



# REVISTA BRASILEIRA DE ANESTESIOLOGIA

Official Publication of the Brazilian Society of Anesthesiology  
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## CLINICAL INFORMATION

# Anesthesia for ex utero intrapartum treatment: renewed insight on a rare procedure

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Received 29 October 2013; accepted 4 December 2013

Available online 10 January 2014

### KEYWORDS

Airway – obstruction;  
Anesthesia – fetal;  
Anesthesia –  
obstetric;  
Cervical  
lymphangioma;  
EXIT

**Abstract** The ex utero intrapartum treatment is a rare surgical procedure performed in cases of expected postpartum fetal airway obstruction. The technique lies on a safe establishment of a patent airway during labor in anticipation of a critical respiratory event, without interrupting maternal–fetal circulation.

Anesthetic management is substantially different from that regarding standard cesarean delivery and its main goals include uterine relaxation, fetal anesthesia and preservation of placental blood flow.

We present the case of an ex utero intrapartum treatment procedure performed on a fetus with a large cervical lymphangioma and prenatal evidence of airway compromise. Modifications to the classic ex utero intrapartum treatment management strategies were successfully adopted and will be discussed in the following report.

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### PALAVRAS-CHAVE

Vias aéreas –  
obstrução;  
Anestesia – fetal;  
Anestesia –  
obstétrica;  
Linfangioma cervical;  
EXIT

### Anestesia para tratamento ex-útero intraparto: visão renovada sobre um procedimento raro

**Resumo** O tratamento ex-útero intraparto é um procedimento cirúrgico feito em casos raros de obstrução esperada das vias aéreas fetais no pós-parto. A técnica tem como base o estabelecimento seguro de vias aéreas permeáveis durante o trabalho de parto em antecipação a um evento respiratório crítico, sem interromper a circulação materno-fetal.

O manejo anestésico é substancialmente diferente daquele destinado à cesariana padrão e tem como principais objetivos o relaxamento uterino, a anestesia fetal e a preservação do fluxo sanguíneo placentário.

Apresentamos o caso de um procedimento para tratamento ex-útero intraparto feito em feto com um grande linfangioma cervical e evidência pré-natal de comprometimento das vias

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aéreas. As modificações das estratégias adotadas no tratamento ex-útero intraparto clássico foram feitas com sucesso e serão discutidas no relato a seguir.

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## Introduction

The ex utero intrapartum treatment (EXIT) is a rare surgical procedure performed to ensure fetal airway patency during labor in situations of expected severe, potentially life-threatening respiratory failure secondary to airway obstruction.

Also known as operation on placental support<sup>1</sup> (OOPS) and airway management on placental support<sup>2</sup> (AMPS), EXIT surgery was first described in the late 1980s by Norris and colleagues<sup>3</sup> and was initially performed in tracheal occlusion reversion protocols for fetuses with congenital diaphragmatic hernia.<sup>4,5</sup> The indisputable usefulness of this technique later extended its applicability to a variety of obstetric clinical scenarios,<sup>6–8</sup> including fetal head and neck tumor surgical approaches.<sup>9</sup>

The procedure consists of a partial cesarean section with simultaneous maintenance of placental circulation as a way to preserve fetal gas exchanges during the establishment of a definitive airway through direct laryngoscopy, bronchoscopy, or tracheostomy.

The anesthetic approach is significantly different from a conventional cesarean section and involves a deep volatile anesthesia with maximum uterine relaxation, preservation of uteroplacental blood flow and fetal anesthesia.

The success of an EXIT depends on a rigorous strategic planning with involvement of a multidisciplinary team where the anesthesiologist often takes the leadership role.

In our report we describe the anesthetic management of a parturient scheduled for EXIT surgery after prenatal diagnosis of cervical lymphangioma with mediastinal involvement, highlighting both fetal and maternal singularities in the light of current clinical practice.

## Case report

A healthy 25-year-old woman, gravida 1, para 0, was scheduled for elective EXIT at 38 weeks of gestation due to a prenatal ultrasound diagnosis of fetal cervical lymphangioma with tracheal deviation and risk of postdelivery airway compromise.

Preparation for the procedure involved a multidisciplinary team of anesthesiologists, obstetricians, neonatologists, pediatric surgeons, otolaryngologists and pulmonologists. Several preliminary meetings were held and every stakeholder's role and positioning in the operating room were clearly defined.

Anesthesia material, room temperature, blood grouping, hemoderivatives availability and both neonatology and postanesthetic care unit vacancies were all preoperatively confirmed.

Additional pharmacological preparation included tocolytic support with intravenous nitroglycerin solution at a concentration of 50 mg mL<sup>-1</sup> and drugs for supplementary intramuscular fetal anesthesia: fentanyl 10 µg kg<sup>-1</sup>, vecuronium 0.2 mg kg<sup>-1</sup> and atropine 100 µg, with a total volume of 2 mL.

Standard monitoring was applied with the parturient in supine and left lateral tilt position under manual uterine displacement. Two intravenous 16G lines were placed and urinary catheterization was performed.

Balanced general anesthesia was initiated after premedication with fentanyl 2 µg kg<sup>-1</sup>. Rapid sequence induction was performed with propofol 2 mg kg<sup>-1</sup> and rocuronium 1.2 mg kg<sup>-1</sup>, followed by endotracheal intubation and mechanical ventilation in volume-controlled mode. A radial artery catheter was placed for invasive blood pressure monitoring. Anesthesia was maintained with low-dose desflurane and nitrous oxide in oxygen mixture. Goal-directed fluid therapy was managed with crystalloids.

Surgery began with a low segmental abdominal incision and hysterotomy followed by fetal cephalic extraction up to the nipple line. Warm Hartmann's solution amnioinfusion was further initiated. The fetus' airway was exposed and evaluated by the neonatologist and tracheal intubation successfully achieved after a single attempt.

After full extraction the newborn was stabilized and transported in a neonatal incubator under mechanical ventilation to the neonatology unit. Total placental bypass time was 4 min and 46 s. Amnioinfusion was discontinued and uterine hypotonicity effectively reversed with oxytocin and volatile concentration reduction.

The parturient remained hemodynamically stable throughout the procedure with MAP > 70 mm Hg, equivalent to preoperative records. Anesthesia emergence progressed uneventfully. Intravenous analgesia was performed with paracetamol, ketorolac and tramadol and nausea and vomiting prophylaxis with droperidol.

## Discussion

The ideal constitution of a multidisciplinary team intervening in an EXIT surgery is not consensual<sup>6,10,11</sup> and depends on the nature and purpose of the surgery: EXIT-to-airway, EXIT-to-ECMO or EXIT-to-resection.<sup>11</sup>

In this case six medical teams were involved. Anesthesiology, obstetrics and neonatology were directly involved in the procedure. Additional participation of pulmonology, otolaryngology and pediatric surgery teams was justified by their assistance in the event of a difficult laryngoscopic approach to execute a bronchoscopic intubation,

establish a surgical airway or perform a partial tumor resection.

The two main physiological goals during EXIT are uterine hypotonicity preservation – which facilitates partial extraction of the fetus and prevents placental dissociation – and placental perfusion pressure conservation that ensures fetal oxygenation.<sup>1–15</sup>

Although associated with higher rates of morbidity and mortality among global obstetric population,<sup>12</sup> general anesthesia is usually favored over regional techniques in this procedure. Although not contraindicated, regional anesthesia presents important disadvantages regarding the cited precepts, particularly the risk of severe hypotension and placental hypoperfusion.<sup>8</sup> Aside from its contribution to an adequate uterine relaxation, general anesthesia allows simultaneous induction of both mother and fetus through placental penetration of anesthetic agents.

Maternal blood pressure must be kept within the limit of 10% of baseline.<sup>7,11</sup> As a result, anesthesia induction should be performed with the lowest possible hemodynamic repercussion, ideally under continuous blood pressure monitoring. Induction without consideration for fetal respiratory depression or time restriction to the expulsion helps to moderate the hypotensive effect of general anesthetics.

Contrary to the classic recommendation of deep inhalational anesthetic maintenance,<sup>6,13</sup> the use of 0.5–1.0 halogenated minimum anesthetic concentration (MAC), supplemented if necessary by a tocolytic, is becoming accepted as an effective strategy for uterine tone control<sup>14</sup> with minimal cardiovascular impact and lower risk of postoperative uterine atony.<sup>6</sup>

In this particular case, pre-induction opiate administration, rapid sequence induction with low dose propofol and maintenance with 0.5 MAC desflurane provided an adequate depth of anesthesia (BIS 35–45) and a stable hemodynamic profile ( $\Delta$ MAP < 10%).

The obtained uterine relaxation was in this case considered sufficient and intravenous nitroglycerin, previously prepared as a first-line tocolytic alternative, was not administered. Without uteroplacental circulation impairment, fetal anesthesia was enabled and adequately demonstrated through complete akinesia at the time of airway approach, also eliminating the need for supplemental ex utero anesthesia.

After complete fetal extraction and umbilical cord clamping, priority focused on pharmacological reversal of uterine hypotonicity with oxytocin and on fetus stabilization for pediatric intensive care unit transportation, which were both held uneventfully. Cesarean section was completed under close supervision of uterine contractility evolution and hemostasis.

Development of a hypocoagulable state following uterine atony and massive postpartum bleeding has occasionally been associated with the occurrence of epidural hematoma.<sup>15</sup> Considering the particular risks of uterine atony and hemorrhage requiring blood transfusion associated with EXIT surgery,<sup>7</sup> we decided to replace neuraxial regional analgesia for a conventional postoperative intravenous analgesia protocol. Effective pain control and patient satisfaction were observed. No reports of

hemorrhagic incidents were issued following the parturient's transference to the postanesthetic care unit.

## Conclusion

The EXIT is an exceptional obstetric procedure bound for life-saving fetal airway interventions.

Preparation for an EXIT surgery involves a detailed multidisciplinary planning, critical for the procedure's safety and success.

Considering current literature, anesthesia management for this procedure is far from unequivocal. Even so and despite the adopted strategy, uteroplacental circulation and uterus relaxation are to be preserved until the fetus' airway is secured.

Anticipation of postoperative coagulation complications may preclude use of unrestricted neuraxial analgesic techniques.

## Authorship

All authors participated in the procedure that originated the report. Data collection was performed by all. The report was drafted by M.M. and revised by all authors.

## Conflicts of interest

The authors declare no conflicts of interest.

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