[2006 CR37]
Title: Maternal Pulmonary Edema Attributable to Fetal Surgery Irrigating Fluid

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Introduction: Fetal surgery is a growing specialty that allows treatment of severe or lethal fetal anomalies. Of the three types of fetal surgery, fetoscopy, open fetal surgery, and the EXIT (ex utero intrapartum therapy), fetoscopy is the least invasive. However, significant complications for both mother and fetus remain. Fetal risks include complications of prematurity, neurologic deficits, and fetal demise. Maternal risks include those associated with anesthesia and surgery, as well as chorioamnionitis, preterm labor, and preterm delivery. While an increased risk of maternal pulmonary edema has been associated with open fetal surgery, we now report maternal pulmonary edema as a complication of fetoscopy.

Case: A 28 year-old G1P0, previously healthy 74 kg woman (BMI 27) presented with an 18 week monochorionic twin gestation, complicated by twin reversed arterial perfusion (TRAP) sequence. Fetoscopy for umbilical cord coagulation was planned to reduce the viable twin's risk of mortality and morbidity with the imminent demise of the acephalic fetus. Following premedication with midazolam and sodium citrate, combined spinal epidural anesthesia was initiated and the patient sedated using a propofol infusion. As per our routine for fetoscopy, intravenous fluids were minimized (200 mL). During the procedure the patient was hemodynamically stable, fully saturated on 2 L oxygen by nasal cannula, conversant and cooperative. Near completion of the fetoscopy, the patient suddenly experienced a paroxysm of coughing, followed by desaturation to 70%. Supplemental oxygen promptly increased SpO2 to 88%. Initially clear lung fields evolved into fine crackles throughout the lower lung fields bilaterally. The procedure was terminated and the patient transferred to the recovery room. Review of the surgical procedure with the operating room team elucidated a significant discrepancy in the volume of normal saline irrigation administered fetoscopically compared to the amount of normal saline recovered (13 liters vs. 5 liters). Chest radiograph confirmed bilateral pulmonary edema. The patient received furosemide resulting in brisk diuresis of 4 liters urine output. Clinical exam, shortness of breath, and oxygen requirement improved significantly over the next five hours. The remainder of the mother's hospital course was unremarkable. The patient experienced preterm labor and delivery at 24 weeks. Neonatal Apgars were 1 and 1, and the infant died 4 hours after birth.

Discussion: Pulmonary edema has been a reported complication of open fetal surgeries, all involving administration of tocolytic medications. (1) The case described here presents the first report of fetoscopic-related incidence of pulmonary edema, notable for minimal intravenous fluid administration and the absence of tocolytics. Pulmonary edema results from cardiogenic (hydrostatic) causes, from an increased capillary permeability, or from a combination. Cardiogenic pulmonary edema is frequently related to valvular disease, which may become unmasked with the increased cardiac output characteristic of the physiologic changes during pregnancy. (2) Several hydrostatic changes related to pregnancy may also contribute to pulmonary edema; the parturient has a 20% decrease in oncotic pressure coupled with a 45-50% increase in intravascular volume. (3) Tocolytic medications, preeclampsia, multiple gestation, maternal infection, and excessive fluid administration are independently associated with an increased risk of pulmonary edema in a parturient. (2)

Our patient had normal cardiac function without preeclampsia, infection, or use of tocolytic medication. Though intravenous fluids were minimized (200 mL Lactated Ringers), there were 8 L of irrigation fluid unrecovered from the surgical field. Fluid absorption from the surgical field causing pulmonary edema has been described in transurethral resection of the prostate (TURP) (4) and hysteroscopy (5). The distending fluid utilized absorbs through open vascular beds or, in the case of hysteroscopy, through the peritoneum after passing through the fallopian tubes. Since significant absorption of irrigating fluid likely caused our patient's pulmonary edema, we have instituted a policy of continual accounting of fluid totals during fetoscopic surgeries. We have not proceeded with surgery after achieving a 2 liter discrepancy since our index case; no further episodes of pulmonary edema have been encountered.

As fetoscopic procedures become more common, we must remain vigilant for new complications, since these procedures carry risk to the fetus as well as to the mother. While the fetuses appropriate for fetal surgery have a high risk of morbidity and mortality from the disease process itself, the mothers offered fetal surgery must be ASA physical status I or II. Therefore, while there may be significant fetal risks of treatment, only minimal maternal risk is acceptable. As we continue to improve the health of the developing fetus, we must assure that the safety of the involved mothers remains paramount.

References:

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