Obstetrical and Pediatric Anesthesia

Massive hemorrhage in a previously undiagnosed abdominal pregnancy presenting for elective Cesarean delivery

[Hémorragie massive pendant la césarienne réglée chez une patiente dont la grossesse abdominale n'avait pas été diagnostiquée antérieurement]

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Purpose: To report a case of previously undiagnosed abdominal pregnancy diagnosed at the time of Cesarean section for persistent oblique lie. Delivery of the fetus was followed by near catastrophic hemorrhage. The management of massive hemorrhage in the context of the obstetric patient is discussed.

Clinical features: A 32-yr-old, ASA I primigravida was scheduled for elective Cesarean delivery at 38 weeks gestation under general anesthesia for a persistent oblique lie. On opening the abdomen, the extra-uterine position of the fetus became obvious. Delivery of the fetus was accompanied by torrential hemorrhage. A portion of the placenta was non-resectable and, following surgery, the patient was sent to the intensive care unit. The patient continued to lose blood and was returned to the operating room soon after. The abdomen was packed with large swabs and the wound left open. The hemorrhage continued and the application of military anti-shock trousers (MAST suit®) helped stem the loss. A total of 36 U of red cells, 20 U of fresh frozen plasma, 7 U of platelets and 10 U of cryoprecipitate were transfused perioperatively. Both the baby and the mother survived.

Conclusion: Massive hemorrhage in obstetric patients is a major test for the anesthetic and obstetric teams. As our experience shows, a multidisciplinary team based approach helped manage this crisis. Obstetric patients are often young and have great physiological reserve. In this case we feel that the MAST suit® significantly contributed to the positive outcome.

Objectif : Rapporter un cas de grossesse abdominale non diagnostiquée avant la césarienne devant être pratiquée à cause d'une présentation oblique persistante. L'accouchement a été suivi d'une hémorragie pratiquement catastrophique. Nous discutons du traitement de l'hémorragie dans le contexte obstétrical.

Éléments cliniques : Une primigeste de 32 ans, ASA I, devait subir une césarienne à 38 semaines de grossesse sous anesthésie générale à cause d'une présentation oblique persistante. La position extra-utérine du fœtus a été révélée à l'ouverture de l'abdomen. L'accouchement a été marqué par une hémorragie torrentielle. Une partie du placenta n'était pas résécable et, après l'opération, la patiente a été dirigée vers l'unité des soins intensifs. L'hémorragie étant incontrôlable, la patiente a été ramenée en salle d'opération peu après. L'abdomen a été rempli de grands tampons et la plaie laissée ouverte. L'hémorragie a continué et l'application de pantalon hypotenseur (MAST suit®) a limité les conséquences des pertes sanguines. Un total de 36 U de globules rouges, 20 U de plasma frais congelé, 7 U de plaquettes et 10 U de cryoprécipités ont été perfusés en période périopératoires. La mère et le bébé ont tous deux survécu.

Conclusion : L'hémorragie massive lors de l'accouchement représente tout un défi pour les équipes d'anesthésie et d'obstétrique. Notre expérience le montre, une démarche appuyée par une équipe multidisciplinaire facilite la résolution d'une crise. Les patientes d'obstétrique sont souvent jeunes et dotées d'une grande réserve physiologique. Ici, le MAST suit® semble avoir significativement favorisé l'heureux dénouement.

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ABDOMINAL pregnancies make up a small percentage of ectopic pregnancies.¹ Ectopic pregnancies are a common occurrence, but abdominal pregnancy on the other hand is a rare condition. In a seminal paper,² Atrash and colleagues estimated the incidence of abdominal pregnancy at 10.9 per 100,000 live births and 9.2 per 1,000 ectopic pregnancies in the United States. Abdominal pregnancies can be classified as 'primary' when fertilization takes place outside the uterine adnexae, or as 'secondary' (thought to be more common) believed to result from undetected rupture of a tubal pregnancy. Implantation can occur anywhere in the abdomen including ligaments, liver and spleen.

Case report

A 32-yr-old, ASA 1 primigravida, weighing 72 kg with persistent oblique lie in the third trimester of pregnancy, presented for elective Cesarean delivery at 38 weeks gestation. There was no past history of any medical illness, allergies, pelvic inflammatory disease (PID), history of abortions, surgery, or injury to pelvic organs. A routine ultrasound scan performed at 11 weeks was reported as normal. The first and second trimesters were uneventful. At 27 weeks she complained of "spotting of blood", but was otherwise well. She presented again at 32 weeks complaining of "pinkish discharge" not accompanied by abdominal pain. The fetus was healthy and was noted to be in a longitudinal lie. The patient was admitted overnight as a precaution and was asked to return in two weeks. It was during her subsequent visit (34 weeks gestation) that the oblique lie of the fetus was recorded for the first time. An ultrasound scan confirmed the position of the fetus while registering a normal growth. At 36 weeks the patient complained of pain in the midthoracic region (T10). A faint rash was seen and she was referred to the infectious diseases department where a diagnosis of herpes zoster was made. Acyclovir was commenced and she was asked to return the following week for another review. The fetus was noted to remain in an oblique lie. The following week (37 weeks) she complained of back pain radiating down to the left groin and on palpation of the abdomen it was difficult to identify the position of the fetus. The pelvis was empty. There was no uterine activity and the fetal activity was normal. A repeat ultrasound scan confirmed the oblique lie and the decision was made to deliver the fetus electively by Cesarean section at 38 weeks. An anesthetic opinion was also requested who, on the advice of the infectious diseases department, felt that a general anesthetic would be the safer option in view of the recent herpes zoster infection.

Two hours prior to surgery the patient was premedicated with oral ranitidine 150 mg. She also received 30 mL of 0.3 mol sodium citrate 20 min before she was taken to the operating room. Routine monitoring was established while a 16 g *iv* cannula was inserted and the mother was preoxygenated with 100% oxygen for two minutes. Anesthesia was induced with thiopentone 400 mg and suxamethonium 100 mg. Following intubation, anesthesia was maintained using an oxygen and air mixture (FiO₂ 0.5), isoflurane (Fi 2%) and atracrium.

The abdomen was opened using a Pfannenstiel incision. As soon as the peritoneum was divided a cystic swelling was seen. On further examination the fetus was noticed to be lying within the cyst. At this point it became obvious that the fetus was lying outside the uterus. The cyst was opened, the amniotic fluid aspirated and a live male infant weighing 3130 g was delivered. The Apgar scores were 2 and 7 at one and five minutes respectively. The infant was resuscitated and transferred to the special care baby unit. Delivery of the fetus was followed by torrential hemorrhage. The placenta was found to be attached to bowel, mesentery and had partially separated from its attachments. Senior help was sought immediately and a consultant general surgeon, vascular surgeon, consultant obstetrician and another consultant anesthesiologist were summoned. An immediate request was made for 10 U of uncross-matched type specific blood, 4 U of fresh frozen plasma and platelets. At this stage the blood pressure was unrecordable. The vascular surgeon secured a femoral venous line by cut-down technique. Fluids and blood were rapidly transfused via the femoral access using the Level-1® pressure infusor (Level-1 technologies, Rockland, MA, USA). Several minutes later the heart rate was 120 beats·min⁻¹ and systolic blood pressure was 50 mmHg. A 12F gauge right internal jugular venous line and peripheral *iv* cannula were also placed as more blood and fluids were infused. In the ensuing 60 min, a total of 18 U of red cells, 8 U of fresh frozen plasma (single donor units) and 1 U of platelets (a unit equals a maximum volume of 300 mL) were transfused in addition to 6 L of crystalloid (3 L of Ringer's lactate and 3 L of 0.9% saline) and 3 L of colloid (Haemaccel, Hoechst Marion Roussel Ltd, Middlesex, UK). Despite the massive transfusion of blood products and other fluids, the patient remained hypotensive and a noradrenaline infusion (4 mg in 50 mL normal saline) was commenced at 1 µg·kg⁻¹·min⁻¹.

Hemostasis was achieved eventually but a section of the placenta attached to the bowels and mesentery could not be resected. The abdomen was closed and the patient was transferred intubated to the intensive

TABLE Hematological testing, transfusion of blood products and their relation to intraoperative and postoperative events

<i>Time</i>	<i>Hb</i>	<i>Platelets</i>	<i>INR</i>	<i>APTT ratio</i>	<i>Fib</i>	<i>Transfusion</i>	<i>Event</i>
Preoperatively	11.2	158					
Intraoperative first results	9.3	21	1.6	3.2	1.3	10 uncrossmatched A neg RBC 6 A neg RBC 2 O neg RBC 8 FFP 1 Platelet in OR	Transfer to ICU
Repeat results in ICU	8.4	59	1.3	1.3	1.4	10 A neg RBC 8 FFP 10 Cryoprecipitate 4 Platelets in ICU	Taken back to OR after 90 min in ICU as patient remained unstable
ICU results after surgical re-exploration	7.9	125	1.4	1.3	1.6	6 A neg RBC 4 FFP	Hemorrhage continues MAST suit® applied in ICU
13 hr postoperatively	8.3	57	1.1	1.0	1.6	2 A neg RBC 2 Platelets	7 hr after re-exploration MAST suit® in place
21 hr postoperatively	11.8	123	1.1	1.0	1.7	None	Patient stable

Hb = Hemoglobin in g·dL⁻¹; Platelets in g·L⁻¹; INR = international normalized ratio; APTT = activated partial thromboplastin time; Fib = fibrinogen in g·L⁻¹; RBC = red blood cells; FFP = fresh frozen plasma; OR = operating room; ICU = intensive care unit. MAST = military anti-shock trousers.

care unit. However, she continued to lose blood from her wounds and the coagulation profile revealed an activated partial thromboplastin time ratio of 1.3, international normalized ratio of 1.3, fibrinogen 1.3 g·L⁻¹ and platelets $59 \times 10^9 \cdot \text{L}^{-1}$. A further 10 U of blood, 8 U of fresh frozen plasma, 10 U of cryoprecipitate and 4 U of platelets were transfused over the next 90 min. A pulmonary artery catheter was introduced and the wedge pressure was measured at 9 mmHg. The blood pressure remained labile and, as the abdomen became more distended, the patient was returned to the operating room.

On opening the abdomen there was bleeding from multiple sites consistent with coagulopathy. This was presumably due in part to massive blood transfusion and hemodilution of coagulation factors and, in part, to disseminated intravascular coagulopathy (DIC). However, specific tests to diagnose DIC were not obtained. The abdomen was packed with 16 large abdominal swabs to apply pressure on bleeding sites (22.5 cm × 22.5 cm) and the patient was returned to the intensive care unit with a laparostomy. A further 8 U of blood, 4 U of fresh frozen plasma and 2 U of platelets were transfused. Despite all efforts the patient continued to bleed from her wound site and an antishock suit [military antishock trousers-MAST® (David Clark Worcester, MA, USA)], was applied to

contain blood loss. Both the lower limb (one for each leg) and abdominal components were used. The limb components were applied first, followed by the abdominal component. The trousers were gradually inflated to a maximum pressure of 35 mmHg.

Over the next several hours the vital signs remained stable and with an improving coagulation profile (Table) her transfusion requirements decreased. The suit remained in place for a total of 36 hr before the limb component (both legs) was removed. This was followed about three hours later by the abdominal component.

The patient was taken back to the operating room for the third time and abdominal packs were removed and the wound closed. The noradrenaline infusion was discontinued soon after and the patient was extubated on the fourth postoperative day. A week later the patient became pyrexial (temperature 39°C) and was returned to the operating room for drainage of an infected wound hematoma. She remained in hospital for a further three weeks before being discharged home. A subsequent magnetic resonance imaging (MRI) scan performed three months later showed irregular opacities at the site of the retained placenta and a small right ovarian cyst was also seen. Both the mother and the baby are currently healthy.

Discussion

There have been many causes of abdominal pregnancy described.¹ Everything from PID, repeated abortions, low socio-economic status and poor or absent antenatal care have been implicated as etiological factors. The incidence appears to be higher in third world countries and in the Afro-Caribbean population. This patient fell into none of the aforementioned categories and had had regular antenatal visits.

Abdominal pregnancy poses a grave threat to the survival of both the mother and the fetus. Hence it is important the diagnosis is made early in pregnancy. Maternal mortality ranges between 0 to 30%.³ This is primarily because of the risk of massive hemorrhage from partial or total placental separation. The placenta can be attached to the uterine wall, bowel, mesentery, liver, spleen, bladder and ligaments. It can detach at anytime during pregnancy leading to torrential blood loss. The fetal outcome tends to be worse than the mother's with perinatal mortality ranging between 40 to 95%.⁴ Fetal abnormalities are also high with several congenital malformations being common.³ Fetal outcome tends to be better with advanced pregnancy and if the fetus is surrounded by a normal volume of amniotic fluid.³ This certainly appears to have been the case in this patient.

The diagnosis of abdominal pregnancy is difficult. Ultrasound, when coupled with clinical evaluation, has roughly a 50% success rate in the diagnosis of abdominal pregnancy.¹ An MRI scan can also be used to confirm the diagnosis of abdominal pregnancy.⁵ Laboratory tests, such as abnormally increasing human chorionic gonadotrophin, are not sufficiently reliable on their own to make a diagnosis, as are signs and symptoms such as abdominal pain and tenderness, palpable fetal parts and persistent transverse or oblique lie.¹ Our patient certainly complained of abdominal pain radiating to the top of her left leg and had a persistent oblique lie. Ultimately the diagnosis requires experience and a high index of suspicion on the part of clinicians.

The management of abdominal pregnancy is the same whether it is primary or secondary. Once a diagnosis is made, it is best to refer the patient to a tertiary hospital with well-equipped adult and neonatal intensive care units. The regional blood bank should be made aware of the potential problem. The mother should be informed of the grave risks involved to herself and her baby and should be closely monitored throughout pregnancy.

Debate continues as to how best provide care for these patients. If the fetus is alive and is less than 24 weeks old, early operative intervention is recommended in order to reduce or avoid the risk of massive hemor-

rhage in the mother.¹ On the other hand if it is undiagnosed and if the pregnancy is over 24 weeks, it has been recommended that the pregnancy be allowed to progress, but close monitoring of the patient in hospital is necessary.¹ Allowing the pregnancy to continue holds inherent risks and one has to balance the benefit of allowing the fetus to develop against the risk of catastrophic hemorrhage in the mother. The patient should be closely involved in the decision making process.

Undiagnosed advanced abdominal pregnancies are an enormous challenge. Massive hemorrhage is common and occurs when the abnormally located placenta separates from its attachments. In this case catastrophic blood loss was not expected and the patient nearly exsanguinated. It was only following the placement of a large bore femoral line to allow the rapid transfusion of fluids and blood products that the patient's condition improved.

Placental management following delivery is controversial. Removal of the entire placenta has been recommended if possible.¹ However, if this is going to be difficult and accompanied by significant blood loss, it is safer to leave the whole or part of the placenta behind and allow it to resorb slowly. This has its risks, such as secondary hemorrhage, infection, intestinal obstruction and preeclampsia/eclampsia and the risk of re-intervention in a critically ill patient.³ This patient had part of the placenta left behind. She developed an infection a week later, but fortunately it turned out to be an infected wound hematoma.

If hemorrhage is intractable, the management is similar to that described for postpartum bleeding from any other cause.⁶ Packing the abdomen and/or pelvis with large swabs may help reduce or control blood loss by applying direct pressure over bleeding areas. If packing fails, then the feeding blood vessels i.e., uterine artery or hypogastric artery can be ligated at surgery or the bleeding vessels may be embolized in the radiology department. This was not a feasible option in this case as the placenta was attached to multiple structures. Other techniques reported include direct pressure on the aorta to identify bleeding vessels that can be ligated, and application of the MAST suit®.

The MAST suit® has been used in both prehospital and hospital situations to control hemorrhage. There are reports of its use in obstetric and gynecological hemorrhage.^{7,8} The suit has three components, one for each leg and an abdominal part. It can be applied within a few minutes and is held together by Velcro®. The suit is gradually inflated to a maximal pressure of 100 mmHg. The usual range is between 20 to 40 mmHg. Its application, in the patient described, resulted in a significant rise in blood pressure and bleeding stopped

almost immediately. Controversy exists as to the exact mechanism of action. The MAST suit® increases the peripheral resistance and has been shown to compress the inferior vena cava and limb vessels, promoting venous return. It also redistributes blood to vital organs and aids autotransfusion of blood from the splanchnic bed. Use of the MAST suit® has also been reported in patients with massive hemorrhage following abdominal pregnancy.⁹

As the patient continued to lose blood in the intensive care unit, a MAST suit® was applied. The pressure was increased gradually to 35 mmHg. The suit was left in place for 36 hr before being removed just prior to the patient's third visit to the operating room. It is difficult to say what role the suit actually played in this case. Given the patient was continuing to lose blood despite abdominal packing and the massive transfusion of blood and blood products, our observation suggests that the MAST suit® contributed to the successful outcome.

In summary, massive hemorrhage in obstetric patients is a major test for the anesthetic and obstetric teams. If diagnosis is made at surgery, we would recommend delaying delivery of the fetus until the necessary precautions are in place. This includes securing one or more large bore *iv* accesses, an arterial line, adequate blood and blood products, and the required surgical expertise. As our experience shows, a multidisciplinary team based approach helped manage this crisis. Obstetric patients are often young and have great physiological reserve. In the present case, we feel that the MAST suit® contributed significantly to the positive outcome.

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