

# When Should Ventriculoperitoneal Shunt Placement Be Performed in Cases with Myelomeningocele and Hydrocephalus?

## Miyelomeningosel ve Hidrosefalisi Birlikteliği olan Olgularda Ventriküloperitoneal Şant Ne Zaman Takılmalı?

### ABSTRACT

**AIM:** The shunt infection rates vary from 2 to 39% among complications related to shunts used for hydrocephalus treatment. Shunt infections are reported to be more common than any other etiologies in newborn babies with myelomeningocele.

**MATERIAL and METHODS:** In this study, we performed a retrospective evaluation of 94 MM and HS cases that were treated in our clinics between 1994 and 2005. Comparisons of shunt infection rates of cases that had surgical placement of VPS either at a different session (group A) or in the same session (Group B) with repair of MM sac were made.

**RESULTS:** Sixty three patients were grouped in group A and 31 cases in group B. MM sac operation site wound infection was seen in 7 versus 5 cases, CSF fistula in 5 versus 3 cases and VPS infection in 9 versus 6 cases in group A and B respectively. 6 patients had meningitis in both groups.

**CONCLUSION:** These data indicate that ventriculoperitoneal shunt placement in the same session of MM sac repair in patients with HS is not an acceptable practice. We therefore believe in VPS placement in a separate session by confirming absence of infection after MM sac repair surgery.

**KEY WORDS:** Hydrocephalus, Myelomeningocele, Shunt infection, Timing, Ventriculoperitoneal shunt

### ÖZ

**AMAÇ:** Hidrosefali tedavisinde şant uygulamaları ile ilgili komplikasyonlar arasında enfeksiyon oranı % 2-39 arasında değişmektedir. Şant enfeksiyonunun etiyolojik faktörleri arasında miyelomeningoselli yeni doğanlar önemli bir yer tutar.

**YÖNTEM ve GEREÇ:** Bu çalışmada, kliniğimizde 1994-2005 yılları arasında tedavi edilen miyelomeningosel ve hidrosefalili 94 olgu retrospektif olarak değerlendirildi. Şant enfeksiyon oranları açısından, miyelomeningosel kese tamiri ve ventriküloperitoneal şant ameliyatı farklı seansta (A Grubu) ve aynı seansta (B Grubu) yapılan olgular karşılaştırıldı.

**BULGULAR:** 63 olgu A grubunu ve 31 olgu da B grubunu oluşturdu. Miyelomeningosel kese tamiri sonrası A grubunda 7, B grubunda da 5 yara yeri enfeksiyonu görülürken, yaradan BOS kaçağı 5'e 3 ve ventriküloperitoneal şant enfeksiyonu da 9'a 6 oranında görüldü. Her iki grupta 6 olguda menenjit görüldü.

**SONUÇ:** Elde ettiğimiz bulgular aynı seansta miyelomeningosel kese tamiri yapıp, şant takılmasının sonuçlarının iyi olmadığını gösterdi. Bu nedenle ventriküloperitoneal şantın enfeksiyonun olmadığından emin olunduktan sonra, bir başka seansta takılması gerektiğinin uygun olacağına inanıyoruz.

**ANAHTAR SÖZCÜKLER:** Hidrosefali, Miyelomeningosel, Şant enfeksiyonu, Ventriküloperitoneal şant, Zamanlama

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## INTRODUCTION

The frequency of HS accompanied by MM ranges from 83 to 93% and 84-89% of these cases require shunt placement (19). The most common treatment of HS recently has been the application of an extracranial shunt with a ventriculoperitoneal shunt used most often. The presence of a central nervous system infection that is not completely treated is a contraindication for shunt treatment of HS.

Shunt infection rates have been reported as between 2-39% in the literature (2,6,26) and these shunt infections are more common than any other etiology in newborn babies with MM (13).

There are important arguments about the timing of MM sac repair. Most researchers agree with early operation of MM and suggest closure of the defect in the first 24-48 hours when the risk of infection is lowest (4,18,19,21). Since delayed correction of the MM sac may lead to increased wound infection and risk of meningitis, VPS placement in the same session may increase shunt infection rates in the presence of HS (11,17).

There are different opinions for timing of shunt placement in cases with MM and HS. In these cases, VPS placement in the same session as MM sac repair was reported to cause decreased hospitalization duration and prevent MM sac repair site problems (14,15,18,25). On the other hand, there is also an opposite view that prolonged surgery, in the same session, may cause an increased shunt infection risk. Placement of the VPS a week after the correction of the MM sac and following the exclusion of possible meningitis, ventriculitis and wound infection may decrease shunt infections (5,11).

In this study we had tried to answer the question of "Should we operate on hydrocephalus in the same session as MM sac repair?"

## MATERIALS and METHODS

A retrospective analysis of 94 patients with myelomeningocele and hydrocephaly, who were hospitalized between 1994 and 2005, was performed. Cases with wound infection and meningitis in the preoperative period and those who refused to be operated in the first 48 hours were excluded.

The cases were grouped into two:

**Group A:** (63 cases) had placement of VPS in a separate session after MM sac repair.

**Group B:** (31 cases) both sac repair and VPS placement were performed in the same session

Neurological and general physical systemic examinations of the MM cases were carried out and the head circumference measured before hospital admission and the presence of hydrocephalus was evaluated with cranial CT.

After 6 hours of fasting, the cases were operated under general anesthesia. The operation site was cleaned with povidone iodine scrub solution for 5 minutes and the MM sac closed with the modified MM closure technique of McLone (16).

## VPS placement

In group A, VPS placement was made in a separate session following exclusion of clinical meningitis and wound infection after MM sac repair.

In group B the operation was continued following MM sac repair with VPS placement with the patient in the supine position.

An antibiotic was administered IV 30 minutes before the surgery and the same antibiotic was continued for 72 hours in both groups. Additionally, the shunt system was immersed into a solution of 500 ml 0.9% saline containing 500 mg vancomycin. Silicon pieces that had been cut from the peritoneal catheter were attached to the tips of the metal instruments that were used to hold catheters. We avoid holding these shunt systems by hand or with metal tools. The cases were evaluated daily for wound infection, cerebrospinal fluid (CSF) fistula, meningitis and shunt infection. We compared the wound infection and shunt infection rates of these two groups.

## RESULTS

The cases were evaluated for gender, location and perforation status of the MM sac, type of operation (elective or emergency operation). In the postoperative period, they were evaluated for wound infection, CSF fistula, VPS infection, mortality and follow up periods.

50 (53.2%) male and 44 (46.8%) female patients were included in the study. The gender distribution of cases is presented in (Table I).

The most common location of the MM sac was the thoracolumbar region followed by the lumbar region. The least common sites were the cervical and thoracic regions. The location of the MM sac by group is shown in (Table II).

MM sac perforation was present before emergency surgery in 9 of 63 (14.2%) group A and 5

of 31 (16.1%) group B patients. The distribution of cases by groups according to the surgery is presented in (Table III).

**Table I:** Gender distribution of cases

Gender	Group A	Group B
Male	31/63	19/31
Female	32/63	12/31

**Table II:** Location of the MM sac

Location	Group A	Group B	Total
Cervical	8	6	14
Thoracal	9	3	12
Thoracolumbar	22	15	37
Lumbar	24	7	31
Total	63	31	94

**Table III:** The distribution of cases in groups according to the state of surgery

Groups	Group A			Group B		
	Elective	Emergency	Total	Elective	Emergency	Total
MM sac repair	54	9	63	26	5	31
VPS placement	63	-	63	26	5	31

The shortest period between MM repair and VPS placement was 6 days and the longest period 6 months in group A. VPS placement was performed in the same session in group B.

Wound infections were seen in 7 of 63 (11.1%) cases in group A and 5 of 31 (16.1%) cases in group B. A CSF fistula were seen in 5 of 63 (7.9%) cases in group A and 3 of 31 (9.6%) cases in group B. Meningitis was seen in 6 of 63 (9.5%) cases in group A and 6 of 31 (19.3%) cases in group B. The distribution of postoperative complications by groups is presented in (Table IV).

2/63 (3.1%)cases in group A and 5/31 (16.1%) cases in group B died. The mortality rates and causes of mortality of these cases were shown in (Table V).

Follow up periods after VPS placement were found as 6-25 months in group A and 10-25 months in group B.

According to different practices in timing of VPS surgery of cases with MM and HS, the statistical analysis showing group distribution of VPS infection was given in (Table VI).

**Table IV:** Distribution of postoperative complications in groups

Complications	Group A	Group B	Total
MM wound infection	7	5	12
CSF fistula of MM wound	5	3	8
Meningitis	6	6	12
Shunt infection	9	6	15

**Table V:** Distribution of etiologies of mortality in the groups

Etiologies of mortality	Group A	Group B
Sepsis + cardiopulmonary failure	1	-
Meningitis + sepsis	-	4
Pneumonia + meningitis	1	1
Total	2	5

**Table VI:** Statistical analysis of group distribution of VPS infections

Groups	Shunt infections		Total
	+	-	
A	9	54	63
B	6	25	31
Total	15	79	94

X<sup>2</sup>=0.20 p>0.05 was accepted to be statistically insignificant.

### DISCUSSION

MM cases have been reported more commonly in female patients (22). In our study 46.8% of the cases were female and 53.2% were male.

There is considerable debate on the timing of MM sac repair. While some authors state that there is no difference between early or late closure of MM, some others defend early closure of the MM sac (7). Furthermore, it is also reported that infection rates were higher in cases with late MM sac repair and VPS placement in the same session may increase infection rates in the presence of HS (5, 11, 17). All our cases were operated within the first 48 hours for MM sac repair.

The wound infection rates of cases that were operated for MM were reported as 12% by McLone (17), 22.4% by Brau (4), and 9% by Shehu et al. (24). Chaddock et al. (6) reported no wound infection after MM sac repair.

The rates of CSF fistula in cases that were operated for MM were reported as 17% by McLone (17), 7% by Guthkelch et al. (12), and 6% by Shehu et al. (24).

The rates of meningitis and ventriculitis without shunt infection in cases that were operated for MM were reported as 4% by Shehu (24), 8% by Ammirati and Raimondi (1), 7% by Charney et al. (8), 7.7% by Seidel et al. (23) and 12.5% by Brau (4).

In our study the rate of wound infection was 12.7%, CSF fistula 8.5% and meningitis 12.7% following MM sac repair. While cases that had VPS placement in the same session with MM sac repair had a wound infection rate of 16.1%, CSF fistula of 9.6%, and meningitis of 19.3%; those who had VPS placement in the separate sessions had rates of wound infection as 11.1%, CSF fistula as 7.9%, meningitis as 9.5%.

The increased rates of wound infection, CSF fistula and meningitis in group B may be the result of operating emergently due to perforation of the sac and VPS placement in the same session. The rates of wound infection, CSF fistula and meningitis in group A were compatible with the literature. In our opinion these low rates despite the cases with MM sac perforation may be due to VPS placement in a separate session. The hydrocephalus has been evaluated with CT since 1976. CT was also used beside the clinical findings for HS diagnosis in our cases. The most commonly used treatment modality has been extracranial shunt applications recently and most of these are VPSs (20).

In our cases VPS insertion was performed to all cases.

There are different views and studies about timing of shunt placement in cases with MM and HS. It is reported that VPS placement in the same session with MM sac repair has decreased both hospitalization period and wound problems (15, 18).

Shunt infection rates following MM repair were reported as 12% by McLone (17), 5.2% by Brau (4), 25.8% by Gamache (11), and 7.5% by Erşahin et al. (10). Some researchers are reluctant to place the VPS in the same session with MM sac repair in HS cases, and they offer shunt placement after ruling out possibilities of meningitis or ventriculitis, and wound infection since prolonged operation time causes an increased risk of infection (22, 24). Researchers defending VPS placement in the

postoperative first week, after excluding the presence of infection following MM sac repair, report an increased shunt infection rate after surgeries performed in the same session (5, 11, 15).

Bell et al. reported the rate of shunt infections as 6% in cases who had shunt placement in the same session with MM sac repair. They also reported that no shunt infection developed when the shunt was placed in a separate session (3).

Caldarelli et al. found a shunt infection rate of 23% in cases that had shunt placement in the same session with MM sac repair and 7% in those with separate sessions (5).

Gamache reported that MM and HS cases can be treated as a single- or two-stage procedure, but a delayed closure is associated with increased rates of infection. The most proper MM sac closure time was reported as within 36 hours after birth. In the presence of infection, surveillance cultures, appropriate antibiotics and external ventricular drainage should be performed, and delayed ventricular shunting then seems more reasonable (11).

In our study, the shunt infection rates of single- or two-stage VPS procedures were compared in 94 cases with MM and HS.

While shunt infection rates of single-stage VPS placed cases was 19.3% that of two-stage cases was 14.2%. These high rates are due to cases that were taken into emergency operations following MM sac perforation. We also think that the lower infection rates of the two-stage operation group is due to performing the operation after ruling out the possibility of infection development after MM sac closure. The number of cases was not sufficient to provide a statistically significant difference but the ratios show lower shunt infection rates with separate session VPS placement. Hubballah and Hoffman operated on 10 cases for MM and HS simultaneously and reported death of a patient secondary to aspiration pneumonia 9 days after the surgery (14). Shehu et al. reported a meningitis-related mortality rate of 3% during the postoperative period (24). Epstein et al. had 12 MM and HS cases and 6 of them were operated in the same session and the other 6 in separate sessions. They reported that there was no difference between these cases for mortality and morbidity (9).

In our study we compared the mortality rates of 94 MM and HS cases that had VPS application in the

same or separate sessions. These rates were found as 16.1% in cases that had VPS insertion in the same session and 3.1% in those where separate sessions were used. This may be due to the increased infection rates in cases that were operated with a perforated MM sac.

### CONCLUSION

1- VPS placement in the same session may be thought to be more advantageous for the patient, family, and physician and also from economic view in cases requiring MM sac repair and HS. However, the morbidity, mortality, costliness of drugs that are used in treatment of infection and prolonged treatment period in case of shunt infection may bring to mind the advantages of performing operations in separate sessions.

2- We believe that VPS insertion should be performed in another session following MM sac repair after excluding the presence of infection, especially in cases with a perforated MM sac.

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