Baylor College of Medicine

Fetoscopic Myelomeningocele Repair: Fetal Wellbeing & Mode of Delivery

CD Sutton MD¹, J Kim BS¹, T Aina MD¹, A Chandrakantan MD¹, MBA, A Hassanpour MD¹, DG Mann MD, MA¹, M Patino MD¹, M Belfort MD², PhD, A Shamshirsaz MD², J Espinoza MD², W Whitehead MD, MPH³, OA Olutoye MD¹ ¹Department of Pediatric Anesthesiology, Perioperative, and Pain Medicine, ²Department of Obstetrics & Gynecology, ³Department of Neurosurgery Texas Children's Hospital, Baylor College of Medicine, Houston, Texas



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:

Secondary Aim:

Determine ultimate mode of Evaluate impact of intra-amniotic delivery (vaginal vs cesarean) insufflation of carbon dioxide on after fetoscopic neural tube fetal wellbeing during fetoscopic defect repair MMC repair

Figure 1:



Table 1.1 eloscopie Repair. 1 etal ana Matemar Benena ana Risk				
	Fetal	Maternal		
Benefit	 ? Less cord tethering ? Equal or better neurologic outcomes vs MOMs 	 Decreased tocolytic need Ability to deliver vaginally Decreased risk uterine rupture/dehiscence 		
Risk	Fetal hypercarbia? Fetal acidosis	 Risk of CO2 embolism Increased risk PPROM, preterm labor 		

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

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



Methods

Retrospective chart review of all patients with MMC scheduled for

Data collected: baseline patient characteristics, surgical data, and

obstetric data including ultimate mode of delivery, intraoperative

To understand how the duration of CO2 insufflation impacted fetal

wellbeing, we used a mixed-effects model using fetal heart rates

fetoscopic repair from June 2015-June 2017

arterial blood gas results, and fetal heart rate

Table 2. Patient Characteristics and Surgical Data

Patient characteristics

Age

Nulliparous

Baseline values

Hа

PaCO2

FHR

Gestational age Surgical characteristics

Uterus insufflation pressure

Duration of surgical procedure

Step I - The uterus is

incision made in the

maternal abdomen

accessed via a transverse

Step 4 - The neurosurgeon

will reduce the MMC sac

Duration of insufflation

(FHR) at 0, 30, 60, and 120 minutes after insufflation.

٠





Step 5 - The def

be closed

27.5 years (5.9)

11mmHg (1.6)

7.43 (0.04)

30.1mmHg (3.7)

120bpm (11)

153 min [123-170]

258.5 min [232.5-300]

34.6%

24w6d

fect will	
	Illustration: Beth Sumner

ege of medicine, nousion, rexas						
Results						
Figure 2: Obstetric outcomes for all patients undergoing fetoscopic MMC repair during study period.	fetoscopic MMC repair					
Cesarean mandatory (n=9): • 3 converted to open MMC repair • 1 intraoperative delivery • 3 repeat cesarean delivery • 1 triplet pregnancy • 1 breech			23.5% singleton, vertex, primary cesarean rate			
Eligible for Vaginal Delivery (n=17): • 3 Cesareans for non-reassuring fetal heart tones • 1 Cesarean for uterine rupture • 13 vaginal deliveries						
Figure 3: Patients included in analysis of CO2 insufflation's impact on FHR	Scheduled for feto (n=	scopi 26)	ic MMC repair			

Excluded (n=5) Converted to open (n=3) FHR not recorded (n=2) Included in analysis (n=21)

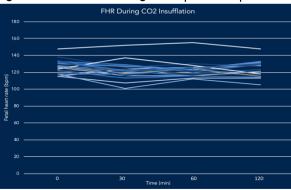
Table 3. Delivery and Neonatal Outcomes

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			
Apgar 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

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