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# Report of 2 Cases of Cerebral Contusion and Laceration Treated with Puncture and Drainage and Literature Review

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## Abstract

**Objective:** To report the clinical data of two patients with cerebral contusion and laceration treated with puncture and drainage, and to conduct a literature review to provide clinical information for the treatment of cerebral contusion and laceration. **Methods:** Clinical data of two patients with cerebral contusion and laceration treated with trephination and drainage were collected. The patients had preoperative supratentorial intracerebral hematomas greater than 20 ml without cerebral herniation. **Results:** Both patients with cerebral contusion and laceration were able to take care of themselves upon discharge. Most of the intracerebral hematoma was drained on the third day after surgery. **Conclusion:** For patients with cerebral contusion and laceration who have intracerebral hematomas greater than 20 ml without cerebral herniation, puncture and drainage is an effective treatment option.

## Keywords

Cerebral Contusion and Laceration, Puncture and Drainage, Efficacy

## 1. Introduction

Brain contusion and laceration refer to the injury of the brain tissue at the point of impact or force when violence is applied to the head, resulting in significant movement of brain tissue within the cranial cavity, leading to brain contusion and laceration. Since these two changes often coexist, they are collectively referred to as brain contusion and laceration [1]. Cerebral hematoma puncture and drainage involves inserting a drainage tube into the intracranial hematoma cavity through a minimally invasive small incision. Then, urokinase is injected into the hema-

toma cavity to dissolve the hematoma and drain it, achieving the goal of removing the hematoma and promoting recovery. Its advantage is that it slowly drains the hematoma under minimally invasive conditions, but its disadvantage is that it cannot immediately relieve the hematoma-occupying effect [2]. There are few reports on the clinical application of trepanation and drainage in the treatment of brain contusion and laceration. This article conducts a literature analysis on the clinical effects of puncture and drainage in the treatment of brain contusion and laceration, providing clinical data for the treatment of brain contusion and laceration.

## 2. Case Presentation

Case Presentation 1: The patient is a 57-year-old male admitted to the hospital due to "headache for one hour following trauma." Physical examination revealed that he was conscious, with a Glasgow Coma Scale (GCS) score of 15 (E4V5M6). His bilateral pupils measured 2 mm in diameter and were responsive to light. Muscle strength in all four limbs was grade 5, and there was a negative bilateral Babinski's sign. He had no significant past medical history. A head CT (computed tomography) scan showed contusions and lacerations in the frontal lobe, a subdural hematoma, subarachnoid hemorrhage, and a skull fracture (**Figure 1**). Conservative management was initiated. A follow-up brain CT scan 24 hours post-injury showed a significant increase in frontal lobe contusions and lacerations, along with pronounced brain swelling (**Figure 1**). The patient underwent puncture and drainage under local anesthesia 24 hours after injury to treat left frontal lobe contusion. The surgery lasted for 30 minutes. Surgical Procedure: After routine disinfection, local anesthesia was administered at the marked point. A 5 mm incision was made on the scalp, and a 4mm drill bit was used to drill through the skull and dura mater using a gun-style fine-hole cranial drill (**Figure 2**). A drainage tube with a stylet was inserted along the long axis of the hematoma, with the tip of the tube positioned close to but not exceeding the posterior boundary of the hematoma. The stylet was then removed, and approximately 2 - 5 ml of hematoma was aspirated using a syringe. The drainage tube was secured, and a closed drainage system was connected externally. Six hours post-surgery, 30,000 units of urokinase diluted in 2 ml of 0.9% sodium chloride solution were injected into the hematoma cavity through the drainage tube. The tube was clamped for 3 hours before being reopened. This process was repeated three times daily based on the drainage situation. On the third day post-surgery, a follow-up cranial CT scan showed that most of the intracranial hematoma had been drained, prompting the removal of the drainage tube (**Figure 1**). Upon discharge, the patient was able to resume normal activities with a GCS score of 15.

Case Presentation 2: A 57-year-old male patient was admitted to the hospital due to "headache persisting for 3 hours after a traumatic injury." Physical examination revealed a lethargic state with a GCS score of 13 (E3V4M6). The patient's bilateral pupils were 2 mm in diameter and responsive to light. Muscle strength

in all four limbs was rated as grade 5, and bilateral Babinski's signs were negative. Preoperative cranial CT scan revealed a contusion and laceration in the right frontal lobe (Figure 3). The patient underwent puncture and drainage under local anesthesia 24 hours after injury to treat right frontal lobe contusion and laceration, with the surgery lasting for 20 minutes. A follow-up cranial CT scan conducted on the third postoperative day (Figure 3) showed that the majority of the intracerebral hematoma had been drained, prompting the removal of the drainage tube. Upon discharge, the patient was able to resume a normal life, achieving a GCS score of 15.

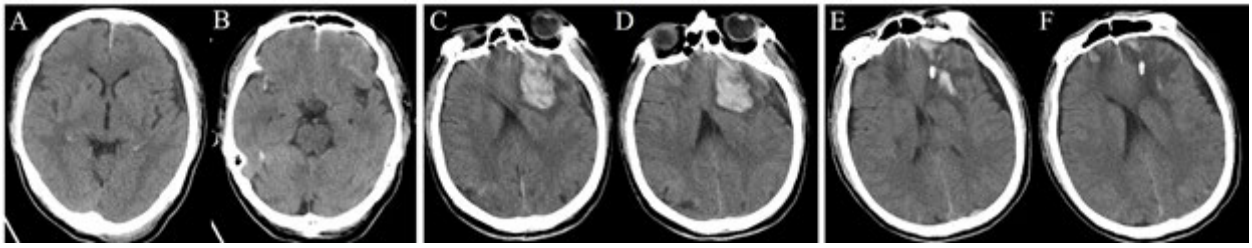


Figure 1. A, B: Cranial CT scan taken 1 hour after injury: frontal lobe contusion and laceration, subdural hematoma, subarachnoid hemorrhage, and skull fracture. C, D: Cranial CT reexamination taken 24 hours after injury showed a significant increase in frontal lobe contusion and laceration, with obvious brain swelling. E, F: Cranial CT reexamination taken 3 days after surgery showed that most of the intracranial hematoma had been drained.

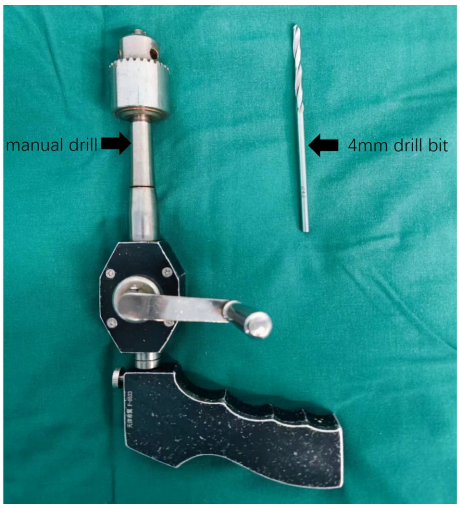


Figure 2. Surgical instruments.

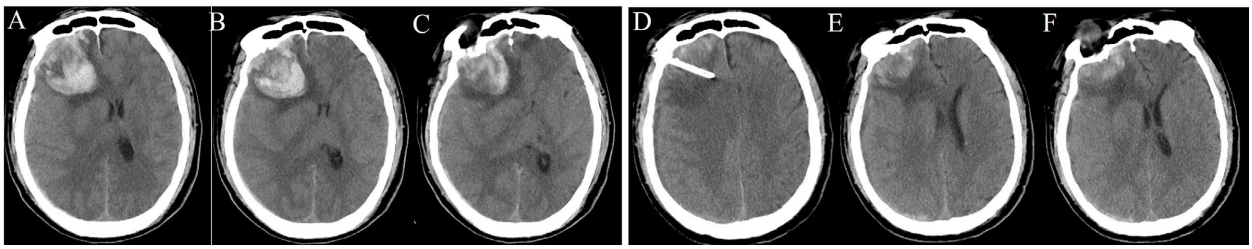


Figure 3. A, B: Preoperative cranial CT of the patient showed contusion and laceration of the right frontal lobe. C, D: Postoperative cranial CT taken 3 days after surgery showed that most of the intracerebral hematoma had been drained.

## 3. Discussion

The volume of intracerebral hematoma and the degree of midline shift affect the prognosis of patients. The larger the intracerebral hematoma volume and the more pronounced the midline shift, the worse the patient's prognosis [3]. Studies have found that when the midline shift exceeds 10 mm, the rate of poor prognosis reaches 70%, and the greater the shift, the higher the likelihood of poor prognosis [4]. The larger the extent of brain tissue contusion and laceration, on one hand, indicates more severe ischemia, edema, and damage to brain cells, and on the other hand, a greater occupying effect, leading to heavier compression on brain tissue. When the compression affects important areas such as the mesencephalic aqueduct or brain stem, it can cause hydrocephalus, brain herniation, and even respiratory and cardiac arrest, directly endangering the patient's life. Therefore, early removal of hematoma can reduce intracranial damage, lower mortality and disability rates, and improve prognosis.

Intracerebral hematoma puncture and drainage refers to the placement of a drainage tube into the intracerebral hematoma cavity through a minimally invasive small incision. Then, urokinase is injected into the hematoma cavity to liquefy and drain the hematoma, achieving the goal of removing the hematoma and promoting recovery. Its advantage is that it slowly drains the hematoma under minimally invasive conditions, while its disadvantage is that it cannot immediately relieve the hematoma-occupying effect. In the treatment of hypertensive intracerebral hemorrhage, it has been reported that compared to craniotomy for hematoma removal, puncture and drainage can avoid damage to other brain tissues due to the operation not requiring traction of these tissues. It can also remove hematoma, relieve brain tissue compression, reduce the degree of neurological impairment, and has high safety, which is beneficial to patient's prognosis. [2]. This study suggests that for patients with supratentorial hematoma greater than 20 ml without cerebral herniation, puncture and drainage is a minimally invasive and effective treatment option for brain contusion patients.

Surgical indications for puncture and drainage in patients with cerebral contusion and laceration. 1) The patient has a closed cerebral contusion and laceration, with a supratentorial hematoma greater than 20 ml, and no cerebral herniation. 2) The patient's GCS score is greater than 12. If the patient's GCS score is less than 12, and the patient's cisterns are well-displayed, with a midline shift less than 5 mm, and no significant brain swelling. 3) The patient's vital signs are stable. 4) The patient has not taken long-term oral anticoagulant drugs such as aspirin, and the patient does not have coagulation dysfunction. If the patient develops cerebral herniation or significant brain swelling, emergency craniotomy is required [5]. Intracranial pressure monitoring can monitor intracranial pressure changes in real time, guide treatment, and is beneficial for patient safety.

There are differing opinions in the literature regarding the timing of surgical puncture and drainage for patients with cerebral contusion and laceration. In the initial stages post-injury, the cerebral contusion and laceration are unstable, with

a potential for hematoma enlargement at any moment. Performing surgery early may elevate the risk of postoperative rebleeding, subsequently leading to a deterioration in clinical prognosis [6]. Generally, a lower risk period for surgery is considered to be between 24 and 36 hours after injury. On the one hand, draining the hematoma can mitigate its space-occupying effect and secondary brain injury. On the other hand, it can decrease the risk of intracranial rebleeding. Some reports also indicate that burr hole surgery conducted within 12 hours post-injury can more effectively alleviate brain edema, thereby enhancing the patient's state of consciousness and reducing the incidence of long-term anxiety [7] [8]. In this article, two patients with cerebral contusion and laceration underwent trepanation and drainage surgery approximately 24 hours after injury. The hematomas in both patients were gradually drained, alleviating the brain edema caused by the hematoma occupying effect. Meanwhile, neither patient experienced secondary cerebral hemorrhage during the surgery. This article suggests that the optimal surgical timing for patients with cerebral contusion and laceration is between 24 and 36 hours after injury.

The timely diagnosis and correct intervention treatment of brain contusion and laceration are crucial, as they can effectively reduce the disability rate and mortality rate of patients. Puncture and drainage of cerebral hematoma can drain the hematoma with minimal trauma, alleviate brain damage, prevent disease progression, and improve patient prognosis. It has the advantages of minimal trauma, simple operation, low cost, and rapid postoperative recovery [2]. It provides a new treatment option for patients with general poor physical conditions who cannot tolerate general anesthesia surgery, patients with brain contusion and laceration who subjectively cannot accept craniotomy surgery, patients with poor heart and kidney function who cannot tolerate long-term dehydration treatment, and elderly patients. In the future, it will provide a diagnostic and treatment plan for brain contusion and laceration that can not only reduce the disability rate and improve prognosis but also reduce medical costs and social burden.

## 4. Conclusion

For patients with cerebral contusion and laceration who have intracerebral hematomas greater than 20 ml without cerebral herniation, puncture is an effective treatment option.

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## Conflicts of Interest

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

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