



# Excessive External Drainage of CSF Might Aggravate Bacterial Ventriculitis

## *Aşırı BOS Eksternal Drenajı Bakteriyel Ventrikülitini Şiddetlendirebilir*

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### ABSTRACT

Bacterial ventriculitis is one of the most difficult diseases of neurosurgery, if not controlled well in the early stage, it will cause empyema, adhesion and separated infectious ventricle locules inside the ventricle. Few studies focus on the relationship between external drainage volume and the occurrence of adhesion and separation of the ventricle. This paper reported a case of ventriculitis, and we propose that excessive external drainage might increase the occurrence rate of the internal separation and adhesion of ventricle in patients with ventriculitis. Choosing an appropriate drainage method and avoiding excessive drainage might be the key to the treatment of ventriculitis.

**KEYWORDS:** External drainage, Lumbar drainage, Drainage volume, Ventriculitis

### ÖZ

Bakteriyel ventrikülit nörocerrahideki en zor hastalıklardan biridir ve erken dönemde iyi kontrol edilmezse ventrikül içinde empiyem, yapışma ve ayrılmış enfeksiyöz ventrikül loküllerine yol açar. Eksternal drenaj hacmi ile ventrikül yapışması ve ayrılmasının oluşması arasındaki ilişkiye odaklanan çok az sayıda çalışma vardır. Bu makale bir ventrikülit olgusu bildirmektedir ve aşırı eksternal drenajın ventrikülitli hastalarda internal ventrikül ayrılması ve adezyonunun oluşma oranını arttırabileceğini düşünüyoruz. Uygun bir drenaj yöntemi seçmek ve aşırı drenajdan kaçınmak ventrikülit önlemenin temeli olabilir.

**ANAHTAR SÖZCÜKLER:** Eksternal drenaj, Lomber drenaj, Drenaj hacmi, Ventrikülit

### INTRODUCTION

Being one of the most problematic diseases in neurosurgery if not controlled in the early phase, bacterial ventriculitis will cause empyema, adhesion and separated infectious ventricle locules inside the ventricle, which means a long course of disease, enormous expense and a high death rate. External ventricle drainage and lumbar drainage are effective ways to treat bacterial ventriculitis. However, few studies focus on the relationship between drainage volume and the occurrence of adhesion and separation of the ventricle. With a report about a ventriculitis case, we propose that excessive drainage might increase the occurrence rate of the internal adhesion and separation of the ventricle of patients with ventriculitis, and conducts analysis and research on it.

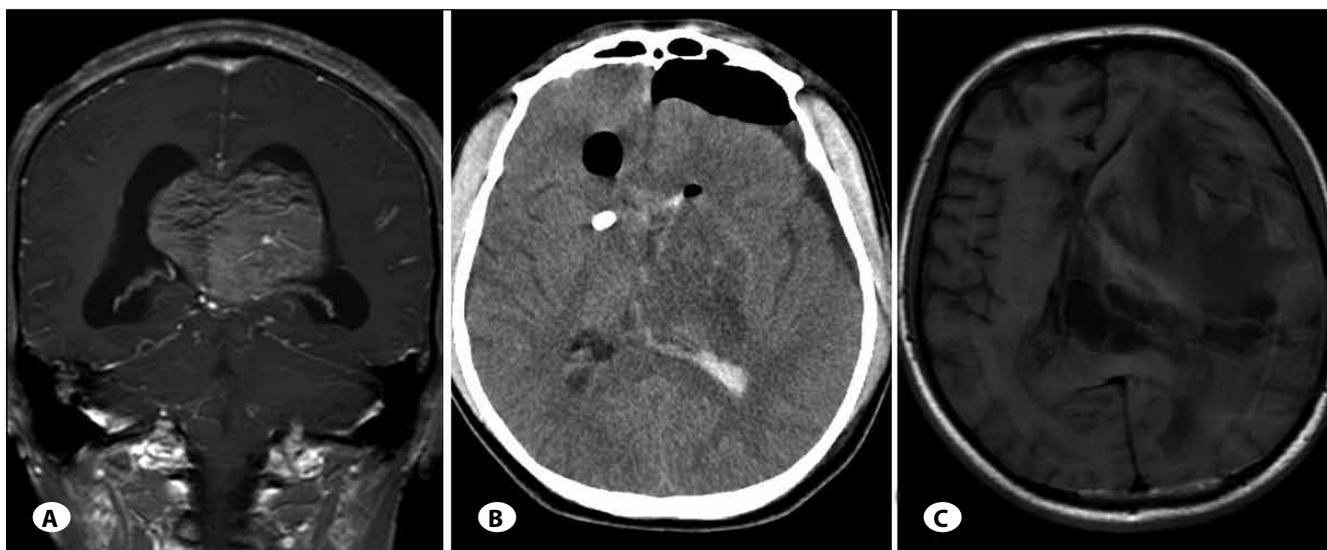
### CASE REPORT

A 22-year-old man was admitted to hospital for having dizziness and headache for a month, and the enhanced head MRI showed that the third ventricle and lateral ventricles were occupied by a huge mass measuring about 6.5x7x7 cm, accompanied with obvious hydrocephalus. With everything normal in the preoperative examination, we carried a tumor resection operation. The tumor was totally removed in surgery and a drainage catheter was indwelled in the lateral ventricle after operation. The pathology result was an ependymoma

(WHO grade II). With a daily drainage volume of 350ml, the drainage catheter was removed after 8 days. At that moment, the CT scanning showed the ventricle was small and a small amount of subdural effusion on the left side. On the tenth day after the operation, the patient developed fever. The cerebrospinal fluid (CSF) examination showed a dramatic increase in the white blood cells. Glucose and chloride decreased significantly. The CSF culture revealed *Escherichia coli*. He was diagnosed with intracranial infection and a lumbar drainage operation was performed. The patient once developed disturbance of consciousness due to excessive drainage as the head CT re-examination showed that the ventricle was contracted along with increasing subdural effusion. The patient's condition was gradually worsened, and empyemata and infectious separations occurred repeatedly in the ventricle (Figure 1A-C). After 15 procedures for surgical debridement, separation resection, chamber shunt, etc. and assisted with antibiotic and whole body supportive treatment, his illness was cured one year later, with the sequela of mild limb activity restriction and serious intellectual impairment.

### DISCUSSION

External ventricular drainage and lumbar drainage have been extensively applied in various fields of neurosurgery, such as the treatment of hydrocephalus and intracranial infection.



**Figure 1:** **A)** Pre-operative enhanced MRI: the ventricle is largely occupied by a mass, accompanied with obvious hydrocephalus. **B)** Post-operative (8 days) CT: obvious contraction of the ventricle after excessive drainage, and some subdural fluids in the left. **C)** Post-operative enhanced MRI: several infectious separated loculi formed in the ventricle.

When treating intracranial infection, an early operation of lumbar drainage or external ventricular drainage is very important for controlling the infection and decreasing the intracranial pressure if conservative treatment cannot control the increasing intracranial pressure or the infection is poorly controlled (3). Nevertheless, they may cause catheter-related infection, which will exacerbate the infection and might even cause empyema and separation in the ventricle, making the condition difficult to control (1).

Current documents mainly focus on lowering the incidence rate by improving the material (2,4), such as antibiotic-impregnated catheters, reducing the frequency of cerebrospinal fluid sampling from extraventricular drains (5) and decreasing the drainage time. However, few documents probe into the relationship between lumbar drainage, external ventricular drainage and the empyema and separation in the ventricle caused by ventriculitis. That is caused by various factors, like malnutrition and improper antibiotic treatment. We believe that unlike common surgical infection, the volume of drainage is a very significant factor in such a special path as the circulation path of CSF.

The ventricle depends on continuous generation of CSF to maintain its state. When ventriculitis occurs, a certain amount of CSF can not only dilute sticky inflammatory fluid, but also keep a certain distance between intraventricular structures that prevents viscous substance from adhering between ventricles to form separated loculi. After we perform external CSF drainage, on one hand, if the drainage volume is too small, CSF can't be discharged effectively, which weighs against the control of intracranial infection and intracranial pressure. On the other hand, with excessive drainage and the neglect of certain symptoms as patients who suffer intracranial infection sometimes cannot report symptoms themselves due to

disorders of consciousness, the contraction of ventricle space and the reducing of CSF will increase the viscosity of fluid in the ventricle and make it easier for purulent fluid to adhere in the ventricle. Therefore, we believe that proper drainage of CSF is more reliable than excessive drainage, and the volume of drainage might change the whole course of disease. In this case, longtime of excessive drainage caused the contraction of the ventricle, possibly resulting in the formation of infectious separated loculus. The patients' illness became chronic.

Then what volume do proper volumes of drainage refer to? There is no answer yet. Lacking enough clinic evidence, we suggest perform draining in a conservative way in the early phase. After intracranial hypertension was mitigated, we may gradually increase the volume. Paying close attention to check whether the patient has the manifestation of intracranial hypotension, and observing the change of the ventricle size according to the recheck of CT scan, we could confirm the best drainage volume by the principle that the ventricle will not be contracted. This not only realizes the purpose of sufficient drainage, but also avoids the possibility of adherence in the ventricle caused by the ventricle contraction. In this case, a daily drainage volume of 350ml led to obvious intracranial hypotension.

Besides, we believe that whether to choose external ventricular drainage or lumbar drainage is related to the separation in the ventricle, and external ventricular drainage is more likely to cause adherence and separation in the ventricle. On one hand, external ventricular drainage discharges the infectious CSF in the ventricle, changes the flowing direction of the CSF in part of the subarachnoid space and cistern, and then the infectious CSF outflows along with the drainage catheter after it enters into the ventricle. That makes it easier for the meningitis of the dorsolateral surface and cistern to spread in

the ventricle, increasing the possibility of the deterioration of ventriculitis. On the other hand, in case of external ventricle drainage, once catheter related infection occurs, bacterial ventriculitis is more likely to deteriorate and form adhesion with the existence of foreign matter. However, the lumbar drainage is different. It won't cause the backflow of CSF in the subarachnoid space and cistern where the inflammation is serious into the ventricle. Therefore, if condition permits, we think that lumbar cisterna drainage is a better choice.

### **CONCLUSION**

Bacterial ventriculitis is one of the most serious intracranial infections of clinical neurosurgery. When treating this disease by lumbar drainage or external ventricular drainage, controlling the volume may be of great significance in preventing adherence and separation in the ventricle. Excessive external drainage of CSF might aggravate ventriculitis. Nevertheless, more prospective clinical trials are needed to prove this view and confirm the best drainage volume.

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