Study of Surgical Intervention in Patient of Meningocele with Hydrocephalus: Simultaneous V/S Sequential Group

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Research Article

Abstract: **Background**: Meningocele is sac protruding from the spinal column, Myelomeningocele is most severe type of spina bifida, which is commonly encountered by surgeon in new born due to failure of caudal neurulation. The incidence of meningocele is 0.2-2/1000 live births, and 15-25% of neonates with myelomeningocele have hydrocephalus at birth. Hence required significant amount of medical intervention, about 80-90% of them need shunt procedure. **Methods:** For all patients evaluation plan was as follows: Detail clinical history followed by thorough clinical examination. **Investigations:** Routine laboratory investigation required for pre anesthetic checkup such as Hemogram, Blood sugar level, Serum electrolytes, Blood urea level, Serum creatinine, Serum bilirubin; Ultrasonography (local, abdomen and pelvis, cranium); CT scan head. **Consent:** A written informed consent for surgery as per the risk was obtained from parents of patients. **Pre-Operative Treatment:** One dose of pre-operative antibiotic i.v Ceftriaxone 100mg/kg before operation. **Anaesthesia:** General anaesthesia **Procedure:** a) Low pressure V.P Shunt was used. b) Skin closure with 2-0 Nylon in both the procedures. **Post-operative Treatment:** All the patients from both the study groups were given- Antibiotics - I.V Ceftriaxone 100mg/kg x 5 days I.V Amikacin 15mg/kg x 5 days Local care -dressing on day 3, 5 and on wards if required **Postoperative:** Each patient's operative time requirement for both study groups was recorded. The operative time was considered as the time from skin incision to the application of dressing. Patients were discharged after the operation as per their comfort and instructed to follow up on for suture removal. Patients were followed up at every week for two week, then on fourth week, eighth week and three months after discharge on outpatient department basis. Problems expected during postoperative period were: 1. Local wound infection. 2. Non healing of the wound. 3. Dehiscence of the wound. 4. Meningitis. 5. Ventriculitis. 6. Shunt failure. **Local infection leading to septicaemia:** In our comparative study, we had compared 40 patients of meningocele with hydrocephalus operated in one stage group and in two stage group. All patients were infants with age less than seven days. The meningocele sac was more commonly situated in lumbosacral region in our study groups. Our average operative time for single stage group was 105 min and average operative time for two stage group was 135 mins. The average hospital stay for single stage group was 10 days and two stage group was 22 days. We had two mortalities in our study, one each for both groups. Both the children developed septicemia and meningitis in spite of aggressive antibiotics treatment, they succumbed. We had complications like fever, local wound dehiscence and cerebrospinal fluid leak, none of which were life threading and all got corrected with appropriate treatment. The incidence in both group was almost similar. Both the procedure appeared to be equally safe and the complication rates were similar. The operative timing and hospital stay was less in one stage procedure which makes it economical and emotional burden lessens for the patients family. If the child appears to be fit and undergoes one stage procedure, it appears to be safe economical and without additional complication. **Conclusion**: Our comparative study revealed as 1. Mean operative time was less in one stage procedure than two stage procedure. 2. Hospital stay in one stage procedure was less than two stage procedure. 3. Complications rate in both the group were comparable. 4. One stage procedure enhanced flap survival and prevented CSF leakage. 5. It can be safely done, 6. It is economical and shortens hospital stay. 7. It avoided need for second aneasthetic administration. 8. It leads to reduction in hospital burden and patient morbidity. 9. Complication such as CSF leakage, wound dehiscence and shunt infection were comparable.

Children who are having meningocele and hydrocephalus can be operated by either one stage procedure or two stage procedure. Both the procedures appear to be equally safe and the complication rate was similar. The operative timing and hospital stay was less in one stay procedure which makes economical and emotional burdens less for the patient's family. If the child appears to be fit, and undergoes one stage procedure, it appears to be safe, economical and without additional complication. A bigger sample size would be needed to validate their finding. Simultaneous surgery had the advantages of exposing these children to ones rather than twice for anaesthesia.

Keywords: Meningocele with Hydrocephalus.

Annexure: CSF: Cerebral spinal fluid, ICP: Intra cranial pressure, VP shunt: Ventricular peritoneal shunt, USG: Ultrasonography, Ct scan: Computed tomography, Kg: Kilogram, Mg: Milligram, Mins: Minutes, Hrs: Hours.

Introduction

Hydrocephalus is a condition in which there is disequilibrium between CSF production and absorption, leading to raised ICP and is often associated with dilated ventricles.[1] A meningocele is defined as a protrusion of the spinal meninges through a defect in the vertebral

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column or foramina usually in association with congenitally dysraphic vertebrae, with the spinal cord remaining enterly confined to the vertebral canal.[2,3] A myelomeningocele is the most severe type of spina bifida in which neural tissue and nerves may be exposed. Incidence of meningocele ranges from 0.2-2/1000 live births. Hydrocephalus occurs in 15-25% of neonates with myelomeningocele at births[4]. However in most surgical series the proportion of patients with meningomyelocele who requires shunting reaches 80-90%.[5, 6] Severity of hydrocephalus usually worsens after neurosurgical repair of the meningocele in the newborn requiring placement of a ventricular shunt apparatus. Meningomyelocele with associated ventriculomegaly can be treated as single stage (i.e. both lesions treated simultaneously) and two stages (i.e. both lesions treated at separate time). A delay in closure of meningomylocele is associated with incidence of ventriculitis, meningitis, particularly when performed more than 36 hrs after birth.[7] so there is good amount of evidence available that emergency repair of meningomyelocele should be done within first three days, however there are lots of controversies regarding the timing of v p shunt.

Materials and Methods

Material

Sample: In this comparative prospective study of 40 patients of unruptured meningomyelocele with hydrocephalus, who need both surgeries i.e. meningomyelocele repair and V P shunt insertion. They were included in two groups,

1. One stage group i.e. neonates getting operated simultaneously for meningomyelocele repair and V P shunt.
2. Two stage group i.e. neonates undergoing emergency repair of meningomyelocele on same day of admission and V P shunt insertion on seventh day of admission.
3. Patients were selected for above mentioned groups by random selection method.

We observed and analysed whether there was a difference in either the complication rate or mean hospital stay for neonates undergoing myelomeningocele repair and shunting under the same anesthetic (simultaneous group) versus those in whom shunt insertion was delayed for several days after myelomeningocele closure (sequential group),

Facility available in this institute for this study:

I. Radiological investigation (USG, CT scan) in the department of radiology.
II. Routine pathological laboratory investigations in the department of pathology.
III. Routine biochemistry investigations in the department of biochemistry.
IV. Routine anaesthesia facility by the department of anaesthesia in the operating room.
V. Pus culture facility available in the department of microbiology.
VI. Well equipped operating room for paediatric surgery
VII. Experienced qualified Anaesthetists, especially for neonates

Inclusion criteria

Neonates having meningomyelocele with hydrocephalus undergoing surgery at surgery department during Aug 2010 to Aug 2013 except those under exclusion criteria. Presenting to us within first week of life.

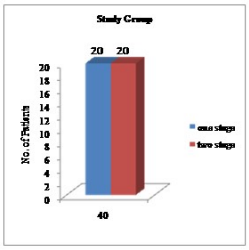
Criteria of Exclusion

1. Ruptured meningomyelocele.
2. Neonates with other severe life threatening congenital anomalies

Observations and Results

Study group

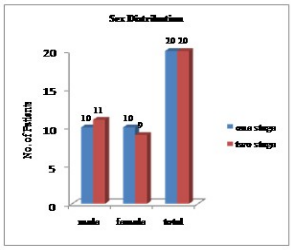
One stage procedure	Two stage procedure
20 patients	20 patients



In our study group 40 patients were included, they were randomly divided in two groups, one stage group had 20 patients and two stage group had 20 patients.

Sex Distribution

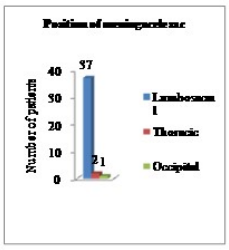
Patients	One stage procedure	Two stage procedure
Male	10	11
Female	10	9
Total	20	20



In the one stage procedure group, out of 20 patients, 10 patients were male and female. In the group of two stage procedure, out of 20 patients, 11 patients were male and 9 patients were female.

Position of meningocele sac

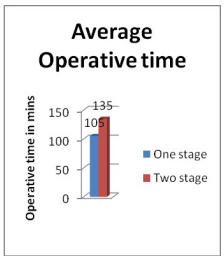
Site	Number
Lumbosacral	37
Thoracic	2
Occipital	1



In our study group, position of meningocele sac was in lumbosacral region in 37 patients, in 2 patients it was in thoracic region and we had 1 patient who had occipital meningocele.

Average operative time

One stage Procedure	Two stage procedure
105mins	135mins



In the group of one stage procedure the average operative time was 105 minutes and In the group of two stage procedure, the average operative time was 135 minutes.

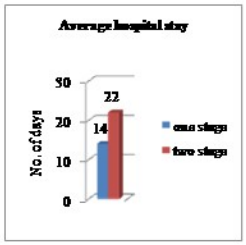
Complications

Complication	One stage procedure	Two stage procedure
Local infection	1	0
Fever	1	1
Dehiscence of wound	2	1
Neurological worsening	0	0
Cerebrospinalfluid leak	0	1
Meningitis	0	0
Ventriculitis	0	0
Shunt failure	0	0
Local infection leading to septicemia	0	0

We studied the incidence of complications in both the groups. In one stage procedure one patients had minor stitch abscess, one patients had mild fever which subsided within three days of usage of higher antibiotics and two patients had minor wound dehiscence, which needed alternate day dressing for 2-3 times. In the group of two stage procedure one patient had fever, which subsided within 48 hours and one patient had minor wound dehiscence, which healed with dressing. One patient had CSF leak who needed two mattress sutured and tablet acetozolamide half twice a day for ten days and it subsided.

Average hospital stay

One stage procedure	Two stage procedure
10days	22days



In the group of one stage procedure the average hospital stay was 10 days and in the group of two stage procedure, the average hospital stay was 22 days. We found significantly shorter hospital stay for those babies treated for VP shunt and repair of the meningomyelocele in the same sitting.

Discussion

Hydrocephalus is a condition in which there is disequilibrium between CSF production and absorption, leading to raised ICP and is often associated with dilated ventricles.[1] In Myelomeningocele, development of the dura as well as the leptomeninges has occurred and they are attached around visibly abnormal neural tissue. The tissue itself is gliotic and disorganized. The neural elements usually present superficially with a surrounding area of hypervascularity. This complex constitutes the neural placode, which is the neural tissue in the region where neural tissue tube closure has failed to occur. At the rostral end of the lesion, the placode exists from a fully formed spinal column. Neural tube defects are among the most common types of birth defect.[46] A meningocele is defined as a protrusion of the spical meninges through a defect in the vertebral column or foramina usually is association with a congenitally dysraphic vertebrae, with the spinal cord remaining enterly confined to the vertebral canal.[2,3] Hydrocephalus occurs in 60-90% of patients born with associated meningocele.[7] The severity of hydrocephalus usually worsens after the neurosurgical repair of the defect in the newborn, requiring placement of a ventricular shunting system.[47] In patients with hydrocephalus overt at birth, ventricular shunting decreases the risk of further brain damage[47] The majority of patients with meningomyelocele will require a shunting procedure, the incidence is upward from 69%. William O. Bell *et al*[48] (1987) reported 92% shunting rate in their study group. The 92 % shunting rate was slightly higher than that reported in other groups of patients might be because of their small sample size (13 neonates) compared to other

studies. They also postulated that shunt placement may be avoidable in some instance when more exacting criteria for ventriculomegaly on computed tomographic scans or ultrasound have been established. Very few neonates with meningomyelocele exhibit overt signs of hydrocephalus at birth and it is a common practice to limit the initial procedure to closure of the meningomyelocele and to place a shunt only if overt hydrocephalus develops. Lorber *et al*[49] (1961) reported 89% needing shunt in their study group. However hydrocephalus is difficult to evaluate in the newborn.[48] Measurement of head circumference and palpation of the anterior fontanelle and cranial sutures in the intial postnatal period may be misleading. The clinical signs of hydrocephalus usually become manifest only after the meningocele are closed. Since 1976, C T scan has provided a previously unobtainable view into the cranial cavity.[50] the management of newborns with myelodisplasia has varied widely, from total abandonment before 1960, to an aggressive approach as advocated by Shared *et al*. in 1963.[51] A delay in closure of meningocele is associated with a higher incidence of ventriculitis/ventricular shunt infection particularly when closure is performed more than 36 hrs after birth.[7] The advantages of early repair in newborn period include preventing CSF infection and further neurological deterioration. Moreover, primary neurosurgical repair of meningocele within the first 72 hours after delivery provides an improved neurogenic bladder/bowel prognosis compared to repair at a later time In fact an increased risk of shunt malfunction has been reported following delayed meningocele repair because of increased CSF proteins and debris, which may lead to shunt occlusion even without infection. Our approach aims to repair the open neural tube defect early (within 72hrs).[52] There is considerable controversy as to optimal timing of operation for meningomyelocele repair. Although some authors claim that there is no difference in outcome between early and delayed closure of a meningomyelocele, there is considerable evidence that myelomeningocele should be repaired early because delay increase the risk of infection. In patient with hydrocephalus overt at birth, simultaneous ventricular shunting not only eliminates the dangers of wound breakdown but also secondary CSF infection. Although early closure of myelomeningoceles has becomes common practice, treatment of the frequently associated hydrocephalus is usually delayed[7]. Surgeons who prefer delayed shunting point out the likelihood of increased morbidity with simultaneous shunting associated with the longer operative times, higher incidence of shunt infection and more importantly, the need to document progressive hydrocephalus.[48] Sharrard *et al*[7] (1963), suggested that delay in closure of spina bifida resulted in a high incidence of infection. Infection rates (shunt or ventriculitis) of 5-37% have been reported by other authors. Francis W.Gamache[7] Jr (1995) reported delayed in closure of the meningocele / encephalocele is associated with a higher incidence of ventriculitis / ventriculitis shunt infection particularly when closure is performed more than 36 hrs after birth. In this situation, closure followed by surveillance cultures, appropriate antibiotics, ventricular drainage, and then delayed ventricular shunting more reasonable. IS Oktem *et al*. (2008) reported that ventriculoperitoneal shunt placement in the same session of meningomyelocele sac repair in patients with hydrocephalus is not an acceptable practice. We therefore believe in ventricular peritoneal shunt placement in a separate session by confirming absence of infection after meningomyelocele sac repair surgery. Parents and McMillan reported on single stage treatment of spina bifida and hydrocephalus stating that the procedure did not increase the risk of shunt infection or malfunction in the first year of life. Hubballah and Hoffman[51] presented a follow-up of ten patients treated at the Hospital for Sick Children in Toronto between 1957 and 1987. According to their observations in patients with overt hydrocephalus at birth, simultaneous ventricular shunting not only decreases the risk of further brain damage, but also eliminates the dangers of wound breakdown, CSF leak and secondary CSF infection. They found that one stage procedure was safe and should be carried out to decrease the risk of meningomyelocele repair breakdown and CSF leaking. Chadduck and Reding[54] reported 22 patients with single stage and 11 patients with two stage procedure. They innovated the semilateral position to perform both procedure without postural change. There was no operative mortality and no shunt infections within 30 days in either group. One shunt infection each was seen in both groups during longer follow-up; therefore, the incidence of complications in the simultaneous groug was no higher than that for sequential group. Machado and Santos de Oliveira[56] reported an experience of 11 patients with simultaneous group and commented that simultaneous surgery did not pose additional risk to the patients. Miller *et al*[57] reported a comparison of 21 patients of simultaneous versus 48 patients of sequential treatment. They found significantly higher rate of CSF leak from the wound in the staged treatment groups, together with a significantly longer hospital stay, where those babies treated for VP shunt and repair of the meningomyelocele in the same sitting had a lower rate of CSF leak. Epstein *et al*[58] compared 6 patients in simultaneous group with 6 patients' sequential group. They noted no increase in mortality or morbidity in the simultaneously treated group which appeared to benefit substantial Caldrelli *et al*[59]. Reported that the rate

of overall complications was the lowest in children with simultaneous group. Wakhlu A *et al* (2009) concluded that single stage treatment of spina bifida and hydrocephalus is feasible and offers advantages in the reduction of hospital stay and complications. These conclusions were based on the observations that 22 out of 110 patients' inn group 1 developed complications compared with 38 out of 135 patients in group 2. Our study was conducted from August 2010 to August 2013. Total 40 patients of meningomyelocele and hydrocephalus admitted in our hospital were included in this study. The admitted patients were divided into two groups randomly. One group of 20 patients was included in one stage group i.e. meningocele repair and V.P shunt insertion done simultaneously and another group of 20 patients was operated by two stage procedure i.e. meningocele repair on day of admission and V.P shunt insertion on seventh day. (Sequential group) Both the groups were compared in relation to

- To study the clinical profile of neonates presenting with meningomycelocele with hydrocephalus.
- To study the problems encountered, complications and progress in neonates with meningomycelocele and hydrocephalus operated as one stage and two stage procedure. (Sequential group)
- To compare the problems encountered complication and progress outcome in the above two groups.

Results and observations noted in both the groups were studied and the results of the study were summarized. Also the results and observations of our study were compared with the standard studies.

Sex

In our study, 40 patients were operated. In the group of one stage procedure, out of 20 patients, 10 patients were male and female. In the group of two stage procedure, out of 20 patients, 11 patients were male and 9 patients were female.

Francis W.Gamache[7] reported 31 patients, 15 were males and 16 were females in their study group.

Position of Meningocele Sac

In our study group, position of meningocele sac was in lumbosacral region in 37 patients, in 2 patients it was in thoracic region and we had 1 patient who had occipital meningocele. John Lorber *et al*[49] (1981) in their study group of 42 patients reported 5 patients with meningocele sac in thoracic region, 34 patients had sac in lumbosacral region and 3 had in thoracolumbar region.

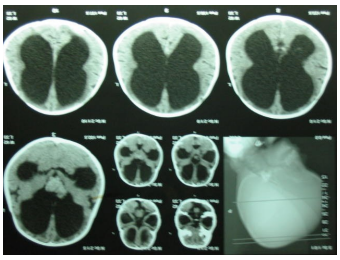


Figure: 1 CT film showing hydrocephalus

Figure 2:

Figure 3: Local wound infection

Figure 4: Hydrocephalus with lumbosacral meningomyelocele

Figure 5: Hydrocephalus with meningomyelocele

Operative Time

The important issue regarding operative time depends on the surgeon's experience, infrastructure and team work. The average operative time in our study for one stage group was 105 minutes. The average operative time taken by Wakhlu A[50], for one stage procedure initially was 3 hours; however by the end of the study period, both operations could be completed in 90-120 minutes without the need for blood transfusion. Whereas, the average operative time for two stages group in our study was 135minutes. The average operative time taken by Wakhlu A[50], for two stage procedure was 120-130 minutes. From above observation it is clear that mean operative time for two stage group was more than one stage group and comparable with Wakhlu *et al*.

Average Hospital Stay

Comparisons of average hospital stay between one stage group and two stage groups. The mean hospital stay in one stage group was 10 days and in two stage group was 22 days in our study group. Miller *et al*.[57] reported a comparison of 21 patients of simultaneous versus 48 patients of sequential treatment The mean hospital stay in one stage group was 13 days and in two stage group was 22 days. We had similar comparable results with Miller *et al*.[57]

Complications

In one stage procedure one patient had minor stitch abscess, one patient had mild fever which subsided within three days of usage of higher antibiotics and two patients had minor wound dehiscence, which needed alternate day dressing for 2-3 times. In the group of two stage procedure one patient had fever, which subsided within 48 hours and one patient minor wound dehiscence, which healed with dressing. One patient had CSF leak which needed two mattress sutures and tablet acetazolamide half twice a day for ten days and it subsided. Both the groups had one single mortality each due to septicemia. Miller *et al* found two stage procedures had more csf leakes. In our study one patient had csf leak in two stage procedure and none in the simultaneous group, which was statistically insignificant. Chadduck and Reding[55] reported no mortality in their study group and single shunt infection on long term follow up. In our study group we had two mortalities due to septicemia and both patients were of low birth weight. No shunt infection was found on follow up in our study group. Parents and McMillan[54] also reported no shunt infection in single stage group. Hubballah and Hoffman[51] found that one stage procedure was safe and should be carried out to decrease the risk of meningomyelocele repair breakdown and CSF leakage..In our study, single stage had no csf leak and in two stage group one patient had csf leak. Considering this Simultaneous surgery has the following advantage-

1. It did not result in increased incidence of shunt infection,
2. It enhanced flap survival and prevented csf leakage,
3. It can be safely done,
4. It is economical and shortens hospital stay,
5. It avoided need for second anesthesia administration.
6. It leads to reduction in hospital burden and patient morbidity,

Complication such as CSF leakage, wound dehiscence were comparable.

Conclusion

Our comparative study revealed following:

1. Mean operative time was less in one stage procedure than two stage procedure.
2. Hospital stay in one stage procedure was less than two stage procedure.
3. Complications rate in both the group were comparable.
4. One stage procedure enhanced flap survival and prevented csf leakage.
5. It can be safely done.
6. It is economical and shortens hospital stay.
7. It avoided need for second anesthesia administration.
8. It leads to reduction in hospital burden and patient morbidity.
9. complication such as CSF leakage, wound dehiscence and shunt infection were comparable.

Children who are having meningocele and hydrocephalus can be operated either by one stage procedure or two stage procedure. Both the procedures appear to be equally safe and the complication rate was similar. The operative timing and hospital stay was less in one stage procedure which makes it economical and emotional burdens less for the patient's family. If the child appears to be fit, undergoes one stage procedure, it appears to be safe, economical and without additional complication. A bigger sample size would be needed to validate these findings. Simultaneous surgery had the advantages of exposing these children to ones rather than twice for anaesthesia.

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