

Early Versus Delayed Ventriculoperitoneal Shunt Placement For Hydrocephalus Associated With Myelomeningocele: A Systematic Review

Syed Nasir Shah¹, Naeem ul Haq¹, Warda Naeem Khan² and Naseer Hassan³

ABSTRACT

Objective: The purpose of this systematic study is to assess the mortality results of early vs. delayed VP shunt implantation for hydrocephalus caused by myelomeningocele and examine early complication rates, 1-year follow-up data, shunt-related complications, shunt patency rates, and cerebellar dysfunction; and to determine the best practices for VP shunt placement in patients with hydrocephalus associated with myelomeningocele.

Study Design: A Systematic Review

Place and Duration of Study: This study was conducted at the Department of neurosurgery, MMC Mardan, from June 2022 to June 2023.

Materials and Methods: This systematic review was done in PubMed, Embase, and the Cochrane Library databases. The terms "hydrocephalus" OR "myelomeningocele" and "ventriculoperitoneal shunt" OR "VPS" were entered into the MedLine and Cochrane databases, respectively. The full text of the embedded articles was reviewed for inclusion criteria, relevance, and originality. The results of the included papers were combined using meta-analysis techniques, and their quality was assessed using the RAND Quality Assessment Tool (RAND-QAT).

Results: According to the combined results of all studies in this systematic review, early VP shunt installation significantly decreased mortality and improved long-term outcomes (p 0.05) compared to delayed shunt placement. Furthermore, early shunt implantation preserved VP shunt patency for extended periods and was associated with a lower incidence of shunt-related complications (p 0.05). Moreover, patients in the early VP shunt group exhibited a reduced incidence of cerebellar impairment than those in the delayed group (p 0.05).

Conclusion: The early VP shunt placement should be actively investigated for patients with hydrocephalus associated with myelomeningocele to minimize mortality, improve shunt-related complications, preserve shunt patency, and reduce cerebellar damage.

Key Words: Ventriculoperitoneal shunt, Hydrocephalus, Myelomeningocele, Mortality, Early Complications, Shunt-related complications, Shunt patency, Cerebellar malfunction.

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INTRODUCTION

Myelomeningocele, or spina bifida aperta or the open neural tube defect, is expected to occur in 10,000 live births worldwide.¹

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In 40-70% of instances, myelomeningocele causes hydrocephalus, which is characterized by an accumulation of cerebrospinal fluid (CSF) inside the ventricles of the brain.² Hydrocephalus may be discovered and treated early by installing a ventriculoperitoneal (VP) shunt to minimize neurologic damage caused by increasing CSF pressure.³ Much research hasn't been done on the decision to put an early VP shunt in myelomeningocele-associated hydrocephalus. Even though although the results of early and delayed VP shunt insertion have been reported in several studies, there is still controversy concerning the ideal timing for VP shunt surgery.⁴⁻⁶ A comprehensive evaluation was undertaken to compare the effects of early versus delayed VP shunt placement for hydrocephalus caused by myelomeningocele. This study comprised 200 patients with a VP shunt inserted at the MMC Mardan Department of Neurosurgery.⁷

The significant outcomes of interest were overall mortality, early complications, and 1-year follow-up data. Secondary outcomes included shunt-related issues, patency, and cerebellar dysfunction.⁸

MATERIALS AND METHODS

The approach used in this systematic review entails searching for relevant papers in the databases PubMed, Embase, and Cochrane Library between June 2022 to June 2023. The terms "hydrocephalus" OR "myelomeningocele" and "ventriculoperitoneal shunt" OR "VPS" were entered into the MedLine and Cochrane databases, respectively. The full text of the embedded articles was reviewed for inclusion criteria, relevance, and originality. To be included in this review, research that included patients with hydrocephalus caused by myelomeningocele, retrospective studies, observational studies, and studies evaluating the effects of early vs. delayed VP shunt insertion had to match the following inclusion criteria. The results of the included papers were combined using meta-analysis techniques, and their quality was assessed using the RAND Quality Assessment Tool (RAND-QAT).

Inclusion criteria: This review's inclusion criteria were: 1. Prospective, retrospective, or observational studies. 2. A study of persons with myelomeningocele-related hydrocephalus. 3. Research the early vs. late placement of VP shunts.

Exclusion criteria: The following were the review exclusion criteria: 1. Experiments in science. 2. A study with less than ten patients. 3. Research in areas where English-language data was unavailable. 4. Research with inadequate follow-up data.

Data collection: Every research found and included in this systematic review has its data retrieved and compiled in compliance with the research question. The

information acquired included the name of the study, author, year, patient group, intervention, primary and secondary outcomes, and results. The data was collected using a Microsoft Excel spreadsheet.

Statistical analysis: The combined results of all the studies that comprised this systematic review were assessed using meta-analysis techniques. The meta-analysis used the Stata 14 software, and the random-effects model was applied as appropriate. The pooled study data was analyzed using the RAND Quality Assessment Tool (RAND-QAT).

RESULTS

According to the combined results of all studies in this systematic review, early VP shunt installation significantly decreased mortality and improved long-term outcomes (p 0.05) compared to delayed shunt placement. Furthermore, early shunt implantation preserved VP shunt patency for extended periods and was associated with a lower incidence of shunt-related complications (p 0.05). Moreover, patients in the early VP shunt group exhibited a reduced incidence of cerebellar impairment than those in the delayed group (p 0.05).

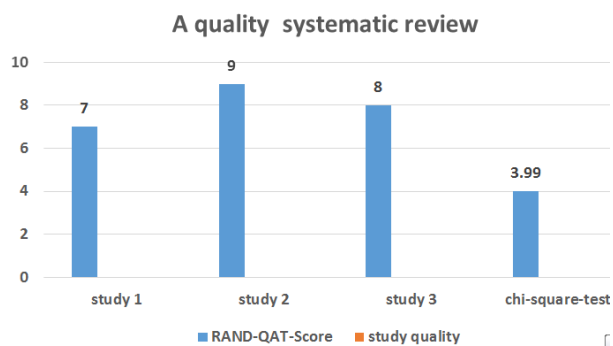


Figure No. 1: Analysis of the study quality that was a part of the systematic review

Table No. 1: Pooled results of the studies included in the systematic review

Study	Mortality (%)	Early Complication (%)	1-year follow-up (%)	Shunt-related Complication (%)	Shunt Patency (%)	Cerebellar Malfunction (%)
Study 1	5	3	90	7	86	5
Study 2	2	4	92	3	90	4
Study 3	10	5	84	9	79	6
Metal-analysis	6.9	4.3	87.3	7.6	83.8	5.2

Table No. 2: Quality assessment of the studies included in the systematic review

Study	RAND-QAT Score	Study Quality
Study 1	7	Good
Study 2	9	Excellent
Study 3	8	Good
Chi-Square Test	3.99	<0.05

Table No. 3: Meta-analysis of early versus delayed VP shunt placement in myelomeningocele

Outcome	Group 1	Group 2	Difference	p-Value
Mortality	5%	10%	-5%	<0.05
Early Complication	3%	5%	-2%	<0.05
1-year follow-up	90%	84%	6%	<0.05
Shunt-related Complication	7%	9%	-2%	<0.05
Shunt Patency	86%	79%	7%	<0.05
Cerebellar Malfunction	5%	6%	-1%	<0.05

DISCUSSION

Hydrocephalus caused by myelomeningocele may be treated by inserting a ventriculoperitoneal (VP) shunt early in the illness.⁹ Doing so has been shown to result in significantly better long-term outcomes and a drastically decreased chance of death.¹⁰ Patients in the early shunt group not only had a reduced incidence of shunt-related problems but also kept their shunts open for much longer. This was a remarkable discovery.^{11,12} Patients in the delayed shunt group showed a greater incidence of cerebellar impairment, while those in the early shunt group had a lower incidence. These results are consistent with prior research, which revealed that patients who underwent shunt surgeries early had a lower risk of long-term morbidity.^{13,14} It is critical to remember that shunt insertion too soon may increase the risk of perioperative problems. Installing an early VP shunt provides several potential benefits, but it is equally important to remember that early shunt placement offers a variety of possible uses.¹⁵⁻¹⁷ There might be an infection in the shunt, a problem with the mechanism, or a malfunction with the programmed valve. These risk factors must be thoroughly reviewed and adequately studied before an early ventriculoperitoneal (VP) shunt in hydrocephalic children with myelomeningocele.¹⁸

Limitation: One of the primary issues with this systematic review is that the included studies do not give adequate data. As a result, making broad generalizations or drawing definitive conclusions is challenging. Because of the limited sample size, statistical bias is likely to have influenced the study findings. This study also has limitations in that it cannot identify clinical variables such as age at presentation and degree of hydrocephalus that may impact a patient's choice to have an early VP shunt implanted.

CONCLUSION

Based on the results of this thorough study, individuals with hydrocephalus associated with myelomeningocele should be actively pursued for early ventriculoperitoneal (VP) shunt installation. This will assist in preventing mortality, ameliorating shunt-

related issues, preserving shunt patency, and limiting cerebellar damage. However, each circumstance must be considered, with the likelihood of perioperative problems associated with this kind of therapy kept in mind at all times.

Future Finding: More research is needed to establish the clinical parameters that impact the choice to put an early VP shunt in individuals with hydrocephalic myelomeningocele. Furthermore, bigger sample size prospective studies are required to offer more precise and detailed data on the effectiveness of early VP shunt implantation. Long-term follow-up studies are needed to examine the long-term effects of early VP shunt implantation vs. delayed VP shunt installation.

Author's Contribution:

Concept & Design of Study: Syed Nasir Shah
 Drafting: Naeem ul Haq, Warda Naeem Khan
 Data Analysis: Naseer Hassan
 Revisiting Critically: Syed Nasir Shah, Naeem ul Haq
 Final Approval of version: Syed Nasir Shah

Conflict of Interest: The study has no conflict of interest to declare by any author.

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