Management Of Fetal Cardiac Dysfunction During Fetal Surgery

Ian Miller, MD; George Hoffman, MD;
Department of Anesthesiology - Children's Hospital of Wisconsin – Medical College of Wisconsin

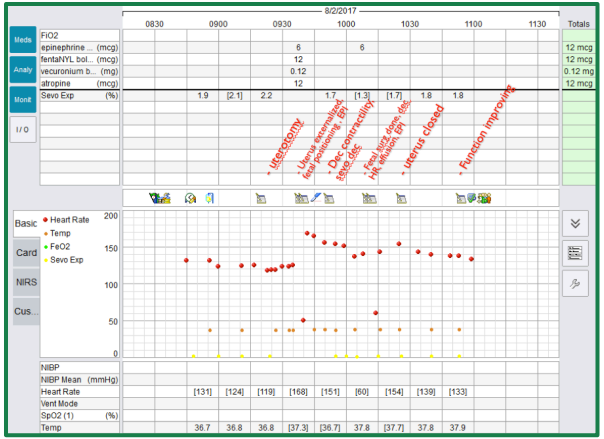
INTRODUCTION[2]:

- Prenatal surgery for congenital anomalies is a burgeoning discipline offering the potential to prevent fetal demise, reestablish fetal organ development, and provide more favorable conditions at the time of birth.
- Indications for fetal surgery are expanding with the advent of minimally invasive surgical technologies.
- Open fetal surgeries have unique anesthetic concerns such as inducing profound uterine relaxation, maintaining placenta-fetal perfusion, monitoring maternal and fetal blood loss, possible fetal resuscitation, and non-invasive fetal monitoring.
- In utero myelomeningocele[MMC] repair has been shown to reduce the need for cerebrospinal fluid shunt placement and to improve motor outcomes.

CASE:

- A 34 year old G3P1 healthy woman with singleton male fetus at 24 weeks gestational age (600gm) underwent intrauterine MMC repair. [S1-5 NTD with hindbrain herniation and ventriculomegaly]
- A balanced anesthetic promoting uterine relaxation and sufficient utero-placental perfusion was conducted [sevoflurane (0.5-1 MAC), propofol, remifentanyl, phenylephrine, and magnesium infusions].
- Maternal epidural analgesia and arterial pressure wave monitoring was utilized.
- After uterine exposure a fetal version was required and a 6 cm hysterotomy was performed with continuous transuterine fetal echocardiography monitoring.
- Vigorous fetal manipulation was required to place the MMC defect within view of the hysterotomy creating difficulty in maintaining intrauterine amniotic fluid volumes. Preceding fetal exposure, the fetus developed severe bradycardia and global hypokinesis with heart rates of 60s.
- Intramuscular epinephrine, atropine, vecuronium and fentanyl were delivered to the fetus once exposure was accomplished.

- The 2.5 by 1.5 cm MMC defect was closed with dural and alloderm grafts. The MMC defect was noted to appear necrotic in nature with purple tones and friable tissues.
- Fetal echocardiography confirmed improved chronotropy however ionotropy remained compromised.
- Umbilical vein doppler signal acquisition was unable to be accomplished by transuterine ultrasound.
- Additional fetal intramuscular epinephrine was delivered just prior to uterine closure as contractility remained suboptimal in concert with the development of a small pericardial effusion.
- The mother was maintained on magnesium infusion for tocolysis and epidural analgesia post-operatively.
- On post-operative day one the fetus sustained demise after unrecoverable severe bradycardia. Autopsy confirmed an intact placental-fetal vasculature architecture.



DISCUSSION[1,3]:

- A detailed understanding of the fetal cardiovascular system and utero-placental interface is essential for anesthesia providers.
- With the fetal heart rate having primary impact on cardiac output, bradycardia or impaired umbilical artery flow can be an ominous sign.
- Fetal IM drug delivery via opioid, NMB, and anticholinergics abates fetal stress, parasympathetic mediated bradycardia and facilitates a motionless surgical field.
- Volatile agents and hypothermia cause direct fetal myocardial depression- Alleviated with supplemental IVA and warm amnioinfusion.
- Umbilical Artery flow can be optimized by LUD, maternal MAP directed vasopressor therapy, tocolysis, UA echo doppler monitoring, and monitoring/maintaining intrauterine pressures.
- For refractory bradycardia ionotropic support, chest compressions, and possible delivery may be needed. Ionotropic support may further increase myocardial demand in hopes of improving end organ perfusion.
- This case brings to light the possible advantage of trans-uterine fetal cocktail administration to minimize stress prior to fetal manipulation.

References:

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