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Cranioplasty after Decompressive Craniectomy Caused an Intracerebral Hemorrhage: A Case Report

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Abstract

Decompressive craniectomy is a common practice for patients with intracranial hypertension. Secondary rigid structural reconstruction following craniectomy can release the effects of atmospheric pressure on the brain, and the brain can become dilated. Although some cases with complications induced by cranioplasty, such as intracranial hematoma, have been reported, no clinical cases with intracerebral hemorrhage after rigid reconstruction have been reported. This case report describes a 39-year-old man with a skull defect following clipping with simultaneous decompressive craniectomy for a subarachnoid hemorrhage. About 25 months later, cranioplasty using a custom-made hydroxyapatite (HAP) ceramic implant was performed. Immediately after the operation, intracerebral hemorrhage was detected on the opposite side by computed tomography (CT). However, there were no physical or neurological findings, the hematoma was completely absorbed within 3 weeks postoperatively, and the skull retained a good shape. This case suggests that rigid reconstruction of a skull defect can influence intracranial conditions, and early postoperative CT is important to detect complications.

Keywords

Cranioplasty, Rigid Reconstruction, Skull Defect, Intracerebral Hemorrhage, Decompressive Craniectomy

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1. Introduction

Decompressive craniectomy is a common practice for patients with intracranial hypertension [1]. Craniectomy usually leads to impairment of cerebral blood flow and glucose metabolism, and may also cause changes to the cerebrospinal fluid circulation [2] [3]. Rigid structural reconstruction following craniectomy can release the effects of atmospheric pressure on the brain, and the brain can become dilated [4]-[6]. Therefore, secondary cranioplasty is performed to restore the cerebrospinal fluid, and improve neurological status [7]-[9]. Nevertheless, cranioplasty on a patient with a concave scalp flap at the craniectomy site increases the risks of fluid collection and hematoma [10]. Here, we report an unusual case with presentation of an intracerebral hemorrhage after cranioplasty for a skull defect.

2. Case Report

The patient was a 39-year-old man that suffered a subarachnoid hemorrhage (SAH) at 37 years old. Emergent clipping with simultaneous cerebral decompression was performed. One month postoperatively, ventriculoperitoneal shunt was performed for subsequent hydrocephalus. Two months after SAH, cranioplasty with a titanium implant was performed, but it was removed due to infection at the operative site and implant 1 month after the cranioplasty. As the surgical site still showed delayed wound healing despite removal of the implant, the patient was referred to our department. We found an abscess on the artificial dura mater by computed tomography (CT) (**Figure 1**). The artificial dura mater was removed, and we performed dural reconstruction with his fascia lata 9 months after SAH. From that point, there was no infection and the patient had good wound healing.

About 25 months after SAH, he was admitted to our hospital for cranioplasty using a custom-made hydroxyapatite (HAP) ceramic implant. On admission, he was clinically obese (body mass index: 34.9) and he had a past history of hypertension and smoking until the onset of SAH. On physical examination and CT scan, a depressed area was located on the temporal part of the skull, but he had no neurological findings (**Figure 2**). We performed cranial reconstruction surgery using a custom-made HAP ceramic implant (**Figure 3**). No intraoperative fabrication was needed, and there were no tenting sutures to the reconstructed dura mater. No intraoperative complications, such as injury to the dura, occurred. On the day after the operation, a putaminal hemorrhage was on the opposite side on CT scan (**Figure 4**). However, there were no physical or neurological findings. Compared to preoperative findings, depression of brain substance in the left frontal lobe and temporal lobe had improved, and the frontal horn of the lateral ventricle was slightly deviated to the left. No adverse events occurred in the postoperative course, and he was discharged from the hospital two weeks after surgery. Follow-up CT scan performed 20 days after surgery showed that the intracerebral hematoma was completely absorbed and the deviation of the frontal horn of the lateral ventricle was improved (**Figure 5**). Six months after cranioplasty, his skull retained a good shape (**Figure 6**), and he is keeping in a good course for more than two years postoperatively with no subsequent issues.

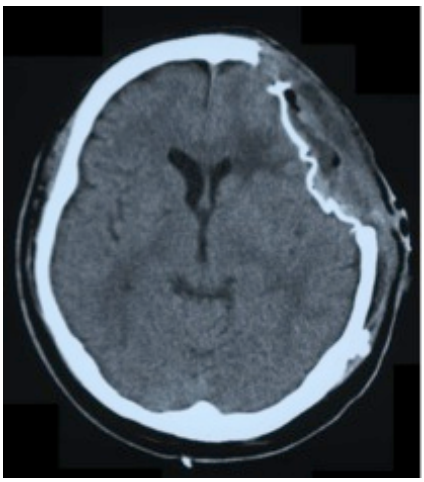
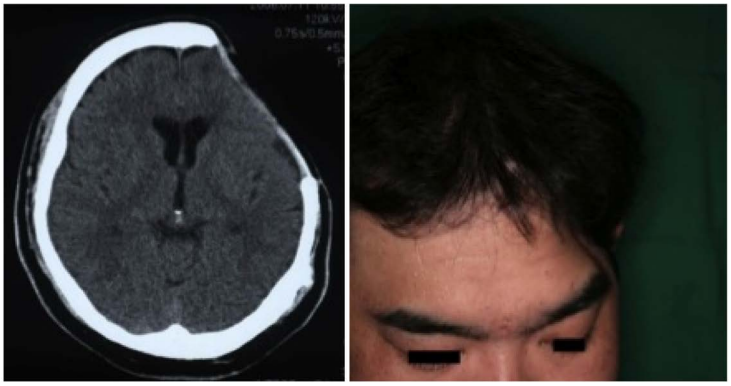


Figure 1. When the patient was referred to our department, an abscess on the artificial dura mater was found on CT scan.



(a) (b)

Figure 2. (a) CT scan image and (b) external appearance at the time of admission for cranioplasty. A depressed area was located on the temporal part of the skull.

(a) (b)

Figure 3. Intraoperative photographs after setting a custom-made HAP ceramic implant. (a) Oblique view; (b) Frontal view.

Figure 4. CT scan image on the day after the operation, which showed a putaminal hemorrhage on the opposite side of the surgical site.

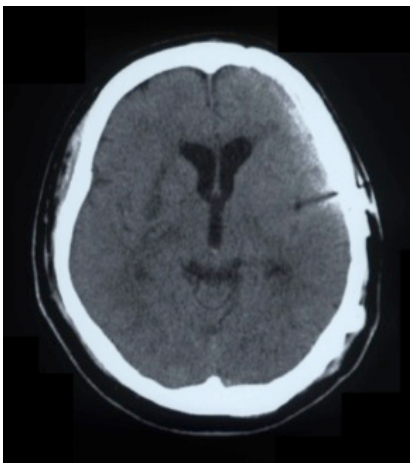


Figure 5. CT scan performed 20 days after surgery showed no intracerebral hematoma and no deviation of the frontal horn of the lateral ventricle.

Figure 6. External appearance with good skull shape six months after cranioplasty.

3. Discussion

A large skull defect may result from congenital deformities, trauma, decompressive craniectomy, or bone flap loss due to infection. Decompressive craniectomy is widely used as a life-saving procedure to release intracranial hypertension following traumatic brain injury [1]. Furthermore, post-traumatic hydrocephalus is a frequent complication, which requires ventriculoperitoneal shunt to divert cerebrospinal fluid, as in the present case [11]. A ventriculoperitoneal shunt for hydrocephalus in patients with a skull defect may lead to excessive sinking at the craniectomy site due to the atmospheric pressure gradient. Patients after craniectomy may also experience neurological deficits, but these patients also have some features of an independent disease, so-called sinking skin flap syndrome, also known as trephined syndrome [12]. This syndrome presents with progressive neurological deterioration and headache, mainly in orthostatic position, dizziness, as well as motor and cognitive impairments.

The aim of cranioplasty in a patient with a sinking skin flap is to remove atmospheric pressure at the craniectomy site, and reconstructive cranioplasty can also relieve several symptoms by restoring intracranial pressure, cerebral blood flow, glucose metabolism, and the cerebrospinal fluid circulation [13]. Cranioplasty following craniectomy also improves several functions, such as mean score of the verbal fluency test, working memory and speed of attention regardless of the size and site of cranioplasty [14]. However, reconstructive cranioplasty

in a patient with a concave scalp flap at the craniectomy site increases the risks of fluid collection and hematoma [10]. Although some cases with complications induced by cranioplasty, such as intracranial hematoma, have been reported, no clinical cases with intracerebral hemorrhage after rigid reconstruction have been reported.

Here, we reported a clinical case of intracerebral hemorrhage after rigid reconstruction. In this case, the postoperative intracerebral bleeding was considered to have occurred because the rigid cranial reconstruction decreased the effect of atmospheric pressure and allowed the brain to become dilated, therefore exposing the contralateral brain parenchyma to a traction force. Furthermore, this patient had a number of risk factors, such as hypertension, obesity, and smoking, suggesting consequent vulnerability of cerebral vessels. However, the goal of cranioplasty is to reconstruct a rigid structure and remove atmospheric pressure, as mentioned before, and there is no specific preventive method to avoid intracranial hemorrhage after cranioplasty. Through this case, we found that rigid reconstruction of a skull defect can elicit a change in the intracranial conditions but also has a certain risk of intracerebral hemorrhage. Consequently, CT scan immediately after reconstructive surgery is important.

4. Conclusion

Here, we reported a case in which cranioplasty after decompressive craniectomy caused intracerebral hemorrhage. Intracranial conditions can be changed after rigid structural reconstruction. Therefore, diagnostic imaging immediately after surgery, such as CT scan, is important.

Conflict of Interest

The authors declare that there are no conflicts of interest.

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