

Placenta Accreta: Management by Peridural Anesthesia

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Running title: Peridural Anesthesia in Placenta Accreta surgery

Introduction

As a consequence of the extensive use of cesarean sections, the incidence of placenta accreta spectrum (PAS) disorders, characterized by abnormal invasion of trophoblastic tissue through the myometrium and uterine serosa, has been growing considerably¹. This condition exposes mothers to the risk of massive bleeding (average blood loss ~2-5 L²) and death. The maternal mortality rate in its most severe form (placenta percreta) is reportedly 7%³.

The most recent guidelines⁴ suggest producing in-hospital protocols that are shared among all involved professionals and establishing a step-by-step plan, from ultrasound-based detection of placenta previa to post-surgery management.

Our internal protocol

The present article intends to share the internal protocol developed in our center, Villa Sofia-Cervello Hospital, Palermo, Italy (Figure 1).

Our hospital meets the criteria outlined by the American College of Obstetricians and Gynecologists (ACOG) and the Society for Maternal-Fetal Medicine to provide the most appropriate level of maternal care required for the management of PAS disorders⁴. This article focuses on the anesthesiologic management of the procedure, while the surgical management is not detailed herein.

From diagnosis to surgery

Table 1 describes the steps we follow from diagnosis to surgery. In particular, early diagnosis allows for a multidisciplinary team, careful tailoring of the management plan, and adequate preparation of the elective cesarean section and subsequent hysterectomy.

Anesthesiology management

To date, there is no consensus on the best type of anesthesia in cases of complete placenta previa with suspected accretism. However, historically, the most frequently used technique is general anesthesia⁸, which is generally preferred because it reduces the mother's anxiety, allows the anesthetist to concentrate on the hemorrhage and cardiovascular stability, and avoids the risk of hemodynamic instability due to an urgent shift (due to hemorrhage) from locoregional to general anesthesia.

Our internal protocol, which indicates general anesthesia in emergency regimens, provides the use of peridural anesthesia not only during birth but also during the hysterectomy, considering the shift to general anesthesia in case of emergency (bleeding or hemodynamic instability). From our point of view, several beneficial effects may be achieved with peridural analgesia, such as:

- reduced risk of Mendelson syndrome;
- better post-surgery pain control;
- no risk of awareness;
- no risk for the fetus being exposed to the effect of general anesthetics;
- participation of the mother in the birth of her baby;
- continuous monitoring of the patient's level of consciousness, which indicates the level of brain perfusion and, thus, of hemodynamic status;
- abolition of the side effects of general anesthetics, such as the reduction of the uterine tone and platelet functionality.

Comparing the current state of the art with that of the past, the pivotal role of the interventional radiologist is apparent in reducing the vascular inflow to the operating field and, in case of hemorrhage during the hysterectomy, to stop the bleeding⁶. Therefore, it is now possible to use locoregional anesthesia in obstetrics to have good outcomes, such as reduced bleeding, reduced use of blood products in the major obstetric hemorrhages, and better management in post-surgery pain therapy. Finally, we chose peridural anesthesia over combined spino-epidural technique because the peridural catheter is placed in the obstetrics operating room 60 minutes (radiological time) before the skin incision in the interventional radiology room. Therefore, the maximum effect of spinal anesthesia would begin to decrease. In our experience, the peridural anesthesia has a reduced hemodynamic effect compared with the spino-epidural technique.

During the entire procedure, two anesthetists from the dedicated group of obstetrics are present.

Obstetric operating room

The patient was prepared in the obstetrics operating room after fasting for at least 8 hours. During this phase, the anesthesiologists explained the procedure step by step to the patient. Two large peripheral veins are cannulated with 16 G or 18 G cannulas. Antibiotic prophylaxis and 7 ml/kg saline (to replace fluids lost through fasting) are administered. While maintaining the absolute sterility of the operating field, the skin is disinfected. Cutaneous wheal is formed using 4-6 mL of 2% lidocaine. The peridural space is identified, generally at the L2-L3 level, using the loss-of-resistance technique. The **peridural catheter** (16 or 18 G) **is placed** on the patient in a sitting or lateral position on the operating bed, while electrocardiogram (ECG), oxygen saturation, and noninvasive blood pressure (NIBP) are monitored. Once the peridural space is identified, the catheter is introduced in the cranial direction approximately 3 cm beyond the bevel of the Tuohy needle. The aspiration test (to rule out the presence of blood or liquor) and dose test are performed with 2 ml of 2% lidocaine. Afterwards, the catheter is attached to the skin. The operating room cart is

prepared (Supporting Information 2) by nurses supervised by the anesthetist. Finally, the patient and the cart are moved to the interventional radiology room.

Interventional radiology room

Time 1

The patient is placed on an X-ray transparent operating bed and warmed up with a thermal mattress. The equipment and devices to be used in the radiological procedure are already in this room (digital angiograph, C arch), as well as the respirator and the dedicated space for the neonate. Colloids (10 mL/kg) are infused intravenously and vital parameters are monitored. Subsequently, two boluses of 14-18 mL of 0.75% **ropivacaine** (105-135 mg) and **fentanyl** 50 γ are administered 7-8 minutes apart to avoid hypotensive episodes. **Radial artery** cannulation is performed to monitor the arterial pressure during the whole surgical intervention and for serial arterial blood gas analysis before and after the surgery (to monitor hemoglobin levels and metabolic status). A central venous catheter is also placed in case of difficult access of other peripheral veins. A **wedge** is placed under the right hip of the patient to avoid compression of the uterus on the vena cava. While waiting for the maximum effect of anesthetics, invasive blood pressure, oxygen saturation, electrocardiogram, and body temperature are monitored, and a pre-surgery arterial blood gas analysis is performed. After approximately 15 minutes, the Pin Prick test is done to evaluate the anesthetic plan of the central block in terms of depth, width, and symmetry. Hollmen and Bromage scales are useful in the assessment of the dermatomal level achieved. When the anesthetic plan reaches the T4-T5 dermatomal level and the Hollmen scale is 3, urinary catheterization may be performed, and the radiological-vascular time starts with the placement of **endovascular catheters in the hypogastric arteries**.

Time 2

Once the radiological examination is completed, **cesarean section** is performed, generally using a supra-umbilical-pubic incision. The patient is then awake, has no pain, and participates in the birth of her child. After extraction, the premature fetus is handed to the neonatology team. The mother is given uterotonic agents intravenously to trigger uterine contraction, facilitate the possible placental stage, and reduce further blood loss.

Time 3

If the placenta is not delivered, morbid placenta adhesion is confirmed. Therefore, the obstetric team performs the riskiest phase of the surgery: **hysterectomy**. In this phase, in order to reduce the mother's anxiety, a **mild sedation** may be administered with i.v. benzodiazepine (midazolam) and, in the absence of apparent hemorrhage signs, after several minutes, a 1.5 mg/kg bolus of i.v. propofol may be slowly administered (over approximately 90 seconds) so that the patient can breathe spontaneously with a Ventimask (40%, O₂ flow 8 L/min). Subsequently, a continuous infusion of propofol may be given (1.5-3 mg/kg/h). Sedation has some advantages:

- the patient does not feel possible visceral pain due to traction and adherence to previous surgeries;
- it strengthens the status of controlled hypotension, further reducing intraoperative bleeding; and
- it allows for an easier shift to general anesthesia, if necessary.

Time 4

The last part of the procedure is proper **evaluation of the possible hemorrhages**. For the management of hemorrhagic emergency, in accordance with the current guidelines of the Italian Ministry of Health¹⁰, an operative protocol was drawn up and is followed (see Supporting Information 3). Finally, the **possible referral to ICU** is considered, taking into account the amount of bleeding, the type of anesthesia, the length of surgery, the hemodynamic stability, and the level of consciousness. Otherwise, after suturing the abdominal belt, sedation is suspended, with **awakening** of the patient in a very short time.

Post-surgery monitoring

After surgery, patients remain under observation in the recovery room in the obstetrics and gynecology unit, where they are monitored and warmed up, assisted by an anesthetist, a midwife, and a nurse. All parameters are registered in the medical record. After 4 hours, if the vital parameters are within the normal range, the Aldrete score is 9-10, and the numerical rating scale (NRS) is 2, the patient is moved to the ward, where the monitoring can be continued. The blood count is controlled every 4 hours in the first 12 hours, and subsequently every 8-12 hours, according to hemoglobin and hematocrit levels. For the first 6 hours after surgery, continuous pressure monitoring is performed, in addition to pulse oximetry, urine output measurement with fluid balance, thromboelastography, serum electrolytes test, and kidney function tests.

Post-surgery pain control

For the 24/48-hour peridural pain management, we follow the protocol reported in Supporting Information 4. Briefly, pain management is administered via the pump for programmed intermittent epidural bolus (PIEB), through which boluses of 8-12 ml of 0.1% ropivacaine (hourly) and acetaminophen (at established times) are administered. The peridural catheter is removed on the third day, 12 hours after the last low-molecular-weight heparin administration, and upon assessment of possible alterations in coagulation status.

Conclusions

The efficiency of this protocol lead to our becoming a reference center for the management of placenta accreta beyond the borders of our region. Logistically, the process is made easier because all the operative units involved are located in the same building.

In these high-risk patients, some elements were very important:

- early prenatal diagnosis;
- referral of patients in qualified hospitals with expertise in the management of such conditions;
- involvement of a multidisciplinary team;
- right surgical timing;
- proper peri-surgery management.

Using the protocol described, we treated more than 20 patients, some of them with the most severe forms of PAS disorders (placenta increta and percreta). We obtained positive results in terms of bleeding, packed red blood cells used, postoperative sequelae, and UTI admissions. No patients died. Most patients had a previous cesarean section.

Few procedures were carried out in an emergency regimen, where general anesthesia was used. Consistent with literature⁸, they required the greatest amount of blood products. However, based on our experience for both elective and emergency surgeries, fibrinogen administration considerably reduced the need for PRBC. Among those treated with an elective regimen, blood loss never exceeded 1800 mL.

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Contribution to Authorship

FC: Conceptualization, preparation, manuscript review, and editing. GC: Supervision, manuscript review.

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Tables

Table 1. Management steps from the diagnostic suspicion to the surgery

Steps	Description
Ultrasonography	Routine ultrasonography, ideally performed before the third trimester (22-32 weeks) ⁵ , allows identification of the first signs of PAS disorders; after an obstetric-gynecological consultancy, a re-evaluation from two experienced sonographers is required
Magnetic resonance imaging	Magnetic resonance imaging is indicated to confirm the diagnosis and better delineate the degree of trophoblastic invasion and its correlation with the anastomotic system of vessels in that area ⁶
Involvement of a multidisciplinary team and planning	After diagnosis confirmation, the delivery should be planned, with the involvement of a multidisciplinary team, including a gynecologist, anesthesiologist, neonatologist, urologist, and interventional radiologist, in addition to obstetricians and nurses ⁷ , that will follow the patients up to the end of post-surgery monitoring and manage pain control. Elective cesarean section is recommended at 36-37 weeks ⁸ in asymptomatic women, in case of suspicion or diagnosis of PAS disorder, with respiratory distress syndrome prophylaxis. However, the exact timing is tailored for each pregnant woman by the gynecologist, who evaluates the risks for the mother and the gestational age of the fetus
Preoperative anesthetic examination and informed consent	During the preoperative anesthetic examination, the anesthesiologist first meets the patient and assesses general condition, airways, venous accesses, vertebral column status, and hemodynamic stability (Supporting Information 1); finally, the patient is given the score according to the American Society of Anesthesiologists (ASA) classification ⁹ . In this first visit, the anesthesiologist establishes a relationship based on trust, explains the phases of surgery in detail, and collects the informed consent, which includes all the possible interventions and complications (hysterectomy, lesions to the surrounding organs, need for blood product transfusions, admission in the Intensive Care Unit [ICU])
Multidisciplinary discussion	A multidisciplinary discussion takes place to coordinate the health professionals involved in the management of the patient.

Steps	Description
Transfusion service and ICU alerted	About 3 days before surgery, the transfusion service should also be alerted: 4 units of packed red blood cells (PRBC) should be stocked in the blood bank of the operating room the day of surgery and further 4 units should be stocked on the hospital transfusion center. In addition, 6 g of fibrinogen and tranexamic acid should be available in the operating room. ICU is alerted to reserve a bed in case of need

Figure Caption List

Figure 1. Summary of the internal protocol for the management of placenta accreta spectrum disorders in the Villa Sofia-Cervello Hospital, Palermo, Italy

