# Comparison of Prenatal and Postnatal Treatment of Myelomeningocele: A Systematic Review

Sydney Gannon, Department of Health Sciences

Carroll College

## Introduction

Myelomeningocele, the most common type of spina bifida, is a rare birth defect that affects about 1400 babies in the United States every year.[1] Infants born with this defect have a death rate of approximately 10% after birth and survivors face lifelong disabilities.[2] The average cost of care for someone with spina bifida is estimated to be almost $800,000 over the course of their lifetime.[1] It is believed that spina bifida is a result of genetic and environmental factors, such as family history of the defect, a lack of folic acid during pregnancy, and maternal diabetes, obesity, and hyperthermia.[3] Females develop this condition more frequently than males, and the rate highest in Hispanic populations.[3] Infants diagnosed with myelomeningocele face major disabilities including mobility issues, bowl and bladder problems, excess brain fluid requiring shunting, and orthopedic complications.[3] In addition to challenges faced by the individual with myelomeningocele, the family of affected individuals also experience financial burdens and stress.[4]

Postnatal repair of myelomeningocele is traditional; however, a new surgical method has been developed for *in utero*, or prenatal, repair of myelomeningocele. This new method was developed in hopes of reducing *in utero* spinal cord trauma and improving post-birth outcomes for both mother and child.[5] Thus there is a need for continued research on long-term outcomes and cost-benefit analysis comparing *in* and *ex utero* repair of myelomeningocele in infants on the basis of infant and maternal well-being. Therefore, the purpose of this study is to review relevant literature to determine if prenatal or postnatal repair of myelomeningocele results in better overall infant and maternal health. The findings of this study should help inform clinicians in treating myelomeningocele, and aid families in selecting a course of treatment. The findings of this study should also raise awareness about myelomeningocele and the impacts it has on affected individuals and their family.

## Methods

Information was gathered in September of 2023 via PubMed, CINAHL, and Google Scholar. Advanced searches were performed using keywords spina bifida or myelomeningocele; AND pre-natal or *in utero*; AND post-natal or *ex utero*.

38 articles were initially identified but were narrowed down to 8 pertinent articles after removing duplicates, meta-analyses, and systematic reviews. Relevant data was collected from sources and summarized in a data extraction table.

## Results

This review included five randomized control trials, [2,4,6–8] one cohort study,[5] one retrospective cohort study,[9] and one non-randomized single-center study,[10] summarized in Table 1. Overall, prenatal repair of myelomeningocele showed reduced need for treatment of future conditions related to the malformation, decreased familial stress, and improved mental development and motor function, when compared to postnatal repair. However, prenatal repair also showed higher levels of preterm labor risks and other obstetrical complications than postnatal repair.[2,4–10]

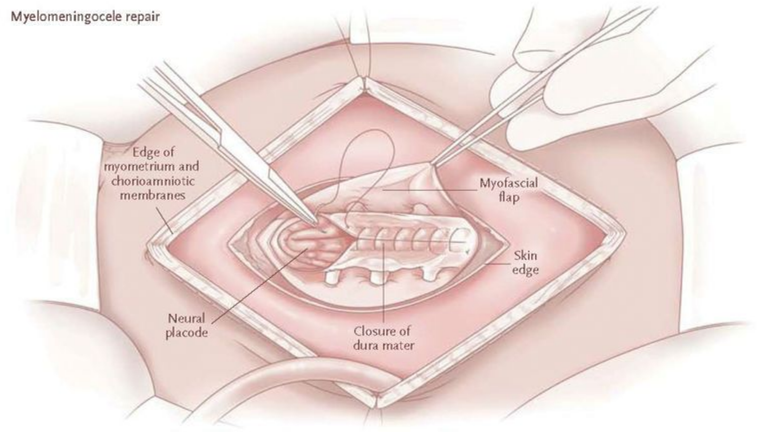


Figure 1. Surgical layout of prenatal repair of myelomeningocele.[11]

## References

1. CDC. Spina Bifida Data and Statistics | CDC. Centers for Disease Control and Prevention. Published August 31, 2020. Accessed September 27, 2023. https://www.cdc.gov/ncbddd/spinabifida/data.html
2. Adzick NS, Thom EA, Spong CY, et al. A Randomized Trial of Prenatal versus Postnatal Repair of Myelomeningocele. *N Engl J Med*. 2011;364(11):993-1004. doi:10.1056/NEJMoa1014379
3. Spina bifida - Symptoms and causes. Mayo Clinic. Accessed September 27, 2023. https://www.mayoclinic.org/diseases-conditions/spina-bifida/symptoms-causes/syc-20377860
4. Antiel RM, Adzick NS, Thom EA, et al. Impact on Family and Parental Stress of Prenatal versus Postnatal Repair of Myelomeningocele. *Am J Obstet Gynecol*. 2016;215(4):522.e1-522.e6. doi:10.1016/j.ajog.2016.05.045
5. Farmer DL, Thom EA, Brock JW, et al. The Management of Myelomeningocele Study: full cohort 30-month pediatric outcomes. *Am J Obstet Gynecol*. 2018;218(2):256.e1-256.e13. doi:10.1016/j.ajog.2017.12.001
6. JOHNSON MP, BENNETT KA, RAND L, et al. MOMS: Obstetrical Outcomes and Risk Factors for Obstetrical Complications Following Prenatal Surgery. *Am J Obstet Gynecol*. 2016;215(6):778.e1-778.e9. doi:10.1016/j.ajog.2016.07.052
7. Swarup I, Talwar D, Howell LJ, Adzick NS, Horn BD. Orthopaedic outcomes of prenatal versus postnatal repair of myelomeningocele. *J Pediatr Orthop B*. 2022;31(1):87-92. doi:10.1097/BPB.0000000000000827
8. Tulipan N, Wellons JC, Thom EA, et al. Prenatal surgery for myelomeningocele and the need for cerebrospinal fluid shunt placement. *J Neurosurg Pediatr*. 2015;16(6):613-620. doi:10.3171/2015.7.PEDS15336
9. Sileo FG, Pateisky P, Curado J, Evans K, Hettige S, Thilaganathan B. Long-term neuroimaging and neurological outcome of fetal spina bifida aperta after postnatal surgical repair. *Ultrasound in Obstetrics & Gynecology*. 2019;53(3):309-313. doi:10.1002/uog.20215
10. Zamłyński J, Olejek A, Koszutski T, et al. Comparison of prenatal and postnatal treatments of spina bifida in Poland--a non-randomized, single-center study. *J Matern Fetal Neonatal Med*. 2014;27(14):1409-1417. doi:10.3109/14767058.2013.858689
11. Children's Hospital of Philadelphia (Fetal Surgery Guidelines for Prenatal Myelomeningocele Repair). Accessed November 29, 2023. https://www.chop.edu/pages/fetal-surgery-guidelines-prenatal-myelomeningocele-repair

## Discussion

Overall, this study found that prenatal treatment of myelomeningocele results in fewer repair surgeries later in life, decreased familial stress levels, and improved physical function and mental development in comparison to traditional postnatal treatment.[2,4–8,10] However, all studies found that prenatal myelomeningocele repair is associated with increased preterm labor risks and other obstetrical complications.[2,4–10]

One of the major strengths of this review is that five of the studies included in were randomized control trials and two were cohort studies. Both of these study types rank highly in terms of result reliability due to randomization of treatments. The final study utilized in this review was a non-randomized trial which still ranks relatively high in terms of reliability of results due to its relatively long follow up time. A limitation of these studies is the rarity of the malformation, making the number of study participants low compared to more common disorders. In addition, the life-long nature of myelomeningocele impact makes it hard for researchers to conduct a long-term quality of life analysis. Since myelomeningocele impacts males more often than females, all studies analyzed had a lack of gender diversity among patients.[5] This could be improved on in future experiments to provide more widely tested and therefore more generalizable results.

This review finds that prenatal repair for myelomeningocele is both successful and beneficial in the long-term, but comes with challenges, such as infection and premature birth in the pre-labor stages that are not typically associated with postnatal treatment. Although the data on prenatal repair is consistent, more data is needed to assess its strengths completely and accurately since it is still considered a novel and somewhat experimental option in comparison to traditional postnatal repair.[9] Both postnatal and prenatal repair are effective treatments for myelomeningocele, so unique features such as malformation size and ventricle size can be used to determine which treatment is the best option for each impacted individual until this further research is conducted. To conclude, this review found prenatal repair of myelomeningocele to be a viable alternative to traditional postnatal repair due to the minimization of future malformation related issues and improved quality of life for mother and infant.

## Acknowledgement

I would like to give a special thanks to Dr. Gerald Schafer for his expert guidance and continuous support.