

Outcome of Myelomeningocele Repair and Early Post-operative Complications

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ABSTRACT

Introduction: Neural tube defects are one of the most common congenital birth defects resulting in a significant number of physical, mental and social disabilities in the earlier years of life. Amongst the central nervous system anomalies which are reported in 31% of newborns with anomalies, myelomeningocele (MMC) is the most common of the central nervous system defects with upto 71% occurrence.

Objective: To determine frequency of post-operative complications in the repair of myelomeningocele.

Material and Method: This study was a Descriptive case series conducted at Pakistan Institute of Medical sciences (PIMS) Islamabad from March to September 2016. Consecutive (non-probability) sampling technique was used. Total of 156 patients were included in the study who presented in neurosurgical department of PIMS, Islamabad suffering from meningomyelocele. Mean Age of presentation of patients was 58.58 days \pm 26.01 Std. deviation. 88 patients (56.4%) were males and 68 (43.6%) were females. 79 patients had size of defect < 5 cm, 68 patients had size of defect ranging from 5-10 cm and 9 patients had defect size > 10 cm in size. 21 patients (13.5%) wound showed signs of surgical site infection while 135 patients (86.5%) wounds healed satisfactorily. 37 patients (23.7%) had CSF leakage while 119 patients (76.3%) recovered completely. Post-operative pyrexia was noted in 141 patients (90.4%) while 15 patients (9.6%) remained afebrile. Post-operative Hydrocephalus was seen in 35 patients (22.4%) as compared to 121 patients (77.6%) with no hydrocephalus post operatively.

Conclusion: The study concluded that early diagnosis and prompt management is key to recovery of child. Early operation without subsequent complications is the backbone of treatment.

Key Words: Meningomyelocele (MMC), Post-operative Pyrexia, Wound infection, Hydrocephalus, Cerebrospinal fluid (CSF) Leak.

INTRODUCTION

Human disabilities are one of the leading burdens of disease upon our society. According to the 'World Report on Disability', there are more than one billion persons with a variety of disabilities which amounts to above 15% of the world population.¹ Neural tube defects are one of the most common congenital birth defects resulting in a significant number of physical, mental and social disabilities in the earlier years of life. The incidence of these anomalies is very high in the developing world, while in the western countries it has reached a steady state where no decrease is noted despite significant research into its prevention.²⁻⁴

These anomalies are the most debilitating amongst

all the structural malformations and have a grave impact upon the functioning of individuals, families and communities as a consequence.^{5,6} Amongst the affected are the families from lower socio-economic status and especially those with poor food quality and hygiene.⁷ Amongst the central nervous system anomalies which are reported in 31% of newborns with anomalies, myelomeningocele (MMC) is the most common of the central nervous system defects with upto 71% occurrence.⁸ The incidence is reported to range from 3 to 6 per 1000 live births.^{8,9}

The current surgical guidelines advise for early repair of the myelomeningocele defect, within 48 hours, and to shunt the hydrocephalus at right time if

present concomitantly. Typically the myelomeningocele defect is repaired within 24 to 48 hours of birth and the infant is followed closely for development of signs of hydrocephalus. In more than 70% of infants however, hydrocephalus develops early post-operatively and ultimately require shunting of CSF. Among the remaining patients, hydrocephalus may develop later at any time in life.¹⁰ A study into short term outcome of surgical management of patients with spina bifida by Khan et al reported various complications. Almost all patients experienced postoperative pyrexia, wound infection was estimated at 9%, 30% cases of cerebrospinal fluid (CSF) leakage through the wound and 21.2% of patients developed hydrocephalous.

The rationale of this study is therefore to further investigate the outcome and frequencies of various complications as they occur in the early post-operative period and to determine their incidence from our population. It will provide an insight and stimulate further improvement in management of myelomeningocele as well as management of the specific complications which arise post-operatively in these patients.

OBJECTIVE

To determine frequency of post-operative complications in the repair of myelomeningocele.

MATERIAL AND METHOD

It was a descriptive case series study conducted in Pakistan Institute of Medical Sciences Islamabad. The study duration was six months from March to September 2016. Non-probability consecutive sampling technique was used for the data collection. Total 156 cases were included in the study according to the inclusion criteria by taking confidence level = 95%, anticipated population proportion = 9%, it was calculated from $p = 9\%$, $d = 4.5\%$.¹⁰ Myelomeningocele was confirmed by clinical examination as the congenital presence of swelling at the level of thoracic or lumbar spine. Following complications were assessed in the study within one month post-operatively; Hydrocephalus termed as accumulation of CSF in the brain ventricles manifested as fullness of anterior fontanelle on clinical examination and dilated ventricles on CT scan of the brain. Post-operative fever included fever of above 100 degree F after 24 hours to one month

postoperative period. Post-operative wound infection was termed as infection that occurred in incision line within 30 days after surgery and identified by the presence of any of the following findings on clinical examination; Pus in wound, redness, swelling and purulent discharge from the wound. CSF leak included clear watery discharge through the wound of myelomeningocele repair and was confirmed by clinical examination within one month post operatively. Inclusion criteria of the study include patients of both genders, patients from birth (24 hours after) and six months of age, patients with the diagnosis of myelomeningocele and patients with a defect size of 10 cm in diameter or less whereas patients with other forms of spina bifida such as encephalocoele and variants of spina bifida occulta, patients with operated myelomeningocele, patients with advanced hydrocephalous concomitant with myelomeningocele and moribund patients who are not fit for general anaesthesia or surgery was taken as exclusion criteria.

All patients with Myelomeningocele admitted in Neurosurgery department of Pakistan Institute of Medical Sciences selected randomly through Outpatient Department (OPD), Emergency and Calls from other units of Pakistan Institute of Medical Sciences were approached. Only those patients who fulfil the inclusion criteria were included in the study. Data was collected on a predesigned proforma. This proforma included information about the identity of patient like name, age, gender, address, admission number, mode of admission, location of the Myelomeningocele, size of the Myelomeningocele, time of presentation and associated anomalies were recorded. Diagnosis of Myelomeningocele was made on clinical examination. Decision regarding operative/conservative treatment was made by a Neurosurgeon with a minimum of five year experience. Patients who needed to be operated were included in our study. Operations were done under general anaesthesia by a Neurosurgeon with above mentioned qualifications. Patient were followed post-operatively till discharge from the hospital and up to one month thereafter. The patient were assessed by a Neurosurgeon with a minimum five year experience for development of any complications like hydrocephalous, fever, wound infection and CSF leak within one month post operatively and were treated accordingly. Observation and examination were also be done by a trainee medical officer and data was recorded on a predesigned proforma. To control confounders and

bias in the study results, exclusion criteria were followed strictly.

Statistical Package for Social Sciences (SPSS version 20) was used to enter and analyse the data. Descriptive statistics like mean and standard deviations was calculated for quantitative variables like age. Frequency/percentage were calculated for categorical variables like gender, defect size and postoperative complications (fever, wound infection, CSF leak, and hydrocephalus). Postoperative complications were stratified among age, defect size and gender to control effects modifiers. Post stratification chi square test was applied keeping p-value less than or equal to 0.05 was considered significant. All results were presented in the form of charts and graphs.

RESULTS

Total of 156 patients were included in the study who presented in neurosurgical department of PIMS, Islamabad suffering from meningomyelocele. Mean age of presentation of patients was 58.58±26.01 days deviation. Out of 156 patients 88 patients (56.4%) were males and 68 (43.6%) were females. Patients were categorized according to size of defect. 79 wound infection was calculated. 21 patients (13.5%) wound showed signs of surgical site infection while 135 patients (86.5%) wounds healed satisfactorily. (Table No. 03) Post-operative pyrexia was noted in 141 patients (90.4%) while 15 patients (9.6%) remained afebrile. Frequency of Post-operative CSF was also noted. Results showed 37 patients (23.7%) had CSF leakage while 119 patients (76.3%) recovered completely. Post-operative Hydrocephalus was seen in 35 patients (22.4%) as compared to 121 patients (77.6%) with no hydrocephalus post operatively.

Post-stratification results were analyzed according to age of patients, gender and size of defect. According to age of patients post stratification results showed post-operative pyrexia was seen in 25 patients at age of 01-30 days, 48 patients at age of 31-60 days, 55 patients at age of 61-90 days, 11 patients at age of 91-120 days and 2 patients of age 121-150 days, as shown in Table 3. Chi square test results had p value 0.991 which was insignificant. Post-operative CSF leak, Hydrocephalus (Table 9) and wound infection results stratified on basis of age showed low frequencies and chi square test results were not significant.

Results were stratified on basis of gender also. Post-operative pyrexia was seen in 76 patients out of

88 males and 65 females out of 68 females. Chi square test results showed p-value of 0.045 which was considered significant, as shown in Table 2. Similarly 27 males out of 88 had CSF leak while 10 females out of 68 had CSF leak. Chi square p-value was 0.015 which was significant. Post-operative Hydrocephalus and Post-operative wound infection results had p-value > 0.05 which was not significant. Post stratification results on basis of size of defect on post-operative pyrexia; p-value 0.182, CSF leak; p-value 0.351, hydrocephalus; p-value 0.906 and wound infection; p-value 0.427 were all not significant.

Table 1: Descriptive statistics of variables.

| | | |
|------------------------------|--------|---------------|
| Age (years) | | 58.58 ± 26.01 |
| Gender | Male | 88 (56.4%) |
| | Female | 68 (43.6%) |
| Wound Infection | Yes | 21 (13.5%) |
| | No | 135 (86.5%) |
| Post-operative Pyrexia | Yes | 141 (90.4%) |
| | No | 15 (9.6%) |
| Post-operative CSF leak | Yes | 37 (23.7%) |
| | No | 119 (76.3%) |
| Post-operative Hydrocephalus | Yes | 35 (22.4%) |
| | No | 121 (77.6%) |

Table 2: Comparison of post-stratification of variables.

| | | Gender | | p-value |
|---------------------------|-----|--------|--------|---------|
| | | Male | Female | |
| Post-operative Pyrexia | Yes | 76 | 65 | 0.053 |
| | No | 12 | 3 | |
| CSF leak | Yes | 27 | 10 | 0.020 |
| | No | 61 | 58 | |
| Presence of hydrocephalus | Yes | 22 | 13 | 0.382 |
| | No | 66 | 55 | |
| Wound infection | Yes | 13 | 8 | 0.585 |
| | No | 75 | 60 | |

| | | Post-Operative Pyrexia | | |
|---------------------|------|------------------------|----|-------|
| | | Yes | No | |
| Size (cm) of Defect | 1-4 | 71 | 8 | 0.182 |
| | 5-10 | 65 | 5 | |
| | >10 | 5 | 2 | |
| | | CSF Leak | | |
| | | Yes | No | |
| Size (cm) of Defect | 1-4 | 16 | 63 | 0.351 |
| | 5-10 | 18 | 52 | |
| | >10 | 3 | 4 | |

| | | Presence of Hydrocephalus | | |
|---------------------|------|---------------------------|----|-------|
| | | Yes | No | |
| Size (cm) of Defect | 1-4 | 17 | 62 | 0.906 |
| | 5-10 | 16 | 54 | |
| | >10 | 2 | 5 | |
| | | Wound Infection | | |
| | | Yes | No | |
| Size (cm) of Defect | 1-4 | 9 | 70 | 0.427 |
| | 5-10 | 10 | 60 | |
| | >10 | 2 | 5 | |

DISCUSSION

Our study included 156 patients who were operated for meningomyelocele, post operatively patients were followed up for complications like pyrexia, wound infection, hydrocephalus and CSF leak. 21 patients (13.5%) wound showed signs of surgical site infection while 135 patients (86.5%) wounds healed satisfactorily. Post operative pyrexia was noted in 141 patients (90.4%) while 15 patients (9.6%) remained a febrile. 37 patients (23.7%) had CSF leakage while 119 patients (76.3%) recovered completely. Hydrocephalus was seen in 35 patients (22.4%) as compared to 121 patients (77.6%) with no hydrocephalus post operatively.

A study done in 2012, 60 consecutive patients with a myelomeningocele was recorded between January 2002 and December 2005. Out of total 60 patients, 7 (11.7%) patients developed wound infections after myelomeningocele repair and 2 (3.3%) patients presented with sepsis unrelated to the neurosurgical procedures. 46 (76.7%) patients received a VP shunt and 9(19.6%) patients had VP shunt infection.¹¹Closure of a myelomeningocele is a simple operation; however, meticulous technique significantly reduces operative complications. Efforts should be coordinated toward preserving neurological capacity and improving the subsequent repair of a fastened spine whenever required later on. The timely management of related hydrocephalus will support to avoid cerebrospinal fluid leakage and wound

Table 3: Comparison of post-operative complications with Age stratification.

| Age (Days) | Post-Operative Pyrexia | CSF Leak | Presence of Hydrocephalus | Wound Infection |
|------------|------------------------|----------|---------------------------|-----------------|
| 1-30 | 25 | 6 | 6 | 4 |
| 31-60 | 48 | 13 | 14 | 5 |
| 61-90 | 55 | 13 | 13 | 8 |
| 91-120 | 11 | 5 | 2 | 2 |
| 121-150 | 2 | 0 | 0 | 2 |
| Total | 141 | 37 | 35 | 21 |
| P-value | 0.991 | 0.549 | 0.853 | 0.008 |

infection/dehesience.¹²

Out of 190 patients who underwent surgery between 1979 and 1993, 82 (43.2%) were males and 108 (56.8%) were females. The lumbar spine was the most common site of myeloma in 113 patients (59.5%). Patients with cervical and sacral meningomyelocele had a higher rate of almost normal motor function than those with meningomyelocele at other levels (P = 0.000). Total of 166 patients, 36 (21.7%) had no hydrocephalus.¹³According to national wide impatient sample database, 7.45 million patient’s admission, 2000 was from retrospectively studied. Demographic data for patients, length of stay, immediate disposal at discharge time, hospital information, and hospitalization costs were determined. It is surprising that only 35% of those who needed VP shunt placement while in the same hospitalfor developing hydrocephalus post

operatively.¹⁴

The Nationwide Inpatient Sample database from 1988-2010 for myelomeningocele repair was analyzed. There were 4034 hospitalizations for surgical repair of myelomeningocele. Overall, 56.6% of patients required shunt placement during the same hospital stay as for surgical repair; 95.0% of patients were routinely released; and the in-hospital mortality rate was 1.4%.¹⁵

Study conducted in 2015, following MMC closure, out of the 91 neonates, 18 (16.4%) developed meningitis/shunt infection and 12 (11%) developed surgical wound infection. Deep surgical wound infection was not associated with the operation time or wound surface area. However, there was a transitional yet vital positive association among meningitis and cerebrospinal fluid (CSF) leakage, length of hospitalization, and flap transposition ($r = 0.377, 0.420, 0.357, \text{ and } 0.503$, individually; for all values, $p < 0.001$).¹⁶

A study conducted in 1995. Early and late complications of myelomeningocele closure were discussed with regard to predisposing factors, diagnosis, treatment, and prevention. These complications include worsened neurological level, wound dehiscence, wound infection, cerebrospinal fluid leak, postoperative ileus, symptomatic Chiari malformation, shunt infection, necrotizing enterocolitis and problems associated to kyphectomy.¹⁷

CONCLUSION

Meningomyelocele is a congenital disorder which results in drastic morbidities, complications and even mortality in newborns. Early diagnosis and prompt management is key to recovery of child. Early operation without subsequent complications has remained the backbone of treatment. Even in developing countries with more and more resources being introduced in health sector, good management of such children is now possible. More studies should be done throughout Pakistan reporting the complication rates, different methods of surgery and long term outcome of patients suffering from meningomyelocele.

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REFERENCES

1. UN World Health Organization (WHO), World Report on Disability: Summary, 2011, WHO/NMH/VIP/11.01, available at: <http://www.refworld.org/docid/50854a322.html>.
2. Khattak ST, Khan M, Naheed T. Prevalence and management of anencephaly at Saidu Teaching Hospital, Swat. J Ayub Med. Coll. Abbottabad, 2010; 22: 61-3.
3. Sibinski M, Synder M, Higgs ZC. Quality of life and functional disability in skeletally mature patients with myelomeningocele-related spinal deformity. J Pediatr. Orthop. B. 2013; 22: 106-9.
4. Roach JW, Short BF, Saltzman HM. Adult consequences of spina bifida: a cohort study. Clin. Orthop. Relat. Res. 2011; 469: 1246-52.
5. Pruitt LJ. Living with spina bifida: a historical perspective. Paediatrics, 2012; 130: 181-3.
6. Rathod KJ, Mahajan JK, Khan RA. Quality of life of very young spina bifida patients after initial surgical treatment. Childs Nerv. Syst. 2012; 28: 883-7.
7. Raza MZ, Sheikh A, Ahmed SS. Risk factors associated with birth defects at a tertiary care centre in Pakistan. Itali J Pediatr. 2012; 38: 68.
8. Gilani S, Kazmi NHS, Najeeb S. Frequencies of congenital anomalies among newborns admitted in nursery of Ayub Teaching Hospital Abbottabad, Pakistan. J Ayub Med Coll Abbottabad, 2011; 23: 114-6.
9. Raza M, Habib S. Frequency of prenatal central nervous system anomalies detected by ultrasound in a tertiary care hospital. Pak J Med Res. 2013; 52: 19-21.
10. Khan MY, Khan K, Ahmed M. Short term outcome of surgical management of patients.
11. McLone DG, Dias MS. Complications of myelomeningocele closure. Pediatr. Neurosurg. 1991-1992; 17: 267-73.
12. Mirzai H, Erşahin Y, Mutluer S, Kayahan A. Outcome of patients with meningomyelocele: the Ege University experience. Childs Nerv. Syst. 1998; 14: 120-3.
13. Sin AH, Rashidi M, Caldito G, Nanda A. Surgical treatment of myelomeningocele: year 2000 hospitalization, outcome, and cost analysis in the US. Childs Nerv. Syst. 2007; 23: 1125-7.
14. Kshetry VR, Kelly ML, Rosenbaum BP, Seicean A, Hwang L, Weil RJ. Myelomeningocele: surgical trends and predictors of outcome in the United States, 1988-2010. J Neurosurg. Pediatr. 2014; 13: 666-78.
15. Demir N, Peker E, Gülşen İ, Ağengin K, Tuncer O. Factors affecting infection development after meningomyelocele repair in newborns and the efficacy of antibiotic prophylaxis. Childs Nerv. Syst. 2015; 31: 1355-9.
16. Pang D. Surgical complications of open spinal dysraphism. Neurosurg. Clin. N. Am. 1995; 6: 243-57.

17 Klusmann A, Heinrich B, Stöpler H, et al. A decreasing rate of neural tube defects following the recommendations for periconceptional folic acid supplementation. Acta Paediatr 2005; 94: 1538.

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