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Peri-operative considerations for in utero repair of myelomeningocele

Myelomeningocele (MMC), the most severe form of spina bifida, occurs in approximately 1 in 1000–2000 births and is associated with significant disability and morbidity.[1] A randomized trial published on 2011 (the MOMS trial) changed clinical practice by showing that open fetal surgery of MMC, conducted between 19 and 26 weeks' gestation, improved a number of important outcomes, but was associated with maternal and fetal risks.[2] Prenatal repair decreased the rate of death or the need for a shunt at 12 months of age, decreased the rate of hindbrain herniation, doubled the rate of the ability to walk independently, and produced a level of function that was two or more levels better than expected according to anatomic levels. However, prenatal surgery increased the risks of preterm birth, placental abruption, pulmonary edema, and uterine thinning or dehiscence at the uterine scar.[3–6] Open fetal surgery is a complex and invasive procedure for the mother and the fetus that requires general anesthesia and invasive hemodynamic monitoring.[7] It is not known as yet what is the best anesthetic technique for these cases. Experience in ex-utero intrapartum (EXIT) fetal surgery can be exploited regarding techniques for uterine relaxation.[8]

A successful outcome requires a multidisciplinary approach and several topics need to be taken into consideration. These include uterine relaxation, fetal and maternal anesthesia, a latex-free environment (avoiding a first lifetime exposure) and fetal neuroprotection to reduce the potential consequences of preterm birth.

We wish to describe the case of a 38-year-old, gravida 3 and para 2, American Society of Anesthesiologists class II patient, who had a prenatal diagnosis of MMC (at L5) with moderate ventriculomegaly (13 mm); an Arnold Chiari malformation type II; and normal karyotype. After maternal counseling, informed consent was obtained and the patient underwent open fetal surgery at 25+3 weeks' gestation. A magnetic resonance image at 29+4 weeks' gestation showed that the Arnold Chiari malformation had disappeared: the rest of the pregnancy was uneventful. A cesarean delivery was performed at 36 weeks' gestation because of spontaneous uterine contractions. The newborn weighed 2750 g; had Apgar scores of 7 and 8; and he was able to move his lower limbs, with no need for a ventricular valve or neonatal MMC surgery. A multimodal approach was performed using nitroglycerin and sevoflurane as the main drugs for intra-operative uterine relaxation; using atosiban instead of magnesium sulfate at the end of surgery (based on better efficacy, without maternal complications)[9] and indomethacin to prevent preterm birth. This strategy could be useful to reduce exposure of the fetus to high concentrations of halogenated agents, while providing good operating conditions, taking into consideration a late-2016 United States of America Food and Drug Administration alert regarding the potential for damaged brain development in children exposed to certain general anesthetic agents in the third trimester of pregnancy. Multimodal uterine relaxation captures the effectiveness of individual agents in optimal dosages and attempts to minimize side effects. This approach promotes the concept that agents with different mechanisms of action may have synergistic uterine relaxation effects when used in combination. It should be further validated with controlled randomized trials, although they would be challenging.

Rapid sequence intubation was performed using fentanyl, propofol and rocuronium. Anesthesia maintenance was achieved by target-controlled infusion of remifentanil, sevoflurane and fentanyl. Bispectral index was used to monitor depth of anesthesia. As there is a known risk of pulmonary edema, advanced hemodynamic monitoring equipment was used to estimate systolic volume variation for a restrictive goal-directed fluid therapy strategy. Norepinephrine was used to maintain maternal blood pressure. Additional drugs were needed for fetal anesthesia and immobilization:

fentanyl, atropine and vecuronium were administered intramuscularly to the fetus. Fetal heart rate was registered by echocardiography. The fetus is highly dependent on maternal body temperature, is unable to thermoregulate, and does not vasoconstrict or shiver in response to decreased core temperature. Induction of general anesthesia, surgical exposure, and hysterotomy can all reduce fetal temperature dramatically. Maintenance of maternal euthermia is essential, which is why we carefully monitored maternal core temperature.[7] The ethical considerations for fetal surgery are analogous to living related organ transplantation, and must not be minimized.[10] Because of the growth in prenatal fetal surgery, anesthetic techniques should be reviewed, as new challenges arrive.

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Antenatal hydration in POTS – could technology help?

Postural orthostatic tachycardia syndrome (POTS) is defined as the presence of orthostatic intolerance symptoms accompanied by an increase in heart rate of at least 30 beats/min (or a rate that exceeds 120 beats/min), within the first 10 minutes of standing or upright tilt. The condition occurs in the absence of other chronic debilitating disorders, prolonged bed rest, or medications that impair vascular or autonomic tone.[1,2]

Postural orthostatic tachycardia syndrome is most commonly seen in women of childbearing age. Approximately 60% of women with POTS find their symptoms improve during pregnancy, but up to 15% say their symptoms stay the same.[3] For some, however, the symptoms may worsen during early pregnancy, especially if a woman suffers from hyperemesis gravidarum.[3]

Initial treatment of patients with POTS is primarily non-pharmacological and is based on increasing fluid and sodium intake, gentle exercise, regular rest periods, and compression stockings. Pharmacological options for non-pregnant patients include midodrine (an alpha-agonist that vasoconstricts), fludrocortisone (to increase blood volume) and ivabradine (to reduce the heart rate by inhibition of pacemaker currents). These medications have little safety data in pregnancy: there is some animal data suggesting harm in the case of ivabradine.[3] Other medications can be tried in resistant non-pregnant cases. In pregnancy, beta-blockade is more commonly used to limit tachycardic symptoms. There is wide experience, including in our clinic, with women using bisoprolol for various cardiac conditions and we monitor fetal growth in these women. In POTS, many women find limited benefit from bisoprolol, however, making non-pharmacological methods even more important.

In our joint obstetrics, cardiology and anaesthetic clinic, we frequently see women struggling with POTS-related symptoms throughout their pregnancy. This year's summer heat wave presented a particular challenge to many and managing water intake, and keeping track of it, can be difficult. So what can be done? We encountered one woman who was confidently