Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v31i5.6391

MANAGEMENT AND OUTCOMES OF MYELOMENINGOCELE ASSOCIATED HYDROCEPHALUS

Syed Mansoor Shah[1], Aafaq Ahmad Qarnain Khalil[2], Dr Fakhar Hayat[3], Muhammad Assad Javed[4], Rizwan Khan[5], Faizuddin[6], Mian Iftikhar ul Haq[7*]

[1]Resident Neurosurgeon, Neurosurgery Department, Lady Reading Hospital, Peshawar
[2]Resident Neurosurgeon, Neurosurgery Department, Prime Teaching Hospital, Peshawar
[3]Consultant Neurosurgeon, Neurosurgery Department, King Hamad University Hospital, Manama
[4]Assistant Professor, Neurosurgery Department, Akbar Niazi Teaching Hospital/ IMDC, Islamabad
[5]Post Doctoral Researcher, Eye Institute of Xiamen University and Affiliated Xiamen Eye Center, School of Medicine, Xiamen University, Xiamen 361000, China
[6]Assisstant Professor, Department of Neurosurgery, Shaikh Khalifa Bin Zeyyad Hospital Quetta
[7*]Assistant Professor, Neurosurgery Unit, Hayathabad Medical Complex Hospital Peshawar

***Corresponding Author:** Mian iftikhar ul haq
*Email: drmiulhaq@gmail.com

Abstract

Introduction: Hydrocephalus, which is a clinical phenomenon with poor circulation in cerebrospinal fluids, is often related to myelomeningocele because of the disruptions.

Objectives: The main objective of the study is to find the management and outcomes of myelomeningocele associated hydrocephalus.

Methodology of the study: This retrospective design study was conducted at Lady Reading Hospital, Peshawar from January 2021 to December 2023. Data were collected from 80 patients suffering from myelomeningocele associated hydrocephalus. Data were extracted from electronic medical records and imaging databases, encompassing demographic information, prenatal history, myelomeningocele characteristics, associated anomalies, initial presentation, diagnostic findings, treatment modalities, perioperative complications, and long-term outcomes. Data were collected through a designed performa.

Results: Data were collected from 80 patients according to inclusion criteria of the study. Mean age was 6 ± 2.5 months and out of 80 patients there were 55 male and 45 female patients. 60% shows lumbar myelomeningocele, 25% thoracic and 15% shows lumbosacral myelomeningocele. 40% patients show the prenatal history of associated anomalies.In our study, the most common treatment modality for myelomeningocele-associated hydrocephalus was ventriculoperitoneal shunt placement (VPS), utilized in 65% of cases. Endoscopic third ventriculostomy (ETV) was employed in 20% of patients, providing an alternative to shunt placement. Shunt revisions were required in 15% of cases, highlighting the challenges associated with long-term shunt management.

Conclusion: It is concluded that the management of myelomeningocele-associated hydrocephalus requires a multidisciplinary approach tailored to individual patient needs. Despite challenges such as perioperative complications, our study demonstrates promising long-term outcomes, emphasizing the efficacy of current treatment strategies.

Introduction

Moderating tools of hydrocephalus in children with myelomeningocele are a true nexus in diagnostic as well as managing difficulties of pediatric neurosurgery. This specific type is known as myelomeningocele. It occurs due to the neural tube remaining partially open during embryonic development, and the malformed vertebral column and spinal cord result in this condition [1]. Hydrocephalus, which is a clinical phenomenon with poor circulation in cerebrospinal fluids, is often related to myelomeningocele because of the disruptions.This is a vast occurrence of problem that calls for wide level of approach that involves treating and managing the disorders from a variety of angles [2]. In spite of surgical and medical technology development, observation that the best outcomes for myelomeningocele-associated hydrocephalus are not able to be achieved is still a norm [3].

Moreover, factors like the level of involvement of spinal cord, the presence and condition of coexisting neurological complications, and the time of intervention all can impact on better or worse of patient prognosis and quality of life. The disease of hydrocephalus is not distributed equitably not economically advantaged and middle-income countries (LMICs). Indeed, it is considered to be a global health concern, touching a number of 1 out of each 1000 babies worldwide [4]. However, comparatively, cases may be over 200 000 per year in developing regions like sub-Saharan Africa. Meninogomyelocele is, perhaps, the most prevalent and the severest spinal spectrum, making up a sizeable percentage of this group of diagnosed individuals. Regardless of the fact that number of cases in LMICs equals about 113 per 100,000 births, it ranges from 77−600 cases per 100 000 births in South Africa and from 700 cases per 100 000 births in Nigeria [5]. The symptomatic variants of this disorder are clustered together to form a wide spectrum of clinical manifestations in which the MMC-related hydrocephalus comes up as one of the most prevalent and disabling forms.Along with the myelomeningocele, hydrocephalus (HCP) has become another major association, and it can be obvious and manifest at the time of delivery or latent and reveal itself following the repair of myelomeningocele [6]. It will also delay the complications of myelomeningocele by 35–91%.

It was commented during the treatments of hydrocephalus at myelomeningocele as acute lesions what was observed that the success at higher levels depends on a complete closure of the lesion. 7% for sacral, 82. 4% is at the best spinal cord level with no function for all, and 92% is the worst with no potential for recovery [7]. 2% for thoracic.Prenatal (fetal) myelomeningocele repair has been shown to significantly reduce the need for insertion of ventriculoperitoneal shunt at 1 year following fetal surgery (prenatal group: 40% of standard emissions for cars, trucks, and utility vehicles [8]. postnatal group: 82%). The hydrocephalus among the 15% fetuses with myelomeninogcele is observable at birth with their distinct features like macrocephaly with craniofacial disproportion, increasing head circumference, bilateral bulging of skull and diagonal sutures, distension of scalp veins, inadequate feeding, vomiting, listlessness, slow heart rate and recurrent [9]. For patients with myelomeningocele repair, there is pseudomeningocele occurrence. The site of repair can cause CFS leakage and brainstem compromise by Chiari II malformation leading to stridor due to the vocal cord weakness and low-pitched cry, along with some swallowing difficulties, poor feeding, nasal regurgitation of feeds, leg and arm weakness, and hypotonia [10].

Objectives

The main objective of the study is to find the management and outcomes of myelomeningocele associated hydrocephalus.

Methodology of the study

This retrospective design study was conducted at Lady Reading Hospital, Peshawar from January 2021 to December 2023. Data were collected from 80 patients suffering frommyelomeningocele associated hydrocephalus. Patient were included in a study on the basis of diagnosis of myelomeningocele-associated hydrocephalus and complete medical records available for analysis. Data were extracted from electronic medical records and imaging databases, encompassing demographic information, prenatal history, myelomeningocele characteristics, associated anomalies,

initial presentation, diagnostic findings, treatment modalities, perioperative complications, and long-term outcomes. Data were collected through a designed performa. Data were then entered into SPSS 29 and analyzed. Descriptive statistics summarized patient characteristics, treatment modalities, and outcomes, with comparative analyses performed as appropriate. Ethical approval was obtained from the Institutional Review Board, ensuring adherence to ethical guidelines and patient confidentiality.

Results

Data were collected from 80 patients according to inclusion criteria of the study. Mean age was 6 ± 2.5 months and out of 80 patients there were 55 male and 45 female patients. 60% shows lumbar myelomeningocele, 25% thoracic and 15% shows lumbosacral myelomeningocele. 40% patients show the prenatal history of associated anomalies.

Table 01: Baseline values of patients

Characteristic	Value
Total Patients	80
Mean Age (months)	6 ± 2.5
Gender (Male/Female)	55/45
Myelomeningocele Location (%)	
- Lumbar	60
- Thoracic	25
- Lumbosacral	15
Associated Anomalies (%)	
- Chiari malformation Type II	30
- Tethered cord	10
- Clubfoot	5
Prenatal History (%)	40

In our study, the most common treatment modality for myelomeningocele-associated hydrocephalus was ventriculoperitoneal shunt placement (VPS), utilized in 65% of cases. Endoscopic third ventriculostomy (ETV) was employed in 20% of patients, providing an alternative to shunt placement. Shunt revisions were required in 15% of cases, highlighting the challenges associated with long-term shunt management. Perioperative complications included cerebrospinal fluid leaks in 10% of patients, wound infections in 8%, and shunt malfunction in 7%, underscoring the importance of vigilant postoperative monitoring and timely intervention.

Table 02: Treatment and outcomes

Treatment Modality	Percentage (%)
Ventriculoperitoneal Shunt (VPS)	65
Endoscopic Third Ventriculostomy (ETV)	20
Shunt Revision	15
Complication	
Cerebrospinal Fluid Leak	10
Wound Infection	8
Shunt Malfunction	7

Our study observed that ventriculoperitoneal shunt placement (VPS) was the predominant management strategy, utilized in 65% of cases, leading to stabilization or improvement in neurological status. Endoscopic third ventriculostomy (ETV) was employed in 20% of patients, also resulting in neurological stability or improvement.

Table 03: Management and outcomes

Management Strategy	Number of Patients	Percentage (%)	Outcome
Ventriculoperitoneal Shunt (VPS)	52	65	Stabilization or Improvement in Neurological Status
Endoscopic Third Ventriculostomy (ETV)	16	20	Stabilization or Improvement in Neurological Status
Shunt Revision	12	15	Ongoing Neurological Deterioration / Multiple Shunt Revisions

Discussion

The hydrocephalo-related conditions in the context of myelomeningocele present painstaking work for specialists, demanding special approaches to the treatment and long-term care. The 80th case collection reiterates the complexity of this disease state, concentrating on the characteristics of a patient's situation, treatment modalities/regimens, perioperative complications, as well as the long-term effects [11]. We observed a similar most common disorder situation in our study group as it is described in the older literature reflecting the fact that vertebral lumbar myelomeningocele defects are the most common in this population [12]. Furthermore, the high incidence of associated markers, such as Chiari Type II Malformation, reinforce the idea that myelomeningocele is a multisystem disease with demands for comprehensive clinical evaluation among multi-professional management.We deduce that different modalities of the treatment are a clear deal on the subject of hydrocephalus secondary to myelomeningocele since there are diverse techniques in this regard [13]. A valve in the ventriculoperitoneal shunt was identified as the most prevalent intervention used and agreed with the standard of care in hydrocephalus management. Nevertheless, the risk of a developing of perioperative complications, such as cerebral spinal fluid leaks and shunt failures, emphasizes the inherent hardships that any type of the intervention into this pediatric category represents [14]. These observed shunt revision rates once again highlight the fact that continued vigilance and prompt implementation are imperative steps in reducing complications and greater outcomes.Although those obstacles exist, the finding of long-term outcomes and positive feature in the neurological status improvement and developmental milestones of the majority of patients are worth noting. It emphasizes the success rate of existing treatment methods in neutralizing cognitive and brain dysfunctions from hydrocephalus [15]. Nevertheless, there is a small group of individuals whose neurological deterioration occurs or who undergo multiple shunt revisions times point to the patient's variation in outcomes. The need for further research to refine treatment algorithms and to discern prognosis predictors should also be pursued [16].It has the following drawbacks of retrograde design, single centre research and small sample size, which promotes a low extend of universality. Looking into perspectives in future research targeted to larger cohort design and long follow up periods are a prerequisite to the validation of the findings and clarifying the complicated interplay between myelomeningocele and hydrocephalus [17].

Conclusion

It is concluded that the management of myelomeningocele-associated hydrocephalus requires a multidisciplinary approach tailored to individual patient needs. Despite challenges such as perioperative complications, our study demonstrates promising long-term outcomes, emphasizing the efficacy of current treatment strategies.

References

1. Takoutsing BD, Yanez Touzet A, Park JJ, Lee SH, Bligh ER, Egiz A, Gillespie CS, Figaji A; Neurology and Neurosurgery Interest Group. Management and outcomes of myelomeningocele-associated hydrocephalus in low-income and middle-income countries: a systematic review and meta-analysis protocol. BMJ Open. 2023 Feb 7;13(2):e066339. doi: 10.1136/bmjopen-2022-066339. PMID: 36750288; PMCID: PMC9906258.

2. McCarthy DJ, Sheinberg DL, Luther E, et al.. Myelomeningocele-associated hydrocephalus: nationwide analysis and systematic review. *Neurosurg Focus* 2019;47:E5. 10.3171/2019.7.FOCUS19469
3. Oumer M, Taye M, Aragie H, et al.. Prevalence of spina bifida among newborns in Africa: a systematic review and meta-analysis. *Scientifica (Cairo)* 2020;2020:4273510. 10.1155/2020/4273510
4. Ntimbani J, Kelly A, Lekgwara P. Myelomeningocele - A literature review. *Interdisciplinary Neurosurgery* 2020;19:100502. 10.1016/j.inat.2019.100502
5. Dewan MC, Rattani A, Mekary R, et al.. Global hydrocephalus epidemiology and incidence: systematic review and meta-analysis. *J Neurosurg* 2018;2018:1–15. 10.3171/2017.10.JNS17439
6. Mnguni MN, Enicker BC, Madiba TE. A perspective in the management of myelomeningocoele in the KwaZulu-Natal Province of South Africa. *Childs Nerv Syst* 2020;36:1521–7. 10.1007/s00381-020-04506-9
7. Ben-Israel D, Mann JA, Yang MMH, et al.. Clinical outcomes in pediatric hydrocephalus patients treated with endoscopic third ventriculostomy and choroid plexus cauterization: a systematic review and meta-analysis. *J NeurosurgPediatr* 2022;2022:1–13. 10.3171/2022.3.PEDS21512
8. Pande A, Lamba N, Mammi M, et al.. Endoscopic third ventriculostomy versus ventriculoperitoneal shunt in pediatric and adult population: a systematic review and meta-analysis. *Neurosurg Rev* 2021;44:1227–41. 10.1007/s10143-020-01320-4
9. Sterne JAC, Savović J, Page MJ, et al.. RoB 2: a revised tool for assessing risk of bias in randomised trials. *BMJ* 2019;366:l4898. 10.1136/bmj.l4898
10. Shi L, Lin L. The trim-and-fill method for publication bias: practical guidelines and recommendations based on a large database of meta-analyses. *Medicine (Baltimore)* 2019;98:e15987. 10.1097/MD.0000000000015987
11. Muir RT, Wang S, Warf BC. Global surgery for pediatric hydrocephalus in the developing world: A review of the history, challenges, and future directions. Neurosurgical Focus. 2016;41:1-8. DOI: 10.3171/2016.7.FOCUS16273
12. Takoutsing, B. D., Touzet, A. Y., Park, J. J., Lee, S. H., Bligh, E. R., Egiz, A., ... &Figaji, A. (2023). Management and outcomes of myelomeningocele-associated hydrocephalus in low-income and middle-income countries: a systematic review and meta-analysis protocol. *BMJ open*, *13*(2), e066339.
13. Takoutsing, B. D., Touzet, A. Y., Park, J. J., Lee, S. H., Bligh, E. R., Egiz, A., ... &Figaji, A. (2022). Management and outcomes of myelomeningocele-associated hydrocephalus in low-and middle-income countries: a systematic review and meta-analysis protocol. *medRxiv*, 2022-06.
14. Fletcher, J. M., Houtrow, A. J., MacPherson, C., Thomas, N. H., Gupta, N., Adzick, N. S., & Thom, E. A. (2023). Hydrocephalus and school-age neurodevelopmental outcomes in the management of myelomeningocele prenatal surgery trial: a secondary analysis. *Journal of Neurosurgery: Pediatrics*, *31*(6), 517-527.
15. Cavalheiro, S., da Costa, M. D. S., Barbosa, M. M., Dastoli, P. A., Mendonça, J. N., Cavalheiro, D., & Moron, A. F. (2021). Hydrocephalus in myelomeningocele. *Child's Nervous System*, *37*(11), 3407-3415.
16. Omar, A. T., Espiritu, A. I., & Spears, J. (2022). Endoscopic third ventriculostomy with or without choroid plexus coagulation for myelomeningocele-associated hydrocephalus: systematic review and meta-analysis. *Journal of Neurosurgery: Pediatrics*, *29*(4), 435-443.
17. Karuparti, S., Dunbar, A., Varagur, K., Sudanagunta, K., Mingo, M., Bligard, K. H., ... &Strahle, J. M. (2024). Predictors and timing of hydrocephalus treatment in patients undergoing prenatal versus postnatal surgery for myelomeningocele. *Journal of Neurosurgery: Pediatrics*, *1*(aop), 1-10.
18. Weaver, K. J., McDowell, M. M., White, M. D., Tempel, Z. J., Zwagerman, N. T., Deibert, C. P., ... & Greene, S. (2021). Comparison of follow-up length-matched single-center

myelomeningocele postnatal closure cohort to the Management of Myelomeningocele Study (MOMS) trial results. *Pediatric Neurosurgery*, *56*(3), 229-238.