchal translucency screening scan[11,12]. Indeed, close scrutiny of the uterine wall, umbilical cord insertion and placentation at the 11–14 week ultrasound screening may be helpful in establishing a diagnosis of MAP at such early gestations.

Risk factors

The commonest etiologic factors seen with MAP are a previous endomyometrial injury in conjunction with a low lying placenta[13]. Women with placenta previa and a previous cesarean delivery are now well established as being at greatest risk for MAP[14]. Screening for MAP is therefore possible by combining the previous obstetric history with a thorough ultrasound examination of the placenta. In women who are found to have placenta previa on ultrasound, the association with previous cesarean section delivery is strong, and the risk of MAP increases from 24% with one previous cesarean to 67% with three or more previous cesareans[15]. Other important associated factors include a short birth interval following a cesarean delivery[16,17], increasing parity and advancing maternal age above 35 years[1].

Biochemical markers

Biochemical detection is not established for MAP. However, elevated maternal serum levels of α fetoprotein (AFP) and serum free β human chorionic gonadotropin (β hCG) have been reported with MAP in the absence of fetal abnormality[18–20]. The rationale is probably similar to other conditions where a breach or leak occurs at fetoplacental–maternal interfaces, although the elevation in AFP is postulated to be more likely related to coexisting placenta previa[21]. An elevated level of creatine kinase, possibly secondary to an endomyometrial breach or increased breakdown, is also reported as a possible marker[20,22]. More sophisticated laboratory tests, including the possibility of antenatal diagnosis from fetal cells in maternal blood are being studied[23].

Ultrasound imaging

Grayscale ultrasound is the mainstay of antenatal diagnosis with a high sensitivity and specificity. Multiple ultrasound diagnostic signs are usually seen in cases later confirmed to have MAP, and, although there is no single pathognomonic feature, most have a strong association. The greater the number of characteristic ultrasound features seen, the more likely is the diagnosis[24], and there may be an increase in the number and clarity of diagnostic ultrasound parameters as gestation increases. Although the superiority and accuracy of one route over another is often debated, the transabdominal and transvaginal routes are often complementary.

Our personal observations suggest that the more severe and extensive the morbid adherence, the easier the antenatal ultrasound diagnosis. Ultrasound appearances, however, do not always accurately predict the clinical severity of bleeding, as perforation and torrential bleeding remain possible, occurring even with small or focal lesions. Ultrasound imaging has a good negative predictive value for the diagnosis of MAP ranging between 92 and 98%, a fact which is invaluable in any good screening program[25,26].

Characteristic findings for MAP on grayscale ultrasound include:

(1) The presence of lacunae;

(2) Loss of the normal hypoechogenic retroplacental myometrial zone;

(3) Irregularity of the retroplacental sonolucent zone;

(4) Thinning, especially less than 1 mm, or disruption of the uterine serosa–bladder interface;

(5) The presence of focal exophytic masses;

(6) Lacunar flow within the placenta[25,27] (Figure 2).

Color Doppler ultrasound

The use of color Doppler can improve the accuracy of diagnosis of MAP by providing a more detailed assessment of the depth of trophoblastic invasion into the myometrium or serosa, especially in an anterior placenta[28–30]. The sensitivity and specificity of color

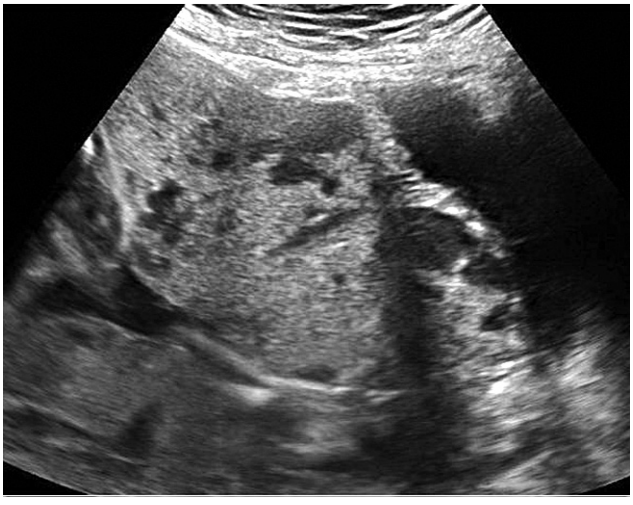

Figure 2 Grayscale image showing presence of lacunae

Doppler in diagnosing placenta previa accreta range between 82.4 and 100% and 92 and 96.8%, respectively[31]. A finding of color Doppler flow within lacunae further increases diagnostic sensitivity to 100%, with an associated 83% positive predictive value for morbid placental adherence[28].

Characteristic findings on color Doppler ultrasound include:

(1) A diffuse lacunar flow pattern with high-velocity pulsatile venous-type flow (peak systolic velocity more than 15 cm/s) spread throughout the placenta, myometrium and cervix;

(2) A central lacunar flow pattern with turbulent flow distributed regionally or focally in the parenchyma;

(3) Bladder–uterine serosal interphase hypervascularity;

(4) Markedly dilated vessels over the peripheral subplacental zone;

(5) An absence of subplacental vascular signals in the areas lacking the peripheral subplacental hypoechoic zone;

(6) Abnormal vascular channels linking the placenta to the bladder[31] (Figure 3).

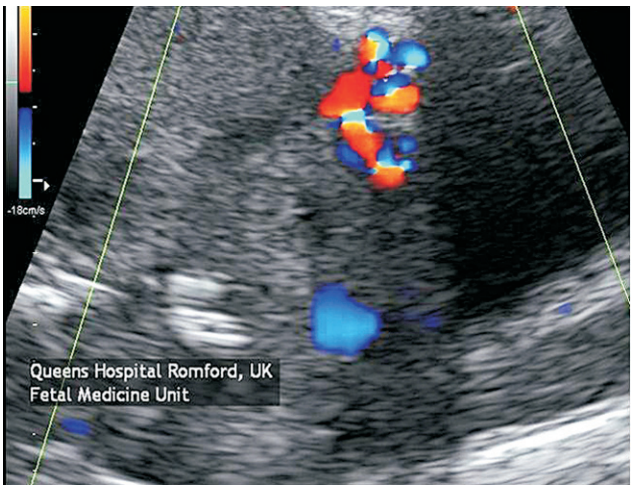

Figure 3 Color Doppler image of placenta increta

Three-dimensional ultrasound

It is unclear whether three-dimensional ultrasonography adds any benefit to diagnostic accuracy for MAP[29]. However, viewing planes can be more easily manipulated to enhance views of the vascular framework of the placenta and adjacent tissues, thus improving detection of bladder and parametrial extension. Four-dimensional ultrasound, on the other hand, permits instantaneous multiplanar reconstructions in real time. This gives an added ability to display and rotate reconstructed images from any desired angle, and from any of the three planes: sagittal, coronal, or axial (Figure 4).

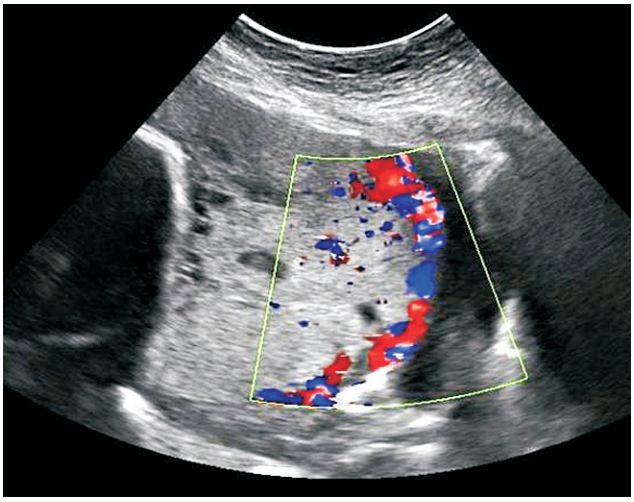

Figure 4 Three-dimensional color Doppler image showing placenta percreta

Three-dimensional color power Doppler ultrasound

The role of three-dimensional color power Doppler is better established. Color power Doppler ultrasound is reportedly the most sensitive and specific single criterion (sensitivity 97% and specificity 92%), with the highest positive predictive value currently reported for diagnosis[24,32] (Figure 5). *This is the single most reliable diagnostic modality* and it increases diagnostic confidence in determining the exact site, depth and extent of invasion. Characteristic findings on three-dimensional color power Doppler ultrasound include:

(1) Numerous dilated and coherent vessels involving the serosa–bladder interface on a basal view;

(2) Increased intraplacental hypervascularity;

(3) Inseparable cotyledonal and intervillous circulations;

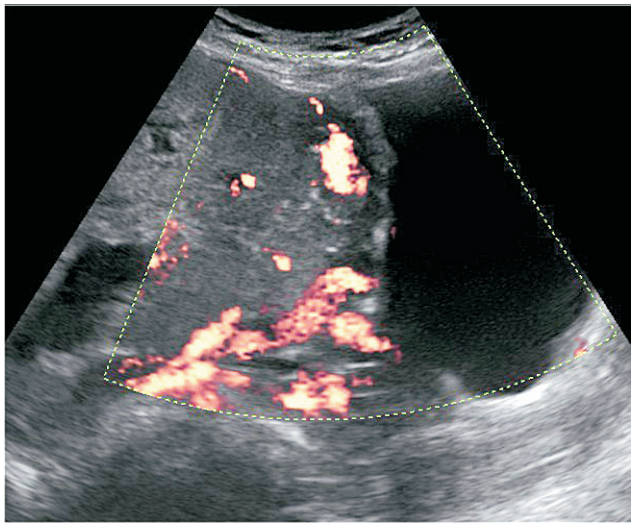

Figure 5 Color power Doppler image of placenta increta

(4) Tortuous vascularity with chaotic branching;

(5) Detour vessels on the lateral view[24,32] (Figure 6).

Magnetic resonance imaging

MRI is an imaging modality that does not require the use of ionizing radiation, provides excellent tissue definition and additionally allows multiplanar imaging. MRI is increasingly useful in planning surgery, particularly in the evaluation of posteriorly sited placentas, in obese women and in pregnancies complicated by a reduced amniotic fluid volume, although claustrophobia in some women may limit its use[33–36]. The additional use of an image enhancing contrast material such as gadolinium is controversial because of the maternal and fetal risks, but this has been used in circumstances where the benefits of an accurate diagnosis appear to far outweigh potential complications. MRI is a valuable diagnostic tool for MAPs with a good negative predictive ability. *Characteristic MRI findings include lower uterine segment thinning, protrusions from the uterine wall, heterogeneous signal intensity within the placenta and dark intraplacental bands on T2-weighted imaging*[33–37] (Figure 7).

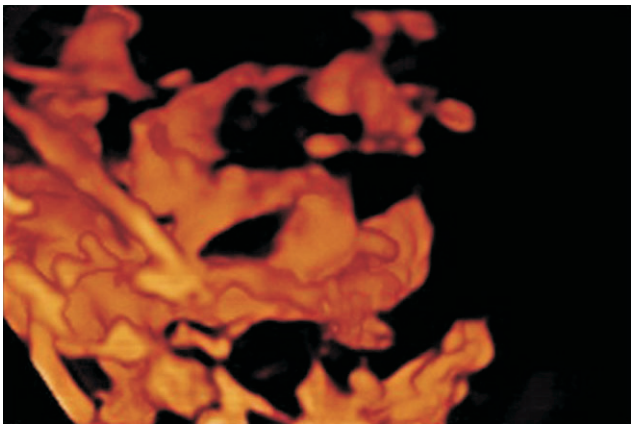

Figure 6 Three-dimensional power color Doppler image of placenta increta

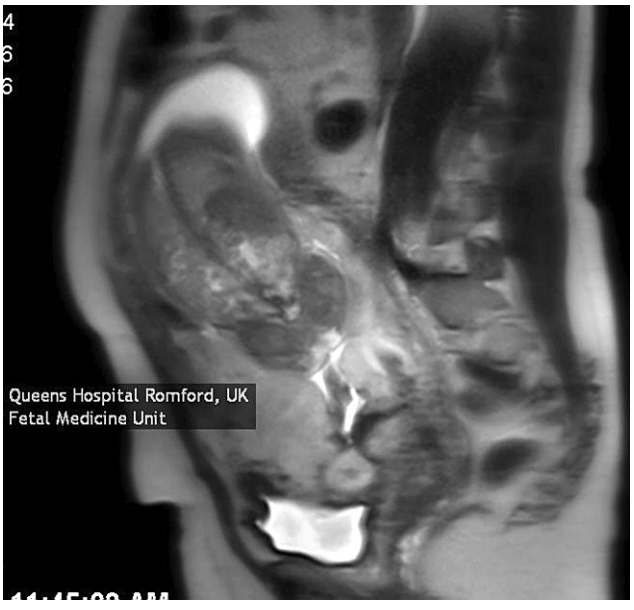

Figure 7 MRI scan showing placenta increta

Screening for morbidly adherent placentas

The role of screening for MAP has yet to be established, even though a more widespread use of this modality would offer clear advantages. In our unit, screening commenced in 2006, using the antenatal booking history and ultrasound as the starting points for our search. Any woman with a history of previous uterine surgery receives a thorough placental assessment at the 20 week second trimester ultrasound scan by a sonographer. A check is made for the diagnostic pointers described above and, if any positive findings are present, the woman is referred to the fetal medicine unit for a consultant's assessment. Where required, an MRI scan is performed at 32 weeks' gestation to help confirm or reject the diagnosis. A diagnosis made in the third trimester is usually conclusive, and adequate preparations for a safe delivery can begin.

Management of morbidly adherent placentas

The most important aspects of management are:

(1) The early identification of women at high risk of MAP;

(2) Intensive multidisciplinary care;

(3) Care and delivery in an appropriately equipped unit.

The care of women diagnosed at any stage of pregnancy with MAP should be conducted by obstetricians working as part of a multidisciplinary team. In our unit two senior obstetricians specialized in fetomaternal medicine supervise the care of women with a diagnosis of MAP. This ensures that routine pregnancy assessments and care are not ignored as a result of the overriding concerns about the risks of placental bleeding. In the 5-year period since screening commenced and our multidisciplinary care team was constituted, we have now encountered 23 cases exhibiting the entire spectrum of MAP across the gestational range.

Planned management in antenatally diagnosed cases

After the antenatal diagnosis of MAP, a multidisciplinary team is assembled. Ideally the team should include specialist obstetricians, anesthetists, urologists, interventional radiologists, hematologists, neonatologists, blood transfusion specialists, operating department practitioners, portering staff and theater nurses and assistants trained to assist in performance of cesarean hysterectomy and laparotomy, along with a full complement of gynecological, vascular surgery and urology instruments. In reality, this list needs to be modified to comply with local needs, requirements and resources.

At Queen's Hospital, Romford, because of the level of risk involved, emergency contact telephone numbers for the delivery suite and senior specialist obstetric team are provided to the woman and her family with 24-hour availability of at least one senior

member of the obstetric team. Details of her diagnosis; the grade and extent of morbid adherence; possible risks and complications to mother and baby; mode, details and risks of planned conservative or extirpative management; the likely need for transfusion with blood products; cystoscopy; ureteric stenting; arterial embolization in the interventional radiology theater suite; selective arterial ligation; planned abdominal incision, type of cesarean section planned; and type of hysterectomy planned are all documented in the hospital antenatal hand-held records. An agreed, signed birth plan with all these details boldly marked on the risk assessment page is also attached to the woman's hand-held hospital notes for contingency reasons.

Counseling

Counseling the woman and her family is crucial and is undertaken primarily by obstetric members of the team who are the point of first contact. The gravity of this condition often dictates prolonged and detailed discussions with multiple family members present in order to ensure a clear understanding. We, therefore hold our discussion sessions in the Fetal Medicine Unit (FMU) counseling room separately, and apart from the routine antenatal clinic sessions for this purpose. After the initial counseling sessions, a definitive management plan is agreed in consultation with the woman and her family by the 32nd week of pregnancy when the diagnosis would have been confirmed by the ultrasound and MRI examinations.

Counseling includes advice to refrain from sexual intercourse until after delivery, to ensure that the woman is not left unattended or on her own at home, and to arrange ambulance transfer to hospital immediately if vaginal bleeding occurs. Advice is also given to report any genital tract discharge, hematuria, abdominal pain or uterine contractions to hospital immediately via the delivery suite emergency telephone hotline. Ambulance services can then be contacted by our midwifery staff or directly via a telephone call from the woman to arrange hospital transfer.

It must be ascertained that the woman lives within easy commuting distance of the hospital and that there have been no prior episodes of vaginal bleeding or other complications before agreeing to outpatient care following the diagnosis. The plans for operative delivery, possible need for blood transfusion, uterine preservation and hysterectomy are discussed in detail with the woman and her relatives before the third trimester and any concerns regarding these are thoroughly discussed. All the discussions are carefully recorded in the hospital notes. Women who live more than 10 miles from the hospital are either managed as inpatients or referred to their local hospital with all their results to date and a copy of the plan of care and delivery.

Consent

Consent for surgical treatment options should be obtained early, soon after the diagnosis, because of the risk of urgent radical operative intervention before the end of the second trimester or emergency preterm delivery. The consent form we use details the planned conservative or extirpative management, associated risks and complications, need for transfusion with blood products, preoperative cystoscopy, ureteric stenting, arterial embolization in the interventional radiology theater suite, selective arterial ligation, planned abdominal incision, type of cesarean section planned, and type of hysterectomy planned with extirpative management. This is individualized, with these details entered manually on the routine National Health Service operation consent form.

Coordination

Antenatal care and multidisciplinary team coordination is handled by the FMU consultant obstetricians, a designated senior midwife and blood transfusion specialist practitioners who all liaise closely with each other and inform and update other team members regularly. Close monitoring for any other incidental pregnancy associated complications continues under the care of the specialist obstetricians. Serial ultrasound scans to assess fetal growth and maternal assessments are arranged at 24, 28 and 32 weeks of gestation. The anesthetic and neonatology team members are involved once viability has been attained.

Gestational age at delivery

This is decided upon on an individual basis depending on the risk to the mother including severe maternal genital tract bleeding, any associated medical or obstetric conditions, fetal status and available facilities for neonatal intensive care. Timing of delivery is discussed at 32 weeks with the multidisciplinary team. In the absence of significant antenatal complications, delivery is usually aimed for 37 weeks' gestation. Early transfer to an appropriate unit should be arranged if appropriate local facilities for neonatal care are deemed suboptimal.

Multidisciplinary team involvement and planning

Preoperative review

A multidisciplinary team review is held at 32 weeks where clinical status of both mother and baby, all imaging, hematology and other test results are discussed, and the plan for delivery is reassessed with any new findings. A diagnosis of parametrial invasion is particularly important in planning surgery[37]. This is assessed antenatally using three-dimensional color Doppler ultrasound and MRI at 32 weeks to enable planning of the surgical technique at the multidisciplinary team meeting with the team's interventional radiologists, urologists and obstetricians.

The final multidisciplinary review takes place in the week before delivery, usually between 34 and 36 weeks. An evaluation of the items listed in Figure 8 is

Checklist for 32-week multidisciplinary team meeting	Details
1. Operation consent forms	
2. Planned anesthesia	
3. Choice of abdominal incision	
4. Planned uterine preservation	
5. Planned placental retention	
6. Anticipated parametrial or paravesical dissection	
7. Anticipated interventional radiology procedures	
8. Anticipated blood transfusion requirements	
9. Any concurrent medical or obstetric complications?	

Figure 8 Morbidly adherent placenta (MAP) multidisciplinary team management checklist

performed and each item is crossed off the checklist once dealt with. At this stage decisions are taken regarding the team members required to attend the delivery, the sterile packs required, which operating theater is to be used and the theater staff who will attend. In order to allow ample time and preparation for the delivery and after care the number of cases booked for other elective surgery in the delivery suite theaters on that morning is curtailed.

Pre-delivery specialist anesthetic reviews are also arranged to decide on the anesthetic plan in consultation with the woman in time for discussion at this meeting along with the neonatology review.

The hematology team members are closely involved in antenatal care; any pre-existing anemia is corrected where possible prior to delivery, and all women who decline blood products are identified to explore means of boosting their hemoglobin levels, avoid excessive blood loss and identify what blood products, if any, they would accept under emergency life-threatening conditions (Chapter 72). This is particularly important because even minimal blood loss in an anemic or undernourished woman could have more profound consequences[38].

This activity is especially valuable in developing countries where access to blood transfusion facilities may be quite a distance away, thereby necessitating early referral and transfer to an appropriate center for hospital-based care until delivery.

Women with a previous cesarean delivery and placenta previa or antenatally suspected morbid placental adherence should be delivered in units where at least a level 2 critical care bed is available. For women who decline blood products, transfer to delivery units where cell salvage and interventional radiology are available is recommended[39]. Women living in developing countries or in areas where no surgical or blood transfusion services are available should be transferred early to secondary or tertiary units where these exist[38,40].

MANAGEMENT OPTIONS

The definitive treatment strategy for MAP is either conservative or extirpative, with the surgical removal of the placenta, uterus or both. Overall, the planned management depends on the degree of placental invasion and the woman's desire to retain her reproductive capacity.

Conservative management

Conservative management is defined by uterine preservation and retention of fertility. Various conservative management methods are described, but, in general, the practice is either to undertake manual placental removal immediately after the delivery of the baby or to proceed with planned placental retention, awaiting either spontaneous expulsion or resorption. In some case reports, manual placental removal has been undertaken after a delayed interval to permit regression of the vascular supply. In other reported cases, immediate placental morcellation, curettage or removal piecemeal followed by the insertion of a uterine pack, uterine tamponade device, balloon catheter or the application of uterine hemostatic or compression sutures have been successful[2,41–47].

Other semiconservative interventions, improvized on the spur-of-the-moment in critical emergency situations to avoid further bleeding complications or more drastic surgery are reported. These include oversewing of the placental bed, or suturing flaps of cervix or surgical mesh to cover defects[41,48].

In cases presenting acutely in the first or second trimester, simple excision and repair of defects caused by the implantation, curettage or removal followed by insertion of a tamponade balloon[49], hysterotomy and evacuation of products or, rarely, wedge resection and repair of myometrium have been reported[48,50].

Those presenting acutely in the third trimester are more often seen during the third stage of labor, after the delivery of the infant. The commonest presentation is of a retained placenta with the finding of an absent cleavage plane for its safe removal. *Conservative management under these circumstances involves leaving the entire placenta in situ for removal later or awaiting spontaneous complete resorption.*

The woman is carefully counseled about the findings and her risks, and closely followed up weekly for at least 6 weeks with regular clinical and ultrasound examinations, monitoring her white cell count and differential along with inflammatory markers such as C-reactive protein to assess for signs of infection. A broad-spectrum prophylactic antibiotic such as amoxicillin and clavulanic acid is given for 10 days.

Complications have been reported with the conservative management of MAP. These include immediate to late postpartum vaginal bleeding up to 3 months after delivery which could result in disseminated intravascular coagulation (DIC), infectious morbidity, fever secondary to tissue necrosis, prolonged retention of products of conception and placental polyps. Rarely, vesicouterine fistulas or urethral strictures may occur from placental necrosis secondary to placenta percreta[44,46]. There is no respite until the placenta is completely reabsorbed or expelled and at the 6 week

follow-up visit the histopathology findings should be reviewed.

In acutely presenting cases postpartum where there is continued or heavy bleeding, radiological embolization or selective surgical arterial ligation of the internal iliac and uterine arteries should be arranged immediately. In some instances, the placenta is then expelled shortly afterwards, within 48 hours to 6 weeks, although it may take up to 6 months and sometimes over a year for the placenta to be entirely reabsorbed[46]. If bleeding does not cease, despite uterotonic administration and arterial occlusion, uterine balloon tamponade, or uterine compression sutures should be tried[49,50].

True MAPs do not undergo complete spontaneous separation from the uterine wall in the third stage, leading to significant attendant risks of secondary hemorrhage, infection and the need for a hysterectomy at a later time. An awareness of these risks has motivated the introduction of interventions to attempt to hasten placental involution. These include reducing blood supply to the uterus through transcatheter arterial embolization, selective surgical arterial ligation or stepwise devascularization[50–54]. Attempts to expedite resorption by inducing placental necrosis using cytotoxic therapy, especially methotrexate, are also well reported in the literature[55–58].

Methotrexate efficacy is not well substantiated, and no standard mode of administration, treatment dosages or protocols exist. Moreover, reports of failed conservative management associated with its use exist[56,57], as do reports of maternal mortality associated with low dose administration for ectopic gestations or with intraumbilical cord injections[59,60]. Because successful conservative management without the use of methotrexate is now reported[46], it may be advisable to refrain from its use as an adjunct. In our unit adjunctive methotrexate in the treatment of MAP was discontinued following catastrophic complications associated with a maternal death secondary to fulminant sepsis and tissue necrosis.

Radiological transcatheter pelvic arterial embolization, on the other hand, is reportedly more effective with conservative management[62], although its prophylactic value is still debated and repeat embolizations may have to be performed[63]. There are no known randomized controlled trials of the use of arterial embolization in the management of MAPs. A review conducted for the World Health Organization in 2009 concluded that although there may be resource issues, it should be considered a recommended intervention for the control of obstetric hemorrhage where readily available[38].

The various adjunctive measures described above are used to prevent, reduce or treat the massive obstetric hemorrhage associated with placental retention or removal, and each is discussed fully in the pertinent chapters. *In the context of MAPs, the usual primary cause of dangerous vaginal bleeding is attempted manual removal which at any stage is fraught with danger and should be strongly resisted[64,65].*

Extirpative management

Extirpative management could be conducted as either an emergency or electively, and is characterized by removal of the placenta and the uterus[64]. Although surgery can be performed immediately, it may need to be deferred depending on the type of presentation and clinical status, to undertake planned placental retention with or without an adjunctive modality, followed by an interval hysterectomy.

Emergency management in acutely presenting cases

Management of MAP presenting acutely in the first and second trimesters is individualized according to the mode of presentation, maternal condition and severity. Definitive management includes hemodynamic stabilization with immediate fluid and blood replacement, followed by diagnostic imaging in the form of an emergency ultrasound, computed tomography (CT) or MRI scan when the woman is hemodynamically stable. Based on the results of the scan, the presence or absence of hemoperitoneum and the woman's clinical condition, an operative procedure is planned. As the risk is very high in those presenting at earlier gestational ages, consent for surgery should always include permission for a hysterectomy.

In cases presenting in the third trimester, the placenta should also be left undisturbed while preparations are quickly made for surgery. The intraoperative findings dictate the mode of treatment. A hysterectomy is the treatment of choice in most severe cases, while selective radiological arterial embolization or other hemostatic methods may be useful in facilitating surgery and arresting hemorrhage. In desperate cases, aortic compression may be required to control uterine bleeding and can be done safely for up to 4 hours until it is controlled or help becomes available[65].

A primary decision required with extirpative management is whether to perform an immediate or interval hysterectomy. It also has to be decided whether a total or subtotal (supracervical) hysterectomy is more appropriate. A subtotal hysterectomy is more expedient particularly in moribund cases, but a total hysterectomy with removal of the cervix is advocated by some surgeons because of concerns about delayed hemorrhage from the hypervascularized vault especially in cases of placenta previa accreta.

In practice, the decision is often best taken intraoperatively based on the patient's physical condition, the degree of distortion of the pelvic anatomy by placental infiltration or scarring from previous surgery and the severity of bleeding. Surgical skill and experience significantly influence the decisions because of the distorted anatomy that often accompanies morbid placental adherence, and situations may arise where a subtotal operation is preferred because of the woman's clinical status, or limited operator experience. Interested readers should consult Chapter 31.

Elective management in antenatally diagnosed cases

Since commencing our screening program, the vast majority of cases presenting in our unit are now diagnosed prior to the late second trimester and are delivered electively in the daytime when proper arrangements for major operative interventions can be made. This helps to prevent major complications such as those described above.

Immediate preoperative preparation

The equipment and supplies checklist (Figure 9) is reviewed the day prior to surgery, and the blood transfusion specialist practitioner checks hematology and blood bank supplies. On the morning of surgery, the woman is admitted from home after an overnight fast or is transferred from the antenatal ward if already admitted, and the consent forms and theater checklist are reviewed once again.

The color Doppler and MRI findings accurately predict the need for preoperative ureteric stenting[37], a fact which has been our experience during the past 5 years. If required, intravascular balloon embolization catheters are inserted in the interventional radiology theater suite, before the woman is transferred to the delivery suite operating theater with the catheters ready in place. The preoperative checklist is then reviewed.

Preoperative placental site mapping is performed with a review of the ultrasound and MRI scans by the urologist, interventional radiologist and obstetricians to identify areas of potential difficulty with dissection, areas of particular hypervascularity and, very importantly, specific areas of parametrial, inferolateral pelvic or bladder extension. An ultrasound scan can be performed intraoperatively to map the placental coverage area using a sterile probe cover. At Queen's, we usually mark the placental outlines on the abdominal skin prior to skin preparation and draping, using a surigcal skin marker fiber-tip pen.

Checklist for operative equipment and supplies	*Details*
1. Cell salvage machine	
2. Central arterial line	
3. High pressure suction pumps	
4. Wide bore intravenous access x 2	
5. High volume intravascular infusion pumps	
6. 4 units of crossmatched packed red blood cells (2 units in the delivery suite fridge for immediate use)	
7. Clotting factors and fresh frozen plasma	
8. Body warmers and warming blankets, Bair-Hugger® and space blankets	
9. Intraoperative calf-compression devices – Flowtron® boots	
10. Instruments for cystoscopy, ureteric stenting, bowel and bladder resection and a vascular surgery set	

Figure 9 Morbidly adherent placenta (MAP) preoperative checklist: equipment and supplies

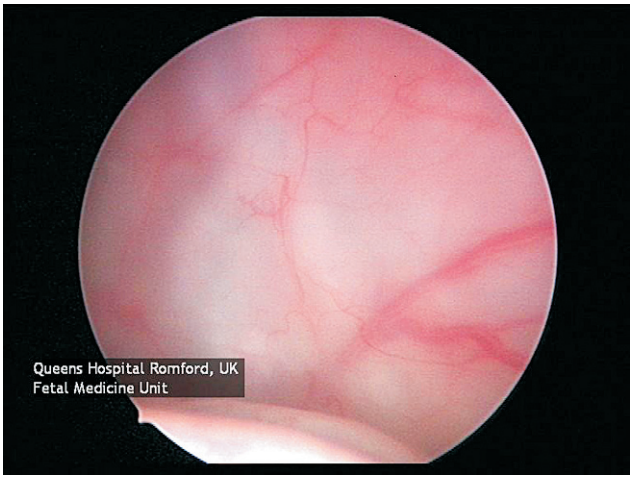

Figure 10 Cystoscopic image showing dilated venous channels with a placenta increta

Intraoperative management

Cystoscopy

A preoperative cystoscopy is performed in all our cases with placenta previa or suspected bladder invasion. Complete penetration or excrescences through the bladder mucosa are rare, but venous congestion and areas of hypervascularity are commonly visible in cases with placenta increta–percreta (Figure 10).

Ureteric stenting

The place of ureteric stenting in the management of the MAP remains in question[68]. The potential benefits include earlier intraoperative diagnosis of ureteric injury and more rapid and easier identification of injured ureters even in the presence of profuse bleeding[68]. However, some surgeons argue that the process of stenting abolishes the elasticity of the ureters and makes them more liable to injury than when normal recoil and peristaltic activity is present[69]. In addition, stenting could possibly kink or displace (and thereby relocate) the ureters, increasing their risk of damage during surgery[69].

Perhaps of greater relevance to the more invasive grades of MAP, it has been argued that even if ureteric stenting does not prevent ureteric injuries, it does not permit such injury to go unrecognized at surgery. This is important, because non-recognition of ureteric injury leads to serious complications. That being said, ureteric stenting is not without risk of complications itself[67–69], including urinary tract infection, reflex anuria secondary to ureterovesical junction edema, renocortical vasoconstriction following catheter stimulation, and even the rare ureterovenous fistula[70]. In a recent study, it was determined that although ureteric stenting did not seem to lead to a reduction in ureteric injury, its use was associated with a reduction in early postoperative morbidity[71].

Direct visualization of the ureters during surgery is the only proven preventive measure against injury[73]. Prophylactic ureteric stenting does not eliminate

ureteric injuries and can therefore not replace direct visualization of the ureters and meticulous surgical technique to avoid complications[72–74].

In summary, although ureteric stenting cannot eliminate ureteric injuries, it may be advisable where an increased risk of injury is present[69]. The greatest blood loss occurs during dissection of the bladder from the lower uterine segment, and the presence of ureteric stents allows more rapid, continuous localization of the ureters, a process that may reduce operative time and blood loss as well as the likelihood of ureteric injury[73].

In our unit, we insert ureteric catheters in cases with bladder base involvement, posteroinferior bladder wall infiltration or parametrial extension because of the likelihood that more extensive dissection would be required, thereby increasing the risk of ureteric damage (Figure 11).

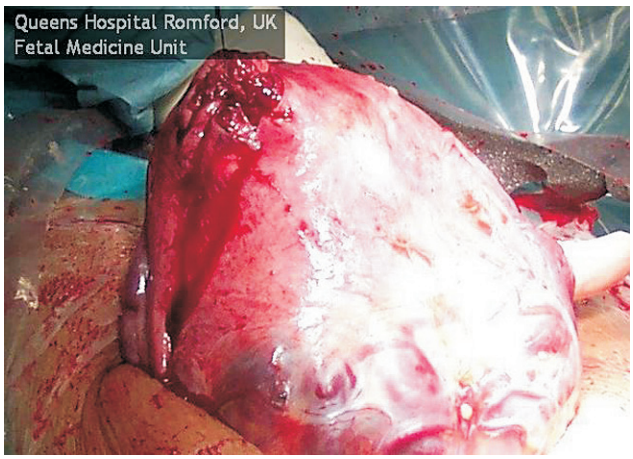

Figure 11 Intraoperative image showing placenta increta

Operative delivery of the infant

The fetal presentation and position are checked preoperatively by ultrasound in anticipation of any manipulations that may be required to effect delivery. A classical cesarean or transfundal uterine incision[75] is made away from the upper placental margin that has been marked preoperatively, to effect delivery of the infant without impinging on the placenta (an image of fundal delivery is found in Chapter 1). The umbilical cord is then ligated, transected and trimmed close to its placental insertion. Where antenatal ultrasound and MRI scans have shown morbid adherence and there is intraoperative evidence of the same, no attempt is made at placental removal. *Forceful or delayed attempts at placental removal are not to be made because of the risk of severe life-threatening hemorrhage,* therefore uterotonics are given at this stage, and the uterine incision is closed.

Selective arterial embolization (Figure 12) or surgical ligation is then performed to reduce the uteroplacental blood supply. In most of our cases, we clamp both internal iliac arteries temporarily until the hysterectomy is completed, only surgically ligating these where there is or has been significant bleeding. In cases with moderate bladder involvement, we perform a wide anterior uterine wall dissection next, reflecting the bladder to expose the lower segment and cervix, and the hysterectomy then follows. The bipolar diathermy forceps and hemostatic clips such as the titanium ligaclips (Ethicon Inc, Sommerville NJ, USA), instruments not routinely used in gynecological surgery, are useful in this endeavor. In other, more severe cases, a bladder wedge resection or partial cystectomy may be required. Complete vault closure or re-peritonealization of the vault is not advisable in such cases, because leaving the cuff open permits any postoperative bleeding to become apparent. In other circumstances, faced with brisk ongoing hemorrhage, it is a good idea to perform a subtotal hysterectomy first to arrest the bleeding, as both the uterine and ovarian arteries are usually ligated with the first pedicles taken[65].

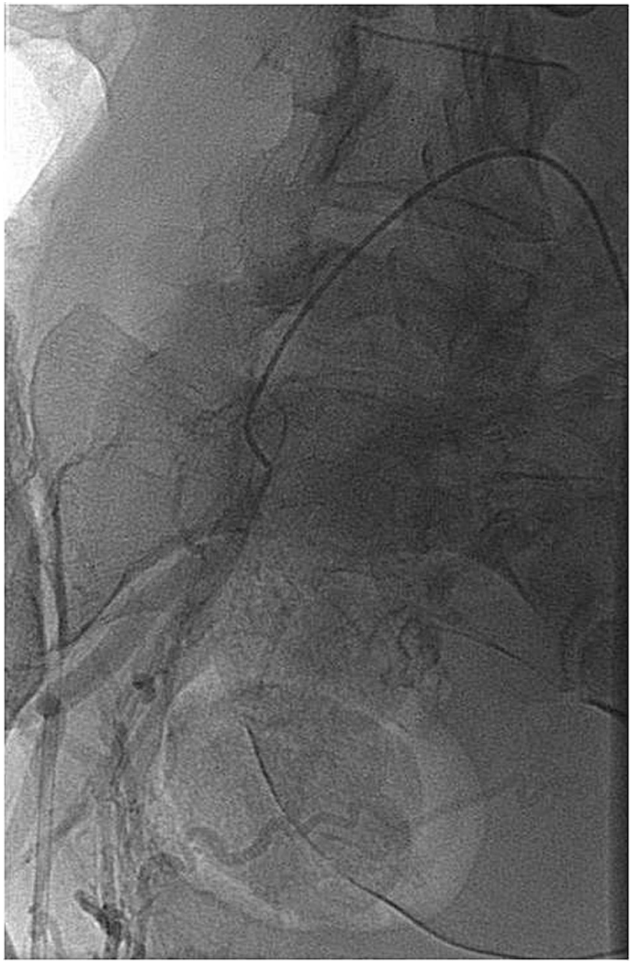

Figure 12 Selective endovascular arterial embolization

An alternative one-step, conservative surgical method has also been proposed as treatment for placenta percreta[45]. The report emanates from a unit with vastly experienced surgeons who have extensive experience with this method which involves extensive dissection and the use of surgical mesh. Although it may hold a place in the management of the more severely invasive placenta percreta, it may not be as appropriate in treating lesser degrees of the condition, particularly in the hands of surgeons who are

unfamiliar with the extensive dissection techniques required for its completion[45].

In our experience, during the immediate postnatal period a substantial degree of the florid vascularization and engorgement subsides; therefore, in cases with severe bladder or extensive parametrial invasion, we retain the placenta and an interval hysterectomy is arranged. Where vascular clamps or embolization catheters have been applied, these are removed after the hysterectomy is complete and hemostasis is ensured.

Tissue reconstruction is commenced once this has been achieved. The suture lines created between the bladder and posterior vaginal wall are then covered with an interpositional peritoneal or omental flap if the latter is easily accessible. A U-shaped flap of peritoneum covering the bladder dome is inverted and tacked down onto the vaginal suture line to provide support as previously described by a member of our team[77]. A wide bore Robinson's or corrugated Yates drain is left behind, with mass closure of the abdomen using loop nylon sutures followed by skin closure with sutures or staples.

Various means are available for measuring operative and immediate postpartum blood loss to ensure that blood replacement is adequate[38]. At Queen's, all surgical swabs and sponges are weighed to quantify the blood loss at surgery. We commence blood replacement intraoperatively with the use of the cell salvage machine as guided by the estimation, the patient's vital signs and central venous pressure monitoring.

Postpartum management

After surgery in elective cases, the woman is transferred to either the delivery suite or the obstetric high dependency unit for close postoperative monitoring, further stabilization and care. In the acutely ill or where maternal condition has deteriorated during surgery, transfer to the intensive care unit is arranged for close monitoring, blood and fluid replacement, and correction of any acidosis, hypothermia, or coagulopathy.

Because postpartum hemorrhage is the commonest complication of morbid placental adherence, close observation of blood loss, abdominal drains and intensive monitoring of fluid input and output is crucial. Central venous pressure line monitoring helps reduce the well known underestimation of blood loss at surgery. Stable vital signs and a good hourly urine output are favorable prognostic signs.

Postoperative thromboprophylaxis

There is an increased risk of venous thromboembolism because of the prolonged operating time, heavy blood loss, the extensive pelvic dissection and tissue manipulation, and reduced mobility postoperatively. Prophylactic heparin should therefore be given[39]. We use pneumatic limb compression devices (Flowtron® boots) intraoperatively and administer prophylactic low molecular weight heparins postoperatively for 6 weeks.

SUMMARY AND CONCLUSIONS

We have discussed the contemporary diagnosis and management of MAPs against the background of the 5-year experience in our obstetric unit. Traditionally, management of MAP centered around hysterectomy[71], but recently the emphasis has changed to favor other, minimally invasive and fertility preserving options[41–46,52,79]. Although conservative management strategies carry a significant risk of maternal morbidity and mortality, they remain viable options that can be safely exercised.

Proper management should be based on accurate early diagnosis with appropriate perioperative multidisciplinary planning to anticipate and avoid massive obstetric hemorrhage at delivery. Previously novel treatment options and appliances such as the Bakri tamponade balloon and radiological transcatheter arterial embolization have rapidly acquired key management roles in the management of MAP.

Women at risk should be delivered at centers with appropriate expertise and resources for managing this condition. The evidence base for the management of MAPs is not always clear, leaving room for debate over some of the strategies recommended. Further clinical evidence and reports are needed to guide appropriate service planning, provide accurate information to support the counseling of women about the associated risks, and develop management guidelines to enhance patient safety.

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