

Comparison of the Application Effects of Intracranial Pressure Measurement and External Ventricular Drainage Devices Versus Simple Lumbar Cistern Drainage in Patients with Stubborn Subcutaneous Effusion after Cranial Surgery

Qiming Yan

Yunnan First People's Hospital, Kunming, 650100, China

Abstract: This study compares the application effects of intracranial pressure measurement and external ventricular drainage devices versus simple lumbar cistern drainage in patients with stubborn subcutaneous effusion after cranial surgery. A therapeutic study was conducted on 100 patients, with the experimental group receiving treatment with intracranial pressure measurement and external ventricular drainage devices, and the control group receiving simple lumbar cistern drainage. The drainage effect, complication rate, and therapeutic effect in both groups were compared. The study found that the external ventricular drainage device was successfully inserted and successfully drained subcutaneous effusion in 48 patients, with a success rate of 96%. The success rate of lumbar cistern drainage was 80% with 40 successful cases. The drainage effect of the experimental group was significantly better than that of the control group ($P < 0.05$). There were 2 cases of infection and 1 case of catheter blockage in the experimental group, and 3 cases of infection and 2 cases of catheter dislodgement in the control group. There was no significant difference in the complication rate between the two groups ($P > 0.05$). Regarding the therapeutic effect, the success rate of treatment in the experimental group was 96%, compared to 84% in the control group, with a significant difference between the two groups ($P < 0.05$). Intracranial pressure measurement and external ventricular drainage devices have a higher drainage effect and treatment success rate in patients with stubborn subcutaneous effusion after cranial surgery.

Keywords: Intracranial pressure measurement, external ventricular drainage device, stubborn subcutaneous effusion, therapeutic effect

1. Introduction

Post-cranial surgery stubborn subcutaneous effusion is a severe complication, often leading to neurological dysfunction and poor prognosis. Traditional treatment methods include simple lumbar cistern drainage, but their effectiveness is limited^[1]. In recent years, the application of intracranial pressure measurement and external ventricular drainage devices has been gradually introduced, aiming to improve drainage effectiveness and treatment success rates^[2]. This study aims to compare the application effects of these two treatment methods to provide a basis for clinical practice.

2. General Information

The clinical data of patients with subcutaneous effusion after craniotomy treated in our hospital from January 2020 to June 2023 were analyzed. Among them, there were 55 males and 45 females; ages ranged from 17 to 65 years, with an average age of 39 years; disease distribution: tumors in 35 cases, aneurysms in 21 cases, cranial trauma in 30 cases, hypertensive cerebral hemorrhage in 12 cases; effusion location: occipital in 24 cases, temporal in 28 cases, frontal in 16 cases, parietal in 12 cases, posterior cranial fossa in 20 cases; disease duration ranged from 5 to 14 days.

Inclusion criteria: ①Patients diagnosed with stubborn subcutaneous effusion; ②Patients without other malignant diseases; ③Patients eligible for intracranial pressure measurement and external ventricular drainage treatment; ④ Patients willing to participate in the study and sign an informed

consent form.

Exclusion criteria:① Patients with intracranial arteriovenous malformation rupture, choroid plexus malformation, Moyamoya disease, or tumors (current treatment for aneurysms or intracranial tumors); ② Patients with other neurological diseases or serious cardiovascular diseases; ③ Patients with significant mental illness or cognitive impairment;④ Patients contraindicated for intracranial pressure measurement and external ventricular drainage treatment;⑤ Patients with suspected or known cranial infections;⑥ Patients who have already received other surgical treatments; ⑦ Pregnant or lactating women.

3. Methods

3.1 Subject Selection

Patients with stubborn subcutaneous effusion after cranial surgery were randomly divided into an experimental group and a control group, with each group including 50 patients.

3.2 Treatment Method for the Experimental Group

The experimental group was treated with intracranial pressure measurement and external ventricular drainage devices (Shandong Dajiang Medical Equipment Co., Ltd., registration number 20193071850). The specific operations included intracranial pressure measurement, insertion of the external ventricular drainage device, and drainage of subcutaneous effusion.^[1-2]

Managing subcutaneous effusion after cranial surgery usually requires close monitoring of intracranial pressure and taking appropriate therapeutic measures when necessary. During surgery, after being positioned and administered local anesthesia, the surgical area is prepared with antiseptic. A small incision is typically made above the ear or at another suitable location on the scalp. A drainage tube is inserted into the ventricle to remove excess cerebrospinal fluid, thereby relieving intracranial pressure. The tube is connected to an external drainage system and stabilized on the patient's head. After the external ventricular drainage device is installed, medical staff continue to monitor the intracranial pressure and adjust the flow rate of the drainage device based on the monitoring results to ensure that intracranial pressure remains within a safe range^[3-4].

3.3 Treatment Method for the Control Group

The control group was treated with simple lumbar cistern drainage. Specific operations included the insertion of a lumbar cistern catheter and lumbar cistern drainage.

Patients should undergo a clinical evaluation before surgery, including neurological and radiological examinations, to determine the presence of subcutaneous effusion. Patients must also be informed in advance about the purpose, risks, and expected outcomes of the procedure, and their consent obtained. Typically, local anesthesia is administered in the lumbar region, and sterile techniques are used to prepare the surgical area to prevent infection. The puncture site in the lumbar area is determined, ensuring the selection of the puncture site avoids intervertebral spaces and nerve roots to reduce the risk of complications^[5]. Local anesthesia is applied to the surgical area to ensure the patient experiences no pain during the procedure. Using sterile techniques, the doctor inserts a catheter or puncture needle at the determined puncture site, gradually guiding it into the lumbar cistern. Once the lumbar cistern is reached, a certain amount of cerebrospinal fluid may be withdrawn, and a drainage system installed if necessary. The catheter is inserted through the puncture site and gradually guided into the lumbar cistern^[6]. The design of the drainage system may include a valve with adjustment capabilities, allowing medical personnel to control the speed and volume of drainage. The catheter is secured to the skin to prevent accidental dislodgement. Closure may be performed at the junction of the catheter and skin to prevent infection.

3.4 Data Collection and Analysis Methods

The drainage effect, complication rate, and therapeutic effect of the two groups of patients were collected and compared. Statistical methods include the t-test and χ^2 (chi-square) test.

4. Results

4.1 Basic Characteristics of Subjects

There was no significant difference in the basic characteristics of age and gender between the experimental group and the control group ($P>0.05$). As shown in Tables 1 and 2:

Table 1: Comparison of Gender Proportions Between the Two Groups

Gender	Control Group	Experimental Group	Total	χ^2	p
Female	25(55.56)	20(44.44)	45	1.01	0.315
Male	25(45.45)	30(54.55)	55		
Total	50(50.00)	50(50.00)	100		

* $p<0.05$ ** $p<0.01$

Table 2: Age Comparison Between the Two Groups

	Control Group(n=50)	Experimental Group(n=50)	t	p
Age	41.70±13.94	36.52±12.71	1.942	0.055

* $p<0.05$ ** $p<0.01$

4.2 Comparison of Drainage Effect

In the experimental group, the number of patients who had successful insertion and successful drainage of subcutaneous effusion was 48, with a success rate of 96%; in the control group, the number of patients who had successful catheter drainage was 40, with a success rate of 80%. The drainage effect of the experimental group was significantly better than that of the control group ($P<0.05$). As shown in Table 3:

Table 3: Comparison of Drainage Effect Between the Two Groups

Group	Drainage Unsuccessful(%)	Drainage Successful(%)	Total	χ^2	p
Control Group	10(20.00)	40(80.00)	50	6.061	0.014*
Experimental Group	2(4.00)	48(96.00)	50		
Total	12(12.00)	88(88.00)	100		

* $p<0.05$ ** $p<0.01$

4.3 Comparison of Complication Rates

In the experimental group, there were 2 cases of infection and 1 case of catheter blockage; in the control group, there were 3 cases of infection and 2 cases of catheter dislodgement. There was no significant difference in the complication rates between the two groups ($P>0.05$). As shown in Table 4:

Table 4: Comparison of Complication Rates Between the Two Groups

Name	Control Group	Experimental Group	Total	χ^2	p
No Complications	45(90.00)	47(94.00)	92(92.00)	0.543	0.461
Complications Occurred	5(10.00)	3(6.00)	8(8.00)		
Total	50	50	100		

* $p<0.05$ ** $p<0.01$

4.4 Comparison of Therapeutic Effect

Table 5: Comparison of Therapeutic Effect Between the Two Groups

Name	Control Group	Experimental Group	Total	χ^2	p
Clinical Treatment Unsuccessful	8(16.00)	2(4.00)	10(10.00)	4	0.046*
Clinical Treatment Successful	42(84.00)	48(96.00)	90(90.00)		
Total	50	50	100		

* $p<0.05$ ** $p<0.01$.

The treatment success rate in the experimental group was 96%, while it was 84% in the control group. The treatment success rate of the experimental group was significantly higher than that of the

control group ($P < 0.05$). As shown in Table 5:

5. Discussion

Post-cranial surgery stubborn subcutaneous effusion is a serious complication commonly observed in patients after cranial surgeries. Its pathophysiological mechanisms are complex, often presenting clinically as persistent hydrocephalus, increased intracranial pressure, and neurological dysfunction, among other symptoms^[7-8]. Currently, there is a lack of unified treatment protocols and effective methods for this condition, posing significant challenges to patients' recovery and survival. The incidence rate of stubborn subcutaneous effusion post-cranial surgery varies across studies but is generally high, with some research finding incidence rates between 15% and 25%^[9], indicating it's a common and risky complication. The pathophysiological mechanisms behind post-cranial surgery stubborn subcutaneous effusion are not fully understood. Existing studies suggest that inflammation response post-surgery, increased intracranial pressure, cerebrospinal fluid circulation disorders, and brain tissue edema might be closely related to its occurrence^[10-11]. However, a consensus on the pathophysiological mechanisms of post-cranial surgery stubborn subcutaneous effusion has not yet been reached. Common treatment methods for this condition include pharmacotherapy, intraventricular drainage, and external ventricular drainage, and further research into the disease mechanisms and treatment strategies is crucial.

In patients with stubborn subcutaneous effusion post-cranial surgery, the application of intracranial pressure measurement and external ventricular drainage devices offers significant clinical advantages. Intracranial pressure measurement provides accurate intracranial pressure values, aiding physicians in assessing patients' intracranial pressure status, which is vital for timely identification and management of increased intracranial pressure. It can also promptly detect the presence of stubborn subcutaneous effusion and determine its relation to increased intracranial pressure, helping to take preventive measures against further deterioration of the condition^[12]. Moreover, real-time intracranial pressure monitoring assists physicians in staying informed about patients' condition changes, facilitating treatment adjustments to achieve optimal therapeutic outcomes^[13]. The use of external ventricular drainage devices can alleviate symptoms like headaches, nausea, and vomiting by draining the effusion, improving patients' quality of life and promoting recovery. Compared to other surgical treatment methods, the application of intracranial pressure measurement and external ventricular drainage devices can reduce the risks and complications associated with surgery^[14]. In summary, the application of intracranial pressure measurement and external ventricular drainage devices in patients with stubborn subcutaneous effusion post-cranial surgery provides clinical advantages in accurately measuring intracranial pressure, promptly detecting stubborn subcutaneous effusion, monitoring condition changes in real-time, draining effusion to alleviate symptoms, and reducing surgical risks.

The results of this study indicate that intracranial pressure measurement and external ventricular drainage devices offer better drainage effects and treatment success rates in patients with stubborn subcutaneous effusion post-cranial surgery compared to simple lumbar cistern drainage. This study compares the therapeutic effects of intracranial pressure measurement and external ventricular drainage devices versus simple lumbar cistern drainage in patients with stubborn subcutaneous effusion, showing that while both treatment methods have similar effects in reducing complication rates, the group treated with intracranial pressure measurement and external ventricular drainage devices had a higher success rate in drainage and treatment, demonstrating a more apparent clinical application advantage. However, this study is limited by its relatively small sample size, which may affect the reliability and generalizability of the results.

6. Conclusion

The results of this study indicate that intracranial pressure measurement and external ventricular drainage devices can accurately monitor intracranial pressure and provide individualized drainage treatment, which may be one of the reasons for their higher drainage effects and treatment success rates. These results offer a more effective treatment option for clinicians treating stubborn subcutaneous effusion, potentially improving patients' prognosis and quality of life. Intracranial pressure measurement and external ventricular drainage devices have shown high efficacy in drainage and treatment success rates in patients with stubborn subcutaneous effusion post-cranial surgery, with their clinical application deemed acceptably safe. However, further research is needed to optimize treatment strategies, including further assessment of complication risks and exploration of the best timing for

treatment.

References

- [1] Zhang Yinqing, Chen Hanmin, Liao Shengfang, et al. Treatment of subcutaneous effusion after cranioplasty with continuous subcutaneous negative pressure drainage[J]. *Medical Theory and Practice*, 2002, (09): 1097.
- [2] Peng Xiaoling. Nursing experience of continuous lateral ventricular drainage for intraventricular hemorrhage with obstructive hydrocephalus[J]. *Electronic Journal of Integrated Traditional Chinese and Western Medicine in Cardiovascular Diseases*, 2019, 7(05): 120-121.
- [3] Wang Yanwei. Clinical analysis of subcutaneous effusion after cranial surgery[J]. *Journal of Medical Forum*, 2014, 35(05): 98-99.
- [4] Chen Hua, Que Siwei, Yi Jing, et al. Clinical analysis of cerebellar hemorrhage treated with craniotomy hematoma evacuation combined with external ventricular drainage[J]. *Chinese Community Doctors*, 2019, 35(17): 13, 16.
- [5] You Yu, Zhao Ming, Xu Xin, et al. Efficacy analysis of lumbar cistern drainage for complications after cranial tumor surgery[J]. *Chinese Journal of Practical Diagnosis and Therapy*, 2013, 27(07): 715-716.
- [6] Zhang Qigang, Tao Yuming, Zhou Min. Application of continuous lumbar cistern drainage in postoperative complications of posterior cranial fossa (with 19 cases report)[J]. *Huaihai Medicine*, 2010, 28(01): 39-40.
- [7] Liu Jun. Clinical efficacy and safety analysis of puncture drainage and liquefaction technology in the treatment of hypertensive cerebral hemorrhage[J]. *Journal of Qiqihar Medical College*, 2017, 38(11): 1309-1311.
- [8] Wu Xiaohong, Yin Jiangliu, Cai Wenhua, et al. Study on the prevention of subcutaneous hematoma effusion after cranioplasty with a negative pressure suction ball[J]. *Practical Preventive Medicine*, 2010, 17(11): 2258-2259.
- [9] Wu Qiangjun, Liu Qin, Xin Bailong. The effects and prognosis of endoscopic hematoma evacuation surgery for hypertensive cerebral hemorrhage via different approaches[J]. *Prevention and Treatment of Cardio-Cerebral-Vascular Disease*, 2023, 23(10): 58-61.
- [10] Liu Daoqing, Gao Xiaoling, Dang Ronglun, et al. The impact of negative pressure drainage on the incidence of post-neurosurgical intracranial infection and subcutaneous effusion[J]. *Henan Medical Research*, 2018, 27(08): 1382-1384.
- [11] Quan Lifang, Zhu Lijuan, Ye Yizhen. The application of an external drainage system in postoperative intracranial infection after intracranial aneurysm clipping surgery[J]. *Journal of Practical Medical Techniques*, 2015, 22(06): 653-654.
- [12] Yin Xiuchun, Yin Xiujun, Wang Canzhi. Nursing experience of 15 cases with stubborn subcutaneous effusion after posterior cranial fossa tumor surgery[J]. *Journal of Liaoning Medical University*, 2016, 37(01): 94-96.
- [13] Zou Peng, Li Ao, Wang Kai, et al. Feasibility study of not placing a subcutaneous drainage tube after neurosurgical craniotomy[J]. *Guide of China Medicine*, 2021, 19(11): 119-120, 125.
- [14] Sun Xin. Nursing outcomes in 45 patients after external ventricular drainage surgery[J]. *Guide of China Medicine*, 2019, 17(23): 236-237.