Neuraxial block for EXIT procedure (ex utero intrapartum treatment) - A case report and literature review

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Abstract

Introduction: The ex utero intrapartum treatment (EXIT) involves the partial removal of the fetus from the uterine cavity during a cesarean section while maintaining placental circulation and oxygenation. This procedure is indicated when we expect a difficult access to the respiratory airway. **Clinical Case:** A 33-year-old female patient, with 35.4 weeks of pregnancy and a diagnosis of placenta accreta and a fetus with Bochdaleck's diaphragmatic hernia diagnosed by prenatal ultrasound, was scheduled for elective cesarean with the EXIT procedure. The chosen anesthetic technique for the patient was neuraxial anesthesia. **Conclusion:** The EXIT procedure is a challenge for the anesthesiologist, and they should be aware and prepared for the physiological changes of pregnancy and uteroplacental physiology. This case demonstrates that even though the preferred technique in the EXIT procedure is general anesthesia, it can also be performed effectively and safely under a neuraxial technique with invasive monitoring.

Key words: Ex utero intrapartum treatment procedure. Obstetric anesthesia. Neuraxial technique. Congenital malformations.

Introduction

The "ex utero intrapartum treatment" (EXIT) consists of the partial extraction of the fetus from the uterine cavity through a C-section procedure while circulation and oxygenation are maintained through the placenta. This is indicated when difficulties in airways are detected, as in the case of airway anomalies and/or congenital malformations¹. This procedure was first described in the late 1980s for the treatment of patients with a large head and neck malformations and a high potential for difficult airway management, although back then it was known as fetal surgery with placental bypass^{2,3}. Today, indications for EXIT are on the rise, and its anesthetic management varies between balanced general

anesthesia and a neuraxial block. We present a case report of a patient at the "Dr. Jose E. González" University Hospital at the Autonomous University of Nuevo Leon (UANL by its Spanish acronym) who underwent an EXIT procedure under neuraxial blockade.

Clinical case

A 33-year-old female, with a body mass index of 28.9, multiple gestations (1 C-section and one interrupted), 35.6 weeks pregnant, attended for an elective C-section, with a diagnosis of placenta accreta and a fetus with a Bochdaleck's diaphragmatic hernia diagnosed by prenatal ultrasound. The decision to perform

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the EXIT procedure was made by the obstetric and pediatric services working together, as a result of the severity of the case. A day before the procedure, a pre-operative assessment was performed by the anesthesiology service, where they found two previous surgeries in the patient's history (cholecystectomy and gastric sleeve). No further findings of pathological data which might interfere with the surgical procedure were reported in the rest of the questionnaire, physical exploration, and laboratory work (Table 1).

The decision to put the patient under a continuous epidural blockade and intravenous (IV) sedation was made on the day of the surgery. Previous to the epidural blockade, the patient was medicated with ranitidine 50 mg, metoclopramide 8 mg, dexamethasone 10 mg, and prophylactic antibiotic therapy with 2 g of cephalothin, all intravenously. Once monitored, a radial arterial line was placed before local anesthesia and was maintained with supplementary oxygen using a face mask at 5 L/min. Subsequently, the patient was placed adequately to have a left uterine displacement. Furthermore, 400 mg of lidocaine with epinephrine was applied through an epidural. Contemplating abundant bleeding caused by placental accretism, the patient was pre-hydrated with 3000 ml of Hartmann's solution before the extraction of the product. To accomplish an adequate sedation on the product and perform the EXIT procedure satisfactorily, IV sedation with fentanyl 300 mcg and midazolam 3.5 mg was administered previous to the uterotomy without causing the patient a respiratory depression nor compromising maternal airways. Subsequently, three rescue doses of IV ephedrine 5 mg were required to maintain mean blood pressure (≥ 65 mmHg) on the patient. After an adequate uterine relaxation was confirmed, the uterotomy took place, extracting the product partially and intubating it by the neonatologist through a direct laryngoscopy using a Miller blade 0. Subsequently, the umbilical cord was clamped to continue with the surgical procedure as planned and the product went on to the intensive care unit.

Since the plan was a hysterectomy due to a placenta accreta, no oxytocin was administered to have an adequate uterine relaxation, thus avoiding abruptio placentae. The surgical procedure concluded with a total bleeding of 3400 ml. Consequently, during the entire procedure, the patient was sustained with 1000 ml of colloid solution, 5000 ml of crystalloid solution, five packed red cell transfusions, four packs of plasma, and four packs of platelet concentrates, keeping the patient hemodynamically stable during the entire surgery, with

Table 1. Cabinet studies of the patient before neuraxial block for the EXIT procedure.

Study	Result	Reference values
Blood count		
HGB	11 g/dL	12.2-18.1
HCT	34.9 %	37.7-53.7
MCV	89.9 fL	80-97
MCH	28.3 Pg	27-31.2
MCHC	31.4 g/dL	29.9-34.2
WBC	9.25 K/uL	4-11
NEU	5.91 K/uL	2-6.9
LYM	2.65 K/uL	0.6-3.4
EOS	0.105 K/uL	0-0.7
BASO	0.066 K/uL	0-0.2
PLT	192 K/uL	142-424
Coagulation times		
TP	11.4 Seg	9.9-12.3
Control	11.3 Seg	
INR	1.03	
Control	1.02	25.2-36
TTP	32.1 Seg	
Control	30.4 Seg	
Clinical chemistry		
GLU in blood	75 mg/dL	60-100
BUN in blood	9 mg/dL	7-20
Cr in blood	0.4 mg/dL	0.6-1.4

HGB: hemoglobin, HCT: hematocrit, MCV: mean corpuscular volumen, MCH: mean corpuscular hemoglobin, MCHC: mean corpuscular hemoglobin concentration, WBC: white blood cells, NEU: neutrophils, LYM: lymphocytes, EOS: eosinophils, BASO: basophils, PLT: platelet, TP: total protein, TTP: thrombotic thrombocytopenic purpura, GLU: glucose, BUN: blood urea nitrogen, Cr: creatinine.

a surgical time of 4 h. It is worth noting that the total amount of time from the incision of the skin to the hysterectomy was 54 min and the total amount of time from the amniotomy until full delivery of the product was 8 min. The patient was placed in the post-surgical recovery room without complications, and morphine 1.4 mg was utilized epidurally for post-operative pain management.

Discussion

The EXIT is a technique designed to establish a safe airway during delivery in products with risk of airway obstruction or congenital malformations, securing the airway through a laryngoscopy, fibroscopy, or tracheostomy before placenta-fetal separation. This consists of maintaining maternal-fetal oxygenation, without umbilical cord section, and controlling the obstruction while a new permeable airway is created^{4,5}. This procedure has been described as harmless for up to 60 min; however, there are reports of cases with a longer duration without complications, neither for the mother nor the product⁴. Anesthetic goals for this

procedure include having a proper uterine relaxation, fetal anesthesia for airway manipulation, and maintaining a permeable maternal-fetal circulation⁶. Anesthetic management of patients who undergo this procedure has also evolved, with a variety of strategies described in the literature. The ideal technique for the EXIT procedure is a C-section under general anesthesia, accomplishing a uterine relaxation with tocolytics such as magnesium sulfate or nitroglycerin and with aggressive management of liquids or vasopressors to avoid hemodynamic instability⁷. Nevertheless, neuraxial anesthesia can also be considered, always keeping in mind the most common complication, which is bleeding linked to uterine atony caused by the administration of tocolytics^{8,9}. Regardless of the technique used, invasive monitoring is highly recommended to have proper control of the patient and the product^{7,8,10,11}.

To be able to perform an EXIT procedure successfully, it is necessary to accomplish proper fetal anesthesia to have an adequate handling of the airways. This is achieved with transplacental anesthetic agents previously administered to the patient¹². In case of sub-optimal anesthesia, this can be handled with IV or intramuscular medications directly on the fetus^{7,8,11}. The anesthetic management of choice in our case was neuraxial anesthesia, obtaining favorable results. Even though this technique is not the golden choice for this type of procedure, there are reports of previous cases where this technique was utilized with satisfactory results^{1,7,9,13}. This reduces the risk of bronchoaspiration and failure in intubation, which are the most frequent complications that general anesthesia brings to the table¹⁴. In our case, a proper uterine relaxation was accomplished without the need to utilize tocolytic agents, maintaining a systolic pressure of >129 mmHg in the patient (with the use of ephedrine, crystalloids, and colloids) and accomplishing placental perfusion.

In a study by Miyakoshi et al., safe administration of IV sedation in obstetric patients was reported¹⁵. In our case, we too were able to accomplish proper sedation without hypoventilating the patient nor compromising the airways. Moreover, fetal sedation was achieved and verified through the absence of reaction during direct laryngoscopy and orotracheal intubation, due to the transference of anesthetic agents previously administered through maternal circulation.

Usually, 10 UI (range 3-40 UI) of oxytocin is administered to avoid uterine atony and postpartum hemorrhage¹⁶. Due to the complexity of our case, where the plan was to perform a hysterectomy for placenta accreta, the decision to not administer this medication on the patient

was made by the obstetrics and anesthesiology services, thus avoiding placenta abruption. Although there was more bleeding than that estimated in a conventional C-section (3400 ml), management with ephedrine, hemoderivatives, crystalloids, and colloids was enough to keep the patient thermodynamically stable.

Conclusion

The EXIT procedure is a technique which is increasingly being used for congenital fetal anomaly treatment during delivery. These cases represent a challenge for the anesthesiologist and require a deep understanding of the physiological changes of pregnancy, placenta-uterus physiology, and the effects of the selected pharmacological agents. Uterine relaxation, uteroplacenta perfusion maintenance, and maternal-fetal cardiovascular compromise prevention are key factors to consider during this procedure. These cases show that although the technique of choice for the EXIT procedure is general anesthesia, we could also perform it effectively and safely under a neuraxial blockade with invasive monitoring.

Conflicts of interest

The authors declare not to have any conflicts of interest.

Financing

There was no financial support.

Ethical disclosures

Protection of human and animal subjects. The authors declare that no experiments were performed on humans or animals for this study.

Confidentiality of data. The authors declare that no patient data appear in this article.

To privacy and informed consent. The authors have obtained the written informed consent of the patients or subjects mentioned in the article. The corresponding author is in possession of this document.

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