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Anesthetic Management of an Emergency EXIT Procedure

N. Kumar , S. Singla, A. Jain

Abstract : We present a case of an EX-utero Intra partum Treatment procedure with special reference to maternal anesthetic technique and management of a difficult neonatal airway as an emergency. A 30-year-old gravida 2, para 1 female, with a prenatal fetal diagnosis of cervical teratoma, presented with premature rupture of membranes for emergent cesarean delivery at 34 weeks of gestation. In view of inadequate fasting status, spinal anesthesia was administered and uterine relaxation achieved by intravenous magnesium sulphate administration. The baby was delivered maintaining uteroplacental circulation. A first generation supraglottic airway was used as a rescue device after the baby's trachea could not be intubated.

Keywords : EX-utero Intra partum Treatment; spinal anesthesia ; cervical teratoma ; neonate ; airway ; supraglottic airway.

Glossary : EXIT : EX utero Intrapartum Treatment. $MgSO_4$: Magnesium Sulphate. SGA : SupraGlottic Airway

Introduction

EX-utero Intrapartum Treatment (EXIT) procedure, a term coined by Mychaliska et al., was initially performed for excision of an anterior neck mass in the baby (1). The procedure requires a controlled uterine hypotonia to preserve uteroplacental circulation. It has, over the years, been performed electively to secure the airway of the newborn baby during cesarean delivery.

With increasing awareness, most of the fetal anomalies are detected in utero, and EXIT procedures are usually planned cesarean deliveries. They involve a multi-disciplinary approach involving an obstetrician, pediatrician and an anesthesiologist.

We present a case of an emergent management of an EXIT procedure using spinal anesthesia along with magnesium sulfate as uterine relaxant. The airway of the baby, diagnosed prenatally as a cervical teratoma, was secured with the use of supraglottic airway as a rescue device due to failed tracheal intubation. Written consent was obtained from the patient for publication of the report and photographs.

Case report

A 30-year-old gravida 2 para 1 patient presented to the emergency room at 34 weeks 5 days gestation with spontaneous rupture of membranes and abdominal pain. The patient had been visiting a different hospital until the 30th week of pregnancy, where a fetal ultrasound at 27 weeks gestation had revealed a large cystic mass of 11.5 × 8 cm in the neck of the fetus, with few hyperechoic areas of post acoustic shadows and suggestive of a teratoma extending from the level of the right orbit to the anterolateral compartment of the neck inferiorly. The diagnosis was confirmed by magnetic resonance imaging (Fig. 1a). Upon admission, the patient was conscious, oriented with normal vital signs and no systemic disease. Previous medical history was unremarkable.

The patient was planned for an elective cesarean delivery at 37 weeks of pregnancy. She

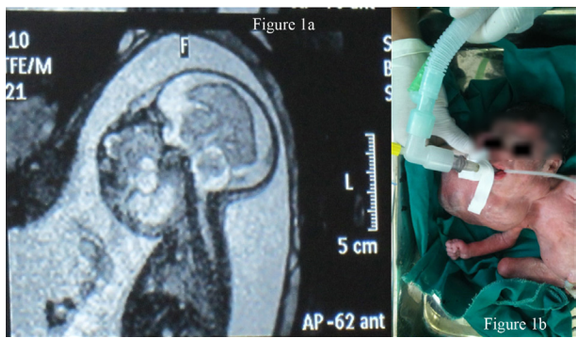

Fig. 1. — a : Magnetic Resonance Image of the fetus at 27 weeks of pregnancy. b. : Baby with supraglottic airway (SGA) in situ.

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had approached our institute as it was nearest to her home because of spontaneous rupture of membranes and abdominal pain, and was scheduled for an emergency cesarean delivery.

The patient was evaluated by an anesthesiologist for the first time in our emergency room. A preanesthetic examination revealed a stable patient with no anticipated airway difficulties. Patient had had a full meal an hour back. Routine blood investigations were within normal range. Imagery of the fetus had not been repeated after the initial evaluation at 27 weeks.

In view of the full stomach status, need for EXIT procedure and, preferably, avoidance of indirect sedation of the baby, regional anesthesia with magnesium sulphate ($MgSO_4$) tocolysis was planned. A written informed consent explaining the anesthetic procedure for both mother and fetus was obtained and the risks explained, including surgical management of the fetal airway and the possibility of fetal death. Two separate anesthesia teams were mobilized, including anesthesia equipment. In case the baby's trachea could not be intubated, plan B was to abandon EXIT and establish a surgical airway under intravenous anesthesia, for which a neonatologist and ENT surgeons were present.

Routine monitors were applied and an 18 G intravenous catheter was secured. The patient was co-loaded with 500 mL of lactated Ringer's solution. One gram of $MgSO_4$ was administered slowly over 5 minutes.

Spinal anesthesia was performed in the left lateral position with 1.8 mL of 0.5% bupivacaine (hyperbaric) containing 25 µg of fentanyl. A sensory block level at T6 was achieved.

The baby was delivered. However, the cord was not clamped. Warm lactated Ringer's solution was infused into the uterus. The uterus was relaxed and there was no separation of the placenta. The APGAR score at 0 min was 3/10. Intubation of the baby's trachea was attempted twice but was not successful (Cormack Lehane IV). The surgeons were reluctant to secure a surgical airway because of the presence of the large mass encroaching the side of the neck and suboptimal positioning. Bag and mask ventilation was attempted, but failed to produce a chest rise. The baby initiated its own respiratory efforts, so as a last resort supraglottic airway (SGA) insertion was attempted before abandoning the EXIT procedure. First generation SGA #1 was secured and attached to a Jackson Rees circuit with oxygen (Fig. 1b). Adequacy of ventilation was confirmed with $EtCO_2$ and the APGAR score improved to 9/10 after 5 minutes.

The cord was then clamped and 2.5 U of oxytocin was injected intravenously, followed by a continuous infusion at a rate of 20 U/h. The total duration of fetoplacental circulation was 9 minutes. The uterus was well contracted and there was no hemorrhage.

Tracheostomy was performed with SGA in situ under inhalation anesthesia in the OR and the baby was shifted to the neonatal intensive care unit. The perioperative course of the mother was uneventful. The baby however, deteriorated and expired due to circulatory shock the next evening.

Discussion

Congenital cervical teratomas are uncommon lesions. Their early diagnosis and an EXIT procedure can greatly increase the chances of survival for the neonate.

Although EXIT procedure is performed during a cesarean delivery, the anesthetic requirements are different as compared to a classical cesarean delivery.

Neuraxial anesthesia is currently the anesthetic technique of choice for cesarean section. Delivery of a vigorous infant involves minimizing drugs that, through placental transfer, may have adverse or depressant effects on the newborn.

The EXIT procedure, in contrast to a routine cesarean delivery, requires complete uterine relaxation after hysterotomy. This is usually accomplished by the use of high dose inhaled halogenated anesthetic agents (2 to 3 Minimum Alveolar Concentration)(3). Complete relaxation of the uterus is required for: surgical manipulation to deliver the fetal head, shoulders, and often an abnormal neck mass. The maintenance of fetal oxygenation is dependent on uterine perfusion and minimizing uterine vascular resistance, which are achieved by prevention of placental separation (2, 3). General anesthesia has been the technique of choice for the EXIT procedure (4). However, a high concentration of inhaled anesthetics may induce maternal and fetal hemodynamic instability, including maternal hypotension, which decreases uterine blood flow leading to impaired uteroplacental circulation, fetal hypoxia and myocardial depression (3). Intraoperative vasopressors may be required to maintain the maternal hemodynamics.

Neuraxial anesthesia, despite being associated with lower morbidity and greater patient satisfaction has infrequently been used as the sole technique for an EXIT procedure (Table 1) (5-8).The use of single shot spinal anesthesia is probably novel to our case.

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Table 1

EXIT procedure performed under regional anesthesia

Authors	Year	n	Indication	Regional Technique	Tocolysis	Duration (min)
Whited et al. (5)	2013	5	3 Arthrogryposis 1 Goitre 1 Micrognathia	Combined spinal epidural	Nitro-glycerine	10
Benonis et al.(6)	2008	1	Congenital High Airway Obstruction Syndrome	Continuous spinal anesthesia	Nitro-glycerine	---
George et al. (7)	2007	3	Arthrogryposis	Combined spinal epidural	Nitro-glycerine	---
Clark et al. (8)	2004	1	Anterior neck mass	Combined spinal epidural	Nitro-glycerine	4

The EXIT procedure can take longer than the effect of a single dose of spinal anesthesia. Furthermore, tocolytics must be administered and hemodynamic control may be difficult, should serious maternal bleeding occur. When neuraxial anesthesia is used for EXIT procedures, uterine relaxation is enhanced with tocolytics such as β_2 agonists, calcium channel blockers (nifedipine), nitroglycerin, and $MgSO_4$ (3). These may be associated with adverse effects such as palpitations, tremors, tachycardia, pulmonary edema and maternal hypotension.

In our case, the EXIT procedure was performed under spinal anesthesia to avoid the risk of aspiration under general anesthesia, insofar as the patient was not adequately fasting. $MgSO_4$ was used to achieve tocolysis. It has advantages over other tocolytic agents in being faster acting with minimum maternal hemodynamic alteration, thus avoiding the use of vasopressors. It also improves uteroplacental flow by causing vasodilation and is better tolerated than other agents such as beta mimetics. We chose a starting dose of 1 gram with a provision of another bolus dose if relaxation was inadequate. Nitroglycerin was also kept ready in case tocolysis was not achieved with $MgSO_4$.

Securing the neonatal airway and maintaining adequate ventilation is a challenge as uteroplacental circulation can be maintained only for a limited period of time. Direct visualization and intubation of the trachea is often difficult because the large mass can distort the airway and limit the available space. Furthermore, the head can be in an awkward position for airway manipulation, resulting from the partial delivery of the baby. Bouchard et al. reported a successful intubation in 77% of cases by laryngoscopy or rigid bronchoscopy (9). However, if endotracheal intubation is not possible, other options such as retrograde intubation, tracheostomy (10) and extra corporeal membrane oxygenation (11) are available. Nowadays, ultrasound is also being utilized to localize the baby's trachea (12). Baker et al. have described the use of SGA as a conduit for fibreoptic-guided intubation during a planned EXIT procedure for a fetus with complex dysgnathia (13).

In our case, no laryngeal structures could be visualized on laryngoscopy, and bag and mask ventilation failed to achieve a chest rise. Surgeons were not comfortable with performing a tracheostomy in a baby with a neck mass and suboptimal positioning. Appropriate sized rigid or fibreoptic bronchoscopes were not available. Intramuscular opioid or neuromuscular blocker could have helped to immobilize the baby, had we proceeded with tracheostomy. When the baby could not be intubated after 2 attempts, a SGA was inserted, which helped maintaining the airway. The baby could maintain a saturation of 100% and normal respiratory pattern on SGA, which precluded the need for immediate tracheostomy. We therefore suggest the addition of SGA in the algorithm for airway management on placental support (14). The SGA may be attempted in case of unsuccessful tracheal intubation and unavailability of a rigid bronchoscope. The step after SGA is the performance of a tracheostomy.

Our limitations included limited time for better coordination between specialties, this being an emergency; and non-availability of a fetal monitor, video-laryngoscope, rigid bronchoscope, and ultrasound.

To conclude, spinal anesthesia with $MgSO_4$ as a tocolytic may be safely used for EXIT procedure, and SGA for the control of fetal airway may be attempted thus precluding immediate tracheostomy.

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