

Introduction

- Evidence supports the safety and efficacy of prenatal myelomeningocele (MMC) repair¹, but fetal intervention entails maternal risk including the risk of uterine scar dehiscence.²
- Fetoscopic MMC repair allows for the possibility of vaginal delivery, but the impact of carbon dioxide (CO2) insufflation on fetal wellbeing is poorly understood.

Fast Facts: Myelomeningocele

- Most common congenital anomaly of CNS that is compatible with life
- Results in lifelong disability despite early postnatal repair
 - Paralysis
 - Bowel/bladder dysfunction
 - Arnold Chiari II malformation with hindbrain herniation
 - Hydrocephalus requiring VP shunt
- Incidence has stabilized at 3.4 per 10,000 live births



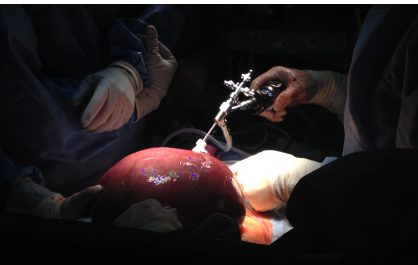
Primary Aim:

Determine ultimate mode of delivery (vaginal vs cesarean) after fetoscopic neural tube defect repair

Secondary Aim:

Evaluate impact of intra-amniotic insufflation of carbon dioxide on fetal wellbeing during fetoscopic MMC repair

Figure 1:



Left: Photo showing uterine exteriorization and port placement for fetoscopic MMC repair.

Below: Table 1 compares maternal and fetal benefits and risks of fetoscopic repair compared with open fetal repair

Table 1. Fetoscopic Repair: Fetal and Maternal Benefits and Risks

	Fetal	Maternal
Benefit	<ul style="list-style-type: none"> ? Less cord tethering ? Equal or better neurologic outcomes vs MOMs 	<ul style="list-style-type: none"> Decreased tocolytic need Ability to deliver vaginally Decreased risk uterine rupture/dehiscence
Risk	<ul style="list-style-type: none"> Fetal hypercarbia ? Fetal acidosis 	<ul style="list-style-type: none"> Risk of CO2 embolism Increased risk PPRM, preterm labor

Methods

- Retrospective chart review of all patients with MMC scheduled for fetoscopic repair from June 2015-June 2017
- Data collected: baseline patient characteristics, surgical data, and obstetric data including ultimate mode of delivery, intraoperative arterial blood gas results, and fetal heart rate
- To understand how the duration of CO2 insufflation impacted fetal wellbeing, we used a mixed-effects model using fetal heart rates (FHR) at 0, 30, 60, and 120 minutes after insufflation.

Table 2. Patient Characteristics and Surgical Data

Patient characteristics	
Age	27.5 years (5.9)
Nulliparous	34.6%
Gestational age	24w6d
Surgical characteristics	
Uterus insufflation pressure	11mmHg (1.6)
Duration of insufflation	153 min [123-170]
Duration of surgical procedure	258.5 min [232.5-300]
Baseline values	
pH	7.43 (0.04)
PaCO2	30.1mmHg (3.7)
FHR	120bpm (11)

Fast Facts: Fetoscopic MMC Repair

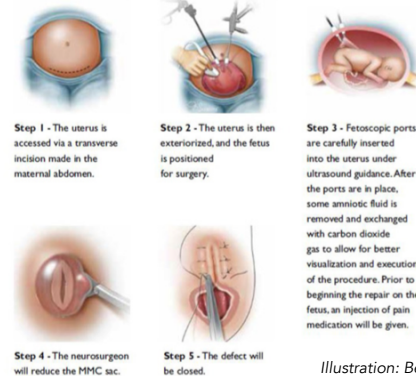


Illustration: Beth Sumner

Results

Figure 2:

Obstetric outcomes for all patients undergoing fetoscopic MMC repair during study period.

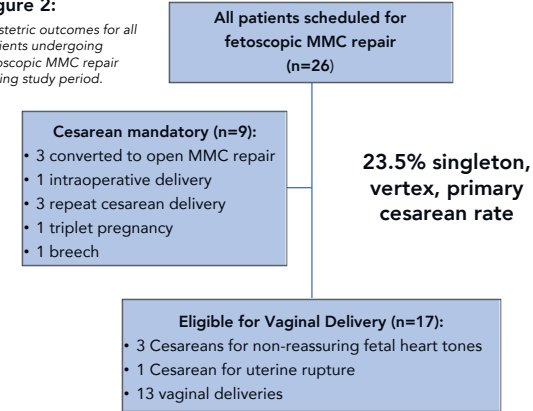


Figure 3:

Patients included in analysis of CO2 insufflation's impact on FHR

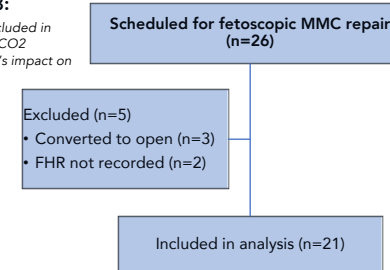


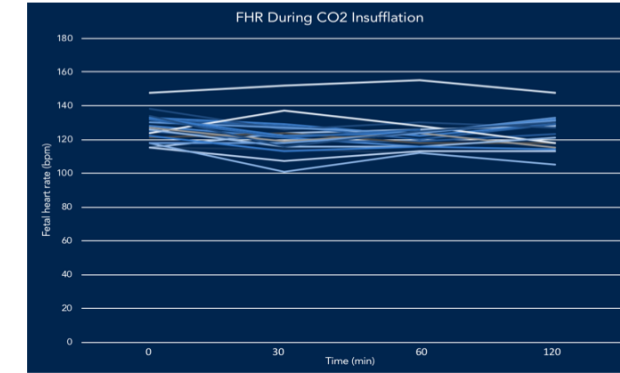
Table 3. Delivery and Neonatal Outcomes

Delivery outcomes	
EGA at delivery	38 [35.8-38.9]
Preterm Labor	3 (12)
Preterm prolonged rupture of membranes	4 (16)
Placental abruption	1 (4)
Uterine rupture	1 (4)
Neonatal outcomes	
Agpar at 1min	8 [7.25-8]
Agpar at 5min	9 [9-9]
Intubated	4 (15.4)

Discussion

- Fetoscopic MMC repair offers the potential benefit of decreased maternal morbidity by allowing for possible vaginal delivery.
- Our center's experience showed a singleton, vertex, primary cesarean rate of 23.5%, well below the 100% cesarean rate mandated by open prenatal MMC repairs.

Figure 4: Fetal Heart Rate During Fetoscopic MMC Repair



Fetal heart rate values (beats per minute) recorded by intermittent fetal echocardiography during CO2 insufflation for fetoscopic MMC repair. Each line represents one fetus.

Table 4. Model for FHR Variation over Time

Mixed Effects Model		
Estimate (SE)	95% CI	p-value
-0.5353 (0.5418)	-1.6235 ~ 0.5529	0.328

Interpretation: Duration of intra-amniotic CO2 insufflation did not significantly affect FHR over time.

- FHR was not impacted by the duration of CO2 insufflation, demonstrating that fetal distress does not appear to be associated with length of intra-amniotic CO2 insufflation.
- The potential decrease in maternal morbidity warrants continued evaluation of fetoscopic repair techniques.
- Close evaluation of long-term fetal outcomes is needed.

References

- Adzick S, et al. A Randomized Trial of Prenatal versus Postnatal Repair of Myelomeningocele. NEJM, 2011.
- Johnson M, et al. The Management of Myelomeningocele Study: obstetrical outcomes and risk factors for obstetrical complications following prenatal surgery. AJOG, 2016.