Comparing Open and Fetoscopic Fetal Surgical Repairs of Myelomeningocele

Kyra Isaacs, MMS (c)
Faculty Advisor: Jodi Freeman, MMS, PA-C
Department of Medical Science

Abstract

This research compares new minimally invasive fetoscopic surgical techniques to open fetal surgery in the prenatal repair of MMC. Searches in PubMed and Clinical Key were conducted to produce papers published on the topic within the last 10 years. The open fetal repair has associated risks to both the mother and child. A minimally invasive procedure may be the solution that could decrease the risks and side effects associated with open fetal surgery. Preliminary studies show that a fetoscopic repair has demonstrated similar rates of shunt placement to patients who received open repair. Despite these promising results, the data is limited and the surgical technique is inconsistent. Once the procedures become standardized, more research is needed to compare fetoscopic and open repairs.

Introduction

- Spina bifida is a type of neural tube defect that can lead to motor and neurological disability.
- The most severe form of the disease is called myelomeningocele and it occurs in approximately 1 in 4,000 live births.
- More than 90% of children with a lesion above the sacral lesion need a shunt placement for hydrocephalus.
- A landmark study conducted by Adzick, “A Randomized Trial of Prenatal versus Postnatal Repair of Myelomeningocele”, showed that open fetal surgery for myelomeningocele decreased the need for shunting and improved motor outcomes as compared to postnatal repair.
- New research shows that 9.6% of women who underwent open fetal repair experienced uterine rupture in their subsequent pregnancies resulting in 2 fetal deaths.

Methods

- Research began in PubMed specifically searching the term “MOMS Fetal Surgery.”
- The search then moved on to broader terms by running another search in PubMed for “fetal surgery myelomeningocele.”
- Aiming to find results pertaining to all aspects of fetoscopic surgery, a search for “Fetoscopy* Myelomeningocele*” was conducted in PubMed.
- Using the search term fetoscopy* included terms like fetoscopic, fetoscopy, fetoscopically, etc.
- The same search parameters, “fetoscopy* myelomeningocele”, were also used in Clinical Key.

Results

   - RCT evaluating an open fetal MMC repair to postnatal repair. Showed that the prenatal repair showed statistically significant improved outcomes.
   - This study was a pilot study looking at safety and feasibility of a fetoscopic repair of the defect.
   - This study examines the possibility of the Management of Myelomeningocele (MOMS) results being generalized to a larger, more inclusive, population of women who might not fall within the strict inclusion and exclusion criteria.
   - This study investigated the need for postnatal surgical revision of the myelomeningocele site after using a patch coverage technique during fetoscopic repair of the defect.

<table>
<thead>
<tr>
<th>Study</th>
<th>Shunt Placement</th>
<th>PPROM</th>
<th>Motor Level</th>
<th>Ambulation Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adzick et al (2011)</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Johnson et al (2016)</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Laskey et al (2017)</td>
<td>NS</td>
<td>NS</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Pedreira et al (2016)</td>
<td>S</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Lapa et al (2017)</td>
<td>S</td>
<td>S</td>
<td>S</td>
<td>N/A</td>
</tr>
<tr>
<td>Graf et al (2015)</td>
<td>S</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Key:
- S = significant; NS = not significant
- Shunt Placement
  - S = Decreased shunt placement as compared to postnatal surgery
  - NS = No change or increased shunt placement compared to postnatal surgery
- PPROM
  - S = Increased rate of PPROM compared to postnatal surgery
  - NS = No change in rate of PPROM compared to postnatal surgery
- Motor Level
  - S = Motor level is increased compared to postnatal surgery
  - NS = No change in motor level compared to postnatal surgery
- Ambulation Status
  - S = Status of ambulation is more advanced at the same age as compared to postnatal surgery groups
  - NS = Ambulation status is the same as compared to postnatal surgery groups

Discussion

- Open fetal surgery is a more mature field with a refined technique for myelomeningocele while fetoscopic surgery is an expanding, but nascent field of study.
- The cohort study design is not as strong as a randomized clinical trial, so the conclusions drawn from these trials do not stand up to the power of a randomized clinical trial.
- The difference in study design between studies on open fetal surgery and fetoscopic surgery make it impossible to conclude that one treatment is better than the other.
- In medicine, patient safety is the ultimate concern which limits the ability to create a perfect study design without preliminary cohort studies.
- Medical research is also limited when studying a rare congenital abnormality. It can take many years to gather a group of patients with the condition of interest large enough to conduct a meaningful study.

Conclusion

At the time of this literature review, research on the fetoscopic procedure is still in its preliminary stages with case studies and small cohort studies. These studies have shown similar outcomes in the rate of shunt placement to the open fetal surgery data from the MOMS trial. Despite these promising results, the low number of cases and inconsistent surgical technique means that the comparison lacks significance, both statistically and clinically. There is no justification for changing the standards of clinical practice until fetoscopic surgery for myelomeningocele is both technically refined and tested in a randomized clinical trial.

![Figure 1](left) Intra-operative photographs of the multi-layered microneurosurgical MMC repair. (Sarnet 2017)
![Figure 2](right) Intra-operative photograph of the fetoscopic MMC repair. (Sarnet 2015)
References


