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Clinical Analysis of Lumbar Pool Drainage Combined with Antibiotics in the Treatment of Intracranial Infection

Liangzhen Shi, Shijie Chen*

The First Affiliated Hospital of Yangtze University, Jingzhou, China
Email: 314639221@qq.com, *1070546194@qq.com

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Abstract

Objective: To explore the clinical effect of lumbar pool drainage combined with antibiotics in the treatment of patients with intracranial infections, and to provide a reference basis for clinical treatment. Methods: To collect and select patients admitted to the First People's Hospital of Jingzhou City for craniotomy from January 2016 to June 2022, the infected were 20 cases, and continuous drainage of the lumbar pool was used under the premise of systemic application of sensitive antibiotics. Results: Twenty cases in this group were discharged cured. Conclusion: Lumbar pool placement drainage combined with systemic application of antibiotics for intracranial infection is a safe and effective treatment method.

Keywords

Cranial Surgery, Intracranial Infection, Continuous External Lumbar Pool Drainage, Intrathecal Injection

1. Introduction

Intracranial infection is a disease caused by pathogenic organisms invading the brain, and common symptoms include meningeal irritation, increased intracranial pressure, and symptoms of systemic infection with impaired consciousness. Intracranial infection is a serious postoperative complication of neurosurgery, leading to disability and death, with low morbidity but serious consequences. Patients admitted to the First People's Hospital of Jingzhou City for craniotomy from January 2016 to June 2022 were collected and selected, with 20 cases of infections. Under the premise of systemic application of sensitive antibiotics, con-

*Corresponding author.

tinuous drainage of the lumbar pool was used, while antibiotics were injected into the subarachnoid space through the drainage tube, and 20 patients were cured with efficacy, as reported below.

2. Data and Methods

2.1. General Information of This Group

Patients admitted to the First People's Hospital of Jingzhou City from January 2016 to June 2022 for cranio-cerebral surgery were collected and selected, and the infected patients were 20 cases, 13 males and 77 females. Among them, 12 cases were complicated by intracranial infection after extraventricular drainage, 7 cases were complicated by intracranial infection after cerebral hemorrhage and traumatic brain injury, and 1 case was complicated by intracranial infection after aneurysm clamping. Inclusion criteria: patients with fever, cranial hypertension, cloudy or purulent cerebrospinal fluid, leukocytosis, glucose < 2.2 mmol/L and cerebrospinal fluid glucose level/serum glucose level ≤ 0.4. Exclusion criteria: combination of severe organic lesions, cancer, intracranial inflammatory lesions. Statement: This clinical study passed the ethical review of clinical topics by the Ethics Committee of Jingzhou First People's Hospital.

2.2. Clinical Presentation

In 20 patients, 3 - 7 days after surgery, the patients showed signs of meningeal irritation, increased intracranial pressure, impaired consciousness and symptoms of systemic infection.

2.3. Ancillary Examinations

Cerebrospinal fluid, blood routine, CRP, urine routine, chest CT, head CT and MRI were performed several times in 20 patients. Patients were found to have white blood cells in all patients while urine routine and chest CT showed no significant abnormalities. Lumbar puncture revealed intracranial pressure > 20 cm, cerebrospinal fluid leukocyte count > 1000×10^6/L and cerebrospinal fluid glucose count < 1 mmol/L were significantly higher and polymorphonuclear cells were higher than mononuclear cells, cerebrospinal fluid biochemical examination protein quantification were increased to different degrees, sugar content were significantly lower than normal, head CT and MRI showed ventricular pus accumulation and/or segregation.

2.4. Treatment Method

Continuous external drainage of the lumbar pool: a disposable lumbar pool drainage kit is applied, and after successful lumbar puncture, the drainage tube is placed in the subarachnoid space of the spinal cord, with the placement side facing caudal, at a depth of about 10 cm. The end of the catheter is connected to a sterile drainage bag with a one-way valve with a tee, and the drainage bag is slightly above the bed edge level. The amount, color, and properties of the daily

drainage fluid are recorded, and the height of the drainage bag is adjusted according to the daily drainage flow. Routine cerebrospinal fluid and biochemical tests were performed daily, and regular cerebrospinal fluid cultures were performed; the puncture site was disinfected and changed every 5 days. In this group, drainage was continued for 5 - 13 days.

Application of antibacterial drugs: choose antibacterial drugs that can easily cross the blood-brain barrier, such as the third-generation cephalosporins cefoperazone, ceftriaxone sodium, laxative cephalosporin and vancomycin, etc. And inject ceftriaxone into the subarachnoid space through the drainage tube, 1 - 2 times/day, the injection volume is 10 mL saline with ceftriaxone, slowly inject and then close the tube for 2 - 3 hours before opening the drainage tube. Efficacy evaluation: 1) patient temperature 2) cranial hypertension symptoms 3) cerebrospinal fluid leukocyte count 4) cerebrospinal fluid glucose level. Cured: all four of the above results returned to normal; effective: three of the four criteria returned; valid: two of the four criteria returned; invalid: one of the four criteria returned or less than one.

3. Results

All 20 patients in this group were discharged with disappearance of clinical symptoms, normal cerebrospinal fluid biochemical indexes, and negative cerebrospinal fluid microbiological culture. No complications such as subcutaneous fluid accumulation at the lumbar puncture site or cerebrospinal fluid leakage were observed in all patients.

4. Discussion

Intracranial infections after neurosurgery include infections caused by microorganisms such as bacteria, fungi and viruses, the most common of which are bacterial infections [1], and the incidence of intracranial infections after neurosurgery is 1.8% [2]. Domestic expert consensus recommends [3] that the criteria for confirming the diagnosis of intracranial infection: 1) The clinical diagnosis of intracranial infection is established when the patient presents with fever, symptoms of cranial hypertension, cloudy or purulent cerebrospinal fluid, leukocytosis, glucose < 2.2 mmol/L and cerebrospinal fluid glucose level/serum glucose level ≤ 0.4. 2) On the basis of clinical diagnosis, a positive microbiological culture of specimen smear, drainage tip, implant and cerebrospinal fluid was present and the pathogenic diagnosis was established. Intracranial infection is a common complication after craniotomy, which seriously affects the prognosis of surgery [4] and has a high rate of disability and death [5]. Therefore, the detection of intracranial infections should be timely, early diagnosis and aggressive treatment is the key to improve prognosis, reduce clinical costs and shorten the number of hospital days. The clinical gold standard for diagnosis is a positive microbiological culture of cerebrospinal fluid [6]. There are three common clinical treatments for intracranial infections: 1) antibiotic use alone, 2) antibiotics

plus lumbar puncture drainage, and 3) antibiotics plus continuous drainage of the lumbar pool. When bacterial infection of the central nervous system is clinically suspected, cerebrospinal fluid, surgical incision secretions and blood specimens should be retained for routine, biochemical, smear, bacterial culture and drug sensitivity testing before antimicrobial use; empirical antimicrobial therapy should be administered as early as possible [7]. Antimicrobial agents that readily cross the blood-brain barrier are preferred, such as ceftriaxone, cefotaxime, meropenem, and vancomycin [3]. In case of poor clinical outcome, the diagnosis needs to be reconsidered; when intracranial infection is still suspected, lumbar puncture to release cerebrospinal fluid to reduce intracranial pressure as well as intrathecal injection of drugs can be chosen but repeated multiple lumbar punctures to release cerebrospinal fluid can cause a lot of pain to the patient [8]. Intrathecal injection is easy to operate, less invasive, and enables the drug to enter the subarachnoid space directly without crossing the blood-brain barrier, with high drug concentration in the cerebrospinal fluid and good results [9]. Continuous drainage of the lumbar pool is a well-established clinical technique, and the use of this procedure allows both cerebrospinal fluid release and intrathecal drug injection, a method that can significantly improve patient healing. Under the premise of treatment with antibiotic drugs, catheter drainage can promptly eliminate intracranial bacteria and toxins, reduce meningeal irritation, and shorten the treatment time [10]. Continuous lumbar pool drainage is a well-established clinical technique that was initially applied to treat or prevent cerebrospinal fluid leakage after cranial and spinal surgery [11]. Lumbar puncture can measure intracranial pressure and collect cerebrospinal fluid for culture and biochemical indexes, and continuous drainage of the lumbar pool can also measure intracranial pressure and collect cerebrospinal fluid for culture and biochemical indexes [12]. However, the success rate of bacterial culture of cerebrospinal fluid in intracranial infections in clinical practice is low, requiring repeated and multiple cultures and biochemical indicators [13]; continuous lumbar pool drainage has significant advantages in the treatment of intracranial infections, such as the advantages of requiring only a single lumbar puncture, high success rate, controlled drainage rate, avoidance of associated adverse effects, easy detection of drained cerebrospinal fluid, and large cumulative drainage volume [14].

5. Summary

In conclusion, lumbar pool drainage combined with intrathecal injection and systemic application of antibiotics for the treatment of intracranial infections can reduce patients' pain, economic burden and hospitalization time, and is a safe and effective treatment method worth promoting.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Hao, J.J., Wu, Y.X. and Wang, Q. (2015) Research Progress in the Diagnosis of Bacterial Infection in the Central Nervous System after Neurosurgery. *Chinese Journal of Neurosurgery*, **31**, 1077-1080.

[2] Ma, Y.F., Wen, L. and Zhu, Y. (2019) Prospective Study Evaluating Post-Operative Central Nervous System Infections Following Cranial Surgery. *British Journal of Neurosurgery*, **33**, 80-83. https://doi.org/10.1080/02688697.2018.1519112

[3] (2021) Chinese Expert Consensus on the Diagnosis and Treatment of Central Nervous System Infections in Neurosurgery (2021 Edition). *Chinese Journal of Neurosurgery*, No. 1, 2-15.

[4] Zhou, Q.F. (2016) Introduction to the Use of Antibiotics in Patients with Postoperative Intracranial Infection in Neurosurgery. *Chinese Continuing Medical Education*, No. 23, 139-140.5.

[5] Wang, H.J., Chen, G.Z., Zhou, C.J., *et al.* (2020) Study on the Diagnostic Value of Combined Cerebrospinal Fluid and Serum PCT Examination on Nosocomial Acquired Intracranial Infection after Neurosurgery. *China Modern Life*, No. 6, 5-8 + 193.

[6] Zhou, F., Song, J. and Yu, A.R. (2021) Advances in the Rational Application of Antimicrobial Drugs for Postoperative Intracranial Infections in Neurosurgery. *Pharmaceutical Herald*, No. 8, 1030-1035.

[7] Shi, Z.H., Xu, M., Wang, Y.Z., *et al.* (2018) Diagnostic Value of Cerebrospinal Fluid Detection Indexes for Intracranial Infection after Neurosurgery. *Chinese Journal of Neurosurgery*, **34**, 601-605.

[8] Xie, Y.M. and Chen, W.M. (2021) Clinical Effects of Modified Epidural Catheter Connection Device for Continuous Lumbar Pool Drainage as an Adjunct to Treatment of Intracranial Infection. *Chinese Journal of Hospital Infection*, No. 6, 886-890.

[9] Chen, X.D., Cai, J.Y., Ba, H.J., *et al.* (2016) Efficacy of Combined Intravenous and Intrathecal Application of Vancomycin in the Treatment of Intracranial Infection in Patients after Craniotomy. *Chinese Journal of Hospital Infection*, No. 7, 1569-1571.

[10] Yang, F. (2019) Efficacy of Continuous Lumbar Pool Drainage Combined with Intravenous and Intrathecal Antimicrobial Drugs in the Treatment of Postoperative Intracranial Infection in Neurosurgical Patients. *Chinese Journal of Modern Medicine*, No. 9, 65-67.

[11] Ren, R.M. and Li, F.F. (2018) Analysis of Efficacy of Continuous External Drainage of Cerebrospinal Fluid from the Lumbar Pool plus Intrathecal Injection in the Treatment of Postoperative Intracranial Infection. *Modern Diagnosis and Therapy*, **29**, 767-768.

[12] Park, K.-H., Gu, Y.-X., Su, X.-Q., *et al.* (2010) Observation and Nursing Countermeasures of Intrathecal Antibiotic Injection for Intracranial Infection. *Journal of Practical Clinical Medicine*, No. 20, 75-76.

[13] Hong, C.S., Wang, K. and Falcone, G.J. (2020) The CSF Diversion via Lumbar Drainage to Treat Dialysis Disequilibrium Syndrome in the Critically Ill Neurological Patient. *Neurocritical Care*, **33**, 312-316. https://doi.org/10.1007/s12028-020-00972-w

[14] Wei, J.J., Qiu, B.H., Ma, S.J., *et al.* (2017) Expert Consensus on the Diagnosis and Management of Infection in Critically Ill Neurosurgical Patients in China. *Chinese Medical Journal*, No. 21, 1607-1614.