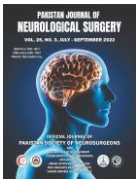

PAKISTAN JOURNAL OF NEUROLOGICAL SURGERY (QUARTERLY) – OFFICIAL JOURNAL OF PAKISTAN SOCIETY OF NEUROSURGEONS

Original Article

Assessment of Outcomes of Myelomeningocele Repair and Early Post-Operative Complications

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ABSTRACT

Objective: To explore the result and frequency of different problems that occur in the early post-operative period and the incidence of these complications in our community. It will give insight and drive further development in the care of myelomeningoceles as well as the unique problems that emerge in these patients post-operatively.

Materials and Methods: At the Jinnah Postgraduate Medical Center in Karachi, the Department of Neurosurgery, this prospective, observational study was carried out over 12 months. Patients of both genders from 1 month to 2 years of age, diagnosed with myelomeningocele, and admitted to the ward for surgical repair were included in the study.

Results: Out of 94, there were 58.5% female patients, with the highest percentage of age group i.e. 48.9% in > 3 months to 9 months. Medium size of MMC (71.3%) at the lumbar side location (46.8%) was observed in the highest frequency among the study sample. The overall postoperative complication rate was 19.1%, with CSF leak being the most common (9.6%) followed by wound infection (5.3%). There was no association of the complications with the age, size, and location of MMC.

Conclusion: Myelomeningocele treatment may be delayed as a result of distant homebirths. Neurosurgeons who are trying to give prompt access to medical care for individuals born with MMC face various hurdles, including the family's desire to seek medical attention, their capacity to do so, and the availability of proper medical treatment.

Key Words: Spina bifida (SB), Myelomeningocele (MMC), Surgical site infection (SSI), Magnetic Resonance Imaging (MRI), Computed Tomography screening (CT Scan), Cerebrospinal fluid (CSF).

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Date of Submission: 11-10-2022
Date of Revision: 12-12-2022
Date of Acceptance: 24-12-2022
Date of Online Publishing: 31-12-2022
Date of Print: 31-12-2022

DOI: 10.36552/pjns.v26i4.804

INTRODUCTION

Spina bifida is the most frequent central nervous system deformity and the second most prevalent cause of congenital diseases after congenital heart abnormalities.[1] One of the frequently abundant malformations of Spina bifida is Myelomeningocele (MMC) which occurs when the spinal neural tube fails to seal correctly during embryonic development (the fourth week after fertilization), resulting in a vertebral abnormality that causes the meninges and spinal cord to herniated.[2] The neural tube fuses rostrally and caudally, beginning at the level of the hindbrain (medulla and pons). Around day 26 of pregnancy, meningomyelocele is created by an incomplete caudal fusion.[3] Despite being one of the most frequent congenital deformities, the mechanism that causes it remains mostly unknown.[4] Various associated neurologic disorders include hydrocephalus, Arnold-Chiari II malformation, motor disorders, cognitive dysfunction, bladder problems, and musculoskeletal abnormalities.[5-6] For patients with concurrent hydrocephalus, the current surgical recommendations are that the myelomeningocele deficiency is repaired as soon as possible, ideally within 72 hours. To reduce the danger of infections, postnatal surgery is often performed within 24 to 48 hours following delivery or after two weeks.[7] Having a child with MMC has an impact not only on the patient's quality of life but also on the parents, siblings, and society as a whole with both psychological and socioeconomic implications. Prevention is always the first step in controlling the incidence of the disease. However, early identification and meticulous repair may have a role in reducing the burden and neurological impairment significantly.[8].

With the widespread use of advanced technology, ultrasonography provides a window for early MMC diagnosis during pregnancy. Nowadays, MMC is treated either through open surgery or by fetal MMC repair. MRI or CT screening is the initial step in determining the best course of therapy for the lesion.[9] To reduce the risk of infections, antiseptic procedures should be followed and medicines administered. It is important to use radiological imaging to rule out any more related abnormalities. Patients with hydrocephalus may benefit from a ventriculoperitoneal shunt as well as posterior decompression surgery with occipital-cervical fusion if Arnold-Chiari II malformation is present.[10] Ultimately, multidisciplinary medical management must be ensured and should focus on preventing further complications and neurological deficits.[11] Literature reported the presence of postoperative pyrexia to be 90.4%, postoperative CSF leak at 23.7%, and wound infection at 13.5%.[12] Another study reported that the incidence of postoperative hydrocephalus was 57.4% after the primary repair of myelomeningocele.[13] Therefore, the purpose of this study is to further examine the results and occurrence rates of different problems as they arise in the early postoperative period and to estimate their prevalence in our community.

MATERIAL AND METHOD

At the Jinnah Postgraduate Medical Center in Karachi, the Department of Neurosurgery this prospective, observational study was carried out over 12 months i.e. June 2021 to May 2022. We enrolled 94 patients in our study who underwent myelomeningocele repair.

Inclusion and Exclusion Criteria

Patients were sampled using non-probability consecutive sampling. Informed consent was taken from each patient's attendants. The age range was from one month of age till two years and both genders were included. However, for those patients who have spina bifida in another form, such as encephalocoele or occult spina bifida, previous history of operated myelomeningoceles, concurrent congenital

abnormality in the cardiovascular or renal system, and those who refused to take part in the study (not informed consent) were excluded.

Preoperative observation and Selection

Meningomyelocele was first diagnosed on clinical examination and then the diagnosis was confirmed using an MRI of the whole neuraxis. Patient demographics, including the age, gender, location of MMC, etc were documented using a proforma. Preoperatively patient was examined clinically and the size of MMC was noted with < 3 cm being considered small, 3 – 6 cm medium, and > 6 cm large. Power in the limbs was also documented. Postoperatively, the patient was examined and followed for one month. Worsening Neurological deficit was considered if there was the presence of a new lower limb weakness in a child with intact spontaneous movements preoperatively.

Post-Operative Observation and Selection

Infection in the incision line within 30 days of surgery was defined as post-operative wound infection and was determined by the presence of any of the following clinical examination findings: Redness, swelling, pus in the wound, and purulent discharge from the wound. Surgeries were done under general anesthesia by a consultant neurosurgeon having a surgical experience of more than 5 years patients were monitored post-operatively for up to one month after discharge from the hospital. The patients were monitored by the researcher and a consultant neurosurgeon for one month following surgery in case any problems such as hydrocephalus, the need to place a VP shunt, wound infection, or CSF leak developed.

Data Analysis

Observation and examination were recorded on a predesigned proforma. Patient confidentiality was maintained by keeping the anonymity of the patients; codes were given to each patient to track the record. The collected information was entered into SPSS Version 26. Effect modifiers of the study were stratified and compared with the presence of hydrocephalus by using the Chi-square test considering two-sided $P \leq 0.05$ as criteria of statistical significance. The confidence interval was taken at 95% with an 8% margin of error.

RESULTS

Distribution of Gender

In our study, there were 94 children received MMC and out of which there were 55 (58.5%) female patients and 39 (41.5%) male patients.

Distribution of Age

As for the age of the MMC patients, the highest percentage of age group i.e. 48.9% in > 3 months to 9 months of age. Age of 1 month to 3 months of age was 36.2%, from 9 months and above to 12 months was 9.6% and all the patients who were marked above the age of 12 months were only 5.3% of the total sample size population.

Size of MMC

Medium size of MMC (71.3%) at the lumbar location (46.8%) was observed in higher frequency among the study sample. However, the large size of MMC was observed at 27.7% population. There was only one patient who had a smaller size f MMC during the data recorded phase.

Neurological Status

At the time of surgery, the power of the lower limbs was observed to be absent in 46 pediatric patients out of 94.

Postoperative Complications

The overall complication rate was 19.1% with 09 pediatric patients having CSF leaks, 05 patients with Wound Infection, New Hydrocephalus in 03 pediatric patients, and a new neurological deficit in one patient. The maximum length of stay among these pediatric patients was observed to be 7 with a mean frequency of 4 days normally (Table 01).

Table 1: Descriptive statistics of MMC neonate's pediatric patients with a sample size of 94.

	Frequency (Percentage)
Age	
1 month to 3 months	34 (36.2%)
>3 months to 9 months	46 (48.9%)
> 9 months to 12 months	09 (9.6%)
> 12 months	05 (5.3%)
Gender	
Male	39 (41.5%)
Female	55 (58.5%)
Size of MMC	
Small	01 (1.1%)
Medium	67 (71.3%)
Large	26 (27.7%)
Location of MMC	
Cervical	05 (5.3%)
Dorsal	14 (14.9%)
Lumbar	44 (46.8%)
Dorsolumbar	31 (33%)
Power of Limbs	
Spontaneous	12 (12.8%)
Decreased	36 (38.3%)
Absent	46 (49%)
CSF Leak	
Present	09 (9.6%)
Absent	85 (90.4%)
Wound Infection	
Present	05 (5.3%)
Absent	89 (94.7%)
Hydrocephalus	
Present	38 (40.4%)
Absent	56 (59.6%)
New Hydrocephalus	
Present	03 (3.2%)
Absent	91 (96.8%)
New Neurological Deficit	
Present	01 (1.1%)
Absent	93 (98.9%)
Outcome Variables	
Readmissions in 30 days (%)	6 (4.0%)
Re-Surgery (%)	5 (3.33%)
Mortality (%)	0 (0%)
Length of Stay (days)	4 (3-7)*

*Median (range)

The age of the patient didn't have any significant impact on the postoperative complications. On statistical stratification of the data analysis, no significance was observed among the size of MMC, Kyphosis, Age, and Location of MMC when cross-tabulated with wound infection, CSF Leak, New Hydrocephalus, and New Neurological Deficit (Table 02).

Table 2: Statistical stratification of the study variables sample of 94 pediatric patients.

		Wound Infection			CSF Leak			New Hydrocephalus			New Neurological Deficit		
	Total	Present	Absent	P. Value	Present	Absent	P. Value	Present	Absent	P. Value	Present	Absent	P. Value
Size of MMC													
Small	**1**	0	1		0	1		0	1		0	1	
Medium	**67**	5	62	0.345	7	60	0.873	2	65	0.962	1	66	0.816
Large	**26**	0	26		2	24		1	25		0	26	
Kyphosis													
Present	**30**	0	30	0.173	4	26	0.46	0	30	0.549	1	29	0.319
Absent	**64**	5	59		5	59		3	61		0	64	

Age													
1 month – 3 months	**34**	2	32		0	34		0	34		0	1	
>3 months – 9 months	**46**	2	44	0.804	8	38	0.06	2	44	0.103	1	52	1.00
> 9 months – 12 months	**9**	1	8		1	8		0	9		0	34	
> 12 months	**5**	0	5		0	5		1	4		0	6	
Location of MMC													
Cervical	**5**	0	5		0	5		0	5		0	5	
Dorsal	**14**	2	12	0.417	0	14	0.313	0	14	0.828	0	15	0.234
Lumbar	**44**	2	42		4	40		2	42		0	56	
Dorsolumbar	**31**	1	30		5	26		1	30		1	17	

*Chi-square test applied

DISCUSSION

In this study, we determined the outcomes of MMC repair in our multispecialty hospital. The commonest sites of lesions in our study were the lumbosacral and thoracolumbar regions. Zoghi et al also reported similar findings in their study.[14] Depending on the location being investigated, there are differences in the gender distribution of people born with a myelomeningocele.[15] The probability of having a baby with a meningomyelocele is certainly greater in primigravid females, who, all together, account for 52.1% of instances, according to one report.[16] Similarly, there are differences in the gender distribution of people born with a myelomeningocele. The male-to-female ratio according to the Nigerian group was 1.1:1. A British group observed a similar sex distribution, with a male-to-female ratio of 1.2:1.[17] However, a Japanese study that reported a male-to-female ratio of 1:1.1 and a Hungarian study that recorded a male-to-female ratio of 1:1.2 both show a reversal of the male preponderance.[18]

The anatomical position of myelomeningocele varies in literature however it has often present at 22.3% to 55.7% lumbosacral, cervical 1.8% to 5.6%, cervicothoracic 0.9%, thoracic 4.2%, lumbar 16.8% to 55.7%, sacral 16% to 34.5% and in 0.9% cervical, 5.6% thoracolumbar, and 16% sacral injuries were reported.[19-20] Age of pediatric patients was not statistically significant in our study which was found to be similar to the Lillegard J.B. et al, study results i.e., with two groups of OMFS (open maternal-fetal surgery) for fMMC (fetal myelomeningocele) closure compared with fetal and maternal outcomes (anterior and posterior placental locations) and found insignificance in gestational age at the time of delivery (p = 0.583).[21] In the Management of Myelomeningocele Study (MOMS) on 161 cohort patients, the children's average age at the time of the study visit was 7.8 years (range 5.9 – 10.3).[22] Similarly, another study of MOMS to find out urological outcomes at school age of 156 children, had a mean age of 7.4 years.[23] Besides the mean age at shunt placement was observed in the literature up to 21.2 weeks of age (range 1 – 44 weeks).[24]

The result of our study's complication variables is similar to that seen in the literature. Rebecca et al. in a study of 75 cases, reported wound dehiscence in 10 cases, infections in 6 cases, and CSF leak in 4 cases.[25] The data of 114 babies with MMC from the NSQIP database of a Texas hospital reported infections in 6.0% of cases, dehiscence in 11% of cases, and mortality in 2.0% of cases.[25] While a study by Khan A conducted on 156 babies with MMC reported wound infections in 13.5% of cases, pyrexia in 90.4% of cases, CSF leak in 23.7% of cases, and

hydrocephalus in 22.4% of cases in post-op follow-up. In a 2015 study, meningitis/shunt infections occurred in 18 (16.4%) of the 91 newborns after the closure of the MMC, whereas surgical wound infections occurred in 12 (11%) newborns. A deep surgical wound infection was not related to the length of the surgery or the extent of the wound.[25]

Closure of MMC is straightforward, but a thorough approach avoids surgical complications. Efforts should be coordinated to preserve neurological capability and meticulous dura and wound closure. Early hydrocephalus therapy can prevent CSF leaks and wound infection/ dehiscence.[26] The major limitation of the current study is only 30 days follow-up, so we were unable to assess the long-term outcomes and quality of life at later stages in these patients. Studies with longer follow-ups are needed to determine the long-term outcomes of MMC repair.

LIMITATION AND RECOMMENDATION

Only limited studies have been published from local settings in Pakistan on the incidence of hydrocephalus in addition to myelomeningocele. A large data sample collection and long cohort studies would suffice the clinical findings in the most authentic and clarified way. It will offer clarity and inspire future advancement in the treatment of myelomeningoceles as well as the unique post-operative problems that these patients are prone to.

CONCLUSION

Meningomyelocele is a congenital condition that may have a large impact on the quality of life and society as a whole. Myelomeningocele treatment may be delayed as a result of distant homebirths. Neurosurgeons who are trying to give prompt access to medical care for individuals born with MMC face various hurdles, including the family's desire to seek medical attention, their capacity to do so, and the availability of proper medical treatment.

ACKNOWLEDGMENT

All thanks to the helping hands that had put their crucial part in data collection and queries during the data collection. Moreover, thanks to seniors and supervisors who helped us in compiling this article into its best form possible.

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Additional Information

Disclosures: Authors report no conflict of interest.
Ethical Review Board Approval: The study was conformed to the ethical review board requirements.
Human Subjects: Consent was obtained by all patients/participants in this study.
Conflicts of Interest:
In compliance with the ICMJE uniform disclosure form, all authors declare the following:
Financial Relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work.
Other Relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

AUTHOR CONTRIBUTIONS

Sr. No.	Author's Full Name	Intellectual Contribution to Paper in Terms of
1.	Sabika Aftab	Study Design, Methodology, and Paper Writing.
2.	Rabail Akbar	Data Calculation and Data Analysis.
3.	Farrukh Javeed	Interpretation of Results.
4.	Tanweer Ahmed	Statistical Analysis.
5.	Iram Bokhari	Literature Review.
6.	Lal Rehman	Literature Review and Quality Insurer.