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Unusual, Acute, and Delayed Traumatic Torcular Herophili Epidural Hematoma Causing Malignant Encephalocele During Surgery: A Case Report

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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Conflict of interest: None declared

Patient: Male, 40
Final Diagnosis: Traumatic torcular herophili unusual acute and delayed epidural hematoma
Symptoms: Coma
Medication: —
Clinical Procedure: Craniotomy
Specialty: Neurosurgery

Objective: Unusual setting of medical care

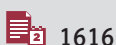
Background: Traumatic torcular herophili epidural hematoma is a rare and specific type of traumatic brain injury that is technically difficult to treat and, more critically, can lead to malignant encephalocele during the operation.

Case Report: A 40-year-old man presented to our hospital 2 h after a motor vehicle crash. Emergency cranial CT showed a frontotemporal subdural hematoma; 3 h after the patient was admitted, the GCS score decreased to 8 and cranial CT re-examination showed that the frontotemporal subdural hematoma was significantly larger than before. We surgically evacuated the hematoma and the patient experienced acute encephalocele 1 h later. An intra-operative cranial CT re-examination showed a large epidural torcular herophili hematoma. Then, via a posterior fossa craniotomy at the torcular herophili, the source of the hemorrhage was identified as the torcular herophili and diploic veins. We used Gelfoam for compression to establish hemostasis and the occipital fascia to repair the broken dura of the torcular herophili and maintain appropriate tension. One month after the injury, CT scans showed absorption of the brain contusion and intracerebral hematoma and reduced cerebral edema, and the patient showed complete resolution of the injury, without neurological dysfunction.

Conclusions: If the first CT scan shows no hematoma in the brain, it can be easy to ignore this complication during the operation. Attention should be paid to confirming a diagnosis as quickly as possible to improve the prognosis of patients with traumatic brain injuries.

MeSH Keywords: Brain Injuries • Encephalocele • Hematoma, Epidural, Cranial

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Background

Extradural hematomas represent 1% of head trauma admissions [1]. Extradural hematomas present as a bilateral hemorrhage in 2–10% of cases [1–3]. Extradural hematomas may be located in the midline and thus associated with a detachment of the sagittal longitudinal sinus, and they may present with unusual clinical signs, which can delay diagnosis and present a dilemma as to indication for and timing of surgery [3,4].

The incidence rate of posterior fossa epidural hematomas was reported to be lower than that of supratentorial epidural hematomas, accounting for just 0.3% of all traumatic brain injuries (TBIs) and 3.4–12.9% of all epidural hematomas [5–9]. However, most of these cases involved a diagnosis made before the operation or that were confirmed by postoperative computed tomography (CT) re-examination [10–12]. A delayed torcular herophili epidural hematoma is a very rare complication that can cause malignant encephalocele during surgery; however, reports of this in the literature are rare.

Case Report

A 40-year-old man presented to our hospital (Huishan People's Hospital, Wuxi, China) 2 h after a motor vehicle crash. Emergency physical examination found the following:

blood pressure (BP), 140/80 mmHg; heart rate (HR), 90/min; Glasgow coma scale (GCS) score, 10; and a double pupil diameter of 3 mm with a light-sensitivity reflex. Emergency cranial CT showed a frontotemporal subdural hematoma (Figure 1A). Three hours after being admitted, the GCS score had decreased to 8, and cranial CT re-examination showed that the frontotemporal subdural hematoma was significantly larger than before, with a midline shift of 0.8 cm (Figure 1B). The patient then underwent a craniotomy to remove the frontotemporal subdural hematoma and treat the cerebral contusion. We used frontal and temporal mark incisions, with a 10×15 cm bone flap. We found that the dural tension was very high when the bone flap was removed; first, we considered that this may be caused by a torcular herophili epidural hematoma because an occipital fracture was found on pre-operative cranial CT. However, intra-operative cranial CT showed no torcular herophili epidural hematoma (Figure 2A). Therefore, the operation was continued, and the dura was cut and the brain contusion treated. However, 1 h after the operation, the patient developed acute encephalocele during the operation to treat the traumatic cerebral injury. Intra-operative cranial CT re-examination showed a large torcular herophili epidural hematoma (Figure 2B). The patient then underwent a posterior fossa craniotomy at the site of the torcular herophili; the bone flap was 8×9 cm. The sources of the hemorrhage were the torcular herophili and diploic veins. We used Gelfoam to provide compression and achieve hemostasis, and we used the occipital

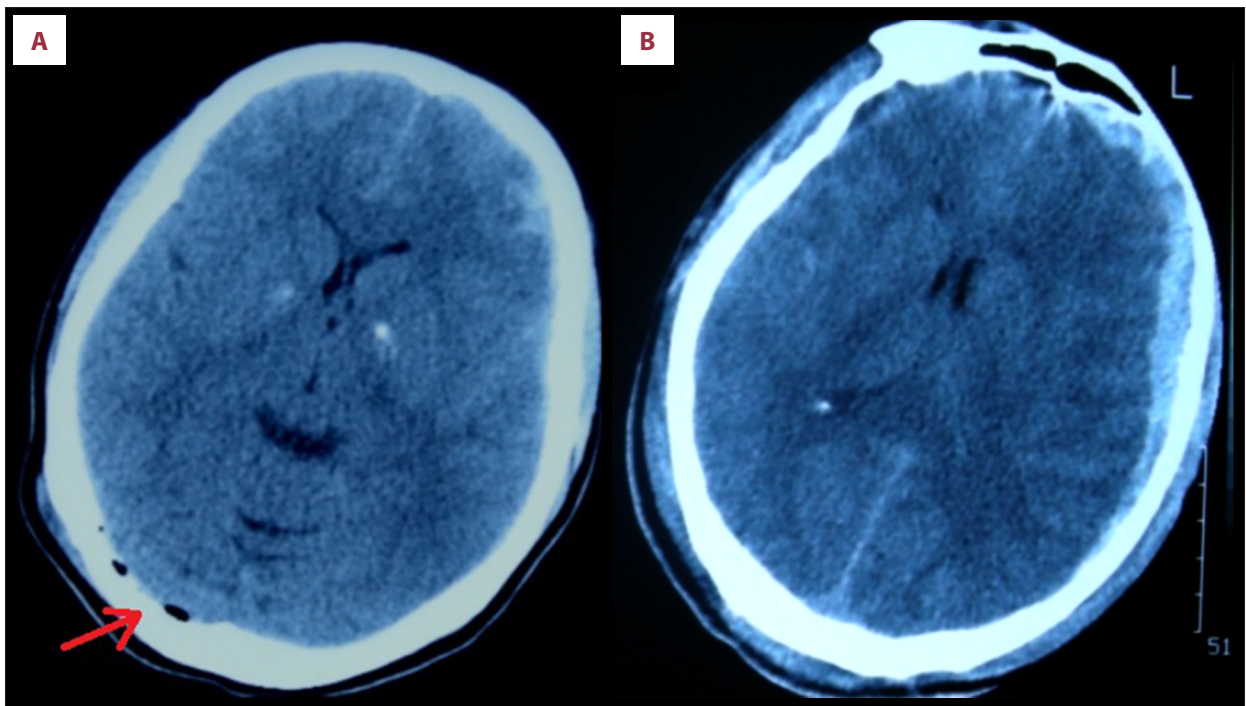


Figure 1. (A) A 40-year-old man at 2 h after brain injury. Cranial CT shows a frontotemporal subdural hematoma and brain contusion, with an occipital fracture (red arrow). (B) Three hours after admission, cranial CT re-examination showed that the frontotemporal subdural hematoma was enlarged (red arrow), with a midline shift of 0.8 cm.

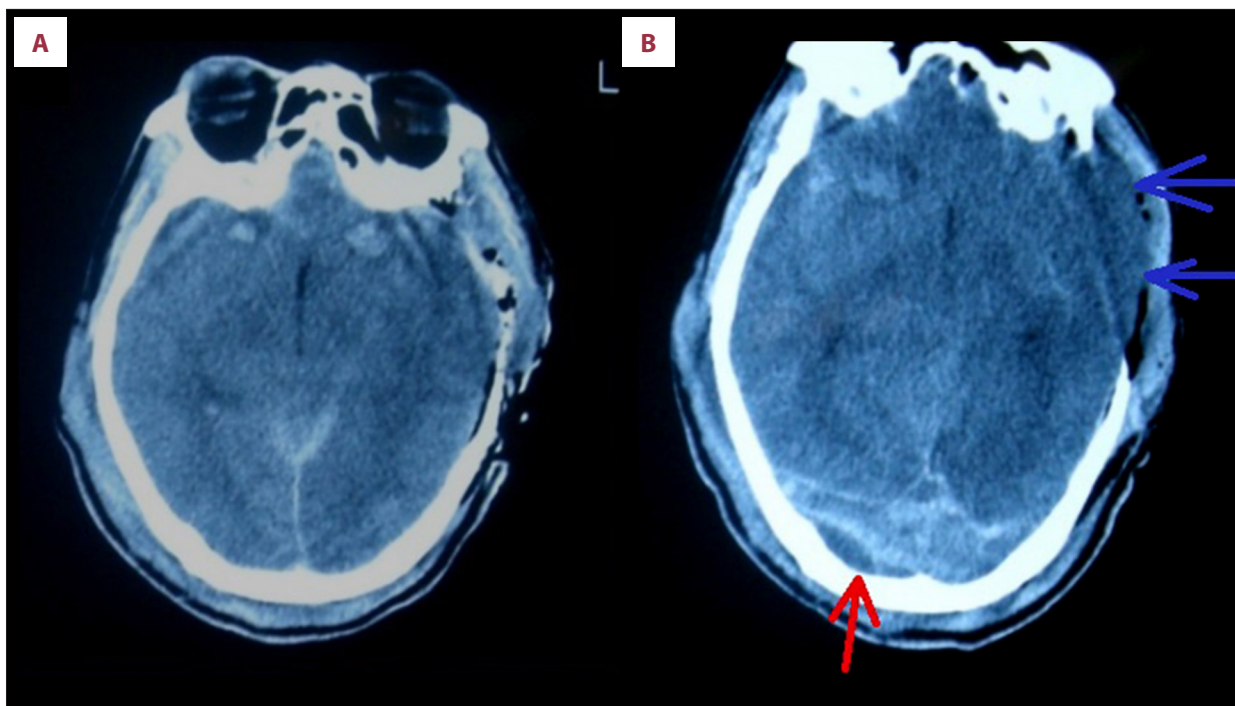


Figure 2. (A) Intra-operative cranial CT shows no torcular herophili epidural hematoma. (B) One hour after we opened the dura mater, the ICP was increased and cranial CT showed a large torcular herophili epidural hematoma (red arrow) and encephalocele (blue arrow).

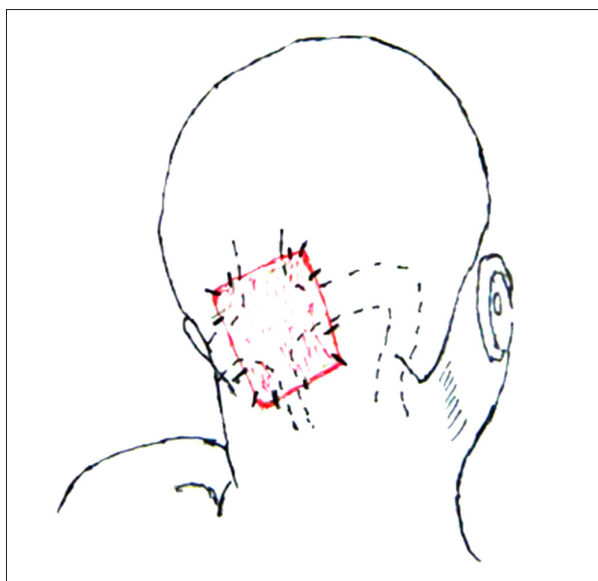


Figure 3. Sketch map of the occipital fascia used to repair the damaged dura of the torcular herophili and maintain appropriate tension; the red patch is the autografted fascia.

fascia to repair the damaged dura of the torcular herophili and maintain appropriate tension (Figure 3). CT re-examination after the operation showed that the torcular herophili epidural hematoma was completely cleared (Figure 4), and the patient

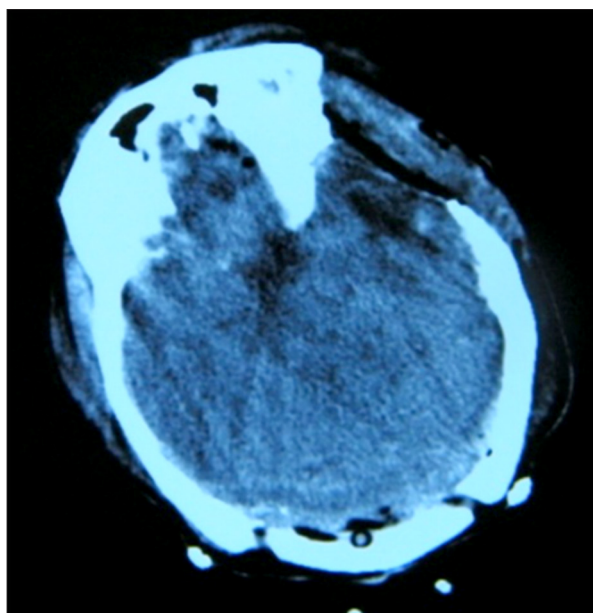


Figure 4. Cranial CT after the operation shows that the torcular herophili epidural hematoma was cleared completely.

was sent to a neuro-intensive care unit. One month after the injury, CT scans showed absorption of the brain contusion and intracerebral hematoma, and reduced cerebral edema, and the patient showed a complete resolution of the injury, without neurological dysfunction.

Discussion

TBIs are one of the most common types of injuries in modern society and are associated with high morbidity and mortality, especially for intracranial hypertension in severe TBI [6]. A torcular herophili epidural hematoma is a specific type of epidural hematoma, and its associated source of bleeding may be the sigmoid sinus or the transverse sinus. A torcular herophili epidural hematoma can be caused by an occipital bone fracture or a tear in the sagittal sinus or sinus transversus. CT or CT angiography (CTA) can be used to confirm a diagnosis, and the volume of an epidural hematoma is often more than 100 mL. Some studies have reported a delayed contralateral epidural hematoma (EDH) [13–16]. An initial report by French [15] provided new ideas about EDHs, indicating that even if no epidural hematoma is visible in the first examination (CT or MR imaging), a re-examination can still detect epidural hematomas at other intracranial locations. In most reports of delayed contralateral EDH after acute subdural hematoma (SDH) evacuation, an overlying skull fracture was demonstrated at the site of the EDH [17]. Contralateral acute EDHs (AEDHs) occurring after resolution of a traumatic acute SDH have been reported as rare but potentially lethal postoperative complications that require consecutive operations. Such delayed contralateral AEDHs may present as intra-operative brain swelling, postoperative neurologic deterioration, or intractably elevated intracranial pressure (ICP). Patients with an unrecognized AEDH are at high risk of acute encephalocele or death. Intra-operative acute encephalocele in severe TBI has received increasing clinical attention. Acute encephalocele has no effective treatment and is associated with many complications, rapid development, and high mortality. A torcular herophili epidural hematoma can be an important cause of acute encephalocele during operations, so occipital fracture, an occipital epidural hematoma, and other similar factors should be considered as well. The clinical features of the torcular herophili epidural hematoma in the current case were: 1) ICP was not high at the beginning of the operation, but when the torcular herophili epidural hematoma increased in size, brain tissue bulged rapidly, making it difficult to continue the surgery and requiring cutting of part of the brain tissue. Most patients with this complication die of hemorrhagic shock. We suspect, based on a review of our experience, that the morbidity associated with torcular herophili epidural hematomas is in fact high because most patients died and patients who were not breathing did not undergo CT examination or autopsy after the operation or after the patient died [18]. 2) Pre-operative CCT showed an occipital fracture and no epidural hematoma, but intra-operative acute encephalocele developed, and intra-operative CCT re-examination then showed an EDH. In this case, when we removed the bone flap, and, before we opened the dura, ICP was high and intra-operative CCT showed no epidural hematoma, but acute encephalocele developed after 30 min,

and CCT confirmed an EDH. Therefore, the cause of the re-hemorrhaging may be that a pressure effect disappeared after the contralateral hematoma was removed. Becker [19] also reported that the removal of pressure was another cause of AEDH. 3) Hemostasis is difficult to maintain in this situation, and severe traumatic injury and increased bleeding can both easily lead to coagulopathy.

On the basis of our experience with these patients, pre-operative imaging must be completely evaluated. It is best to prepare in advance if an occipital fracture is found before the operation. During the operation, we adopted controlled decompression to remove the hematoma and treat the brain contusion; controlled decompression was achieved via craniotomy whereby ICP was gradually released (as opposed to rapidly releasing ICP with a standard decompressive craniectomy) during the surgery [18]. If ICP is found to progressively increase, AEDH must be considered, and we suggest simply suturing the site and immediately rechecking the injury with CCT. AEDH should be managed first if confirmed by CCT, and treatment with blood transfusion, blood platelets, and blood coagulation factors should be prepared for before the operation to address a coagulopathy.

Larger EDH volumes result in higher mortality. Rivas [20] reported that increased mortality may be associated with EDH volumes greater than 150 ml and a midline shift of more than 12 mm. Sealing [21] reported that there was no effect of factors such as EDH location or midline shift on outcomes in patients with an EDH. However, the present case and our experience indicate that a torcular herophili EDH has a poor outcome as a result of the location. Some studies and case reports have indicated a good outcome from torcular herophili craniectomy to expose the torcular herophili to treat EDHs at this location [22,23]. In the present case, we used occipital craniectomy to remove the hematoma, and all hemorrhagic sites were exposed completely. We then used a gelatin sponge to achieve compression and hemostasis. We do not recommend bipolar coagulation because it can lead to diffuse blood leakage, making the site of bleeding at the torcular herophili difficult to reveal clearly. In our experience, it is best to remove the EDH quickly, use a gelatin sponge to compress the hemorrhagic site, and then use an autogenous section of occipital fascia to cover the gelatin sponge, stitching the fascia together with dura to maintain appropriate tension. We refer to this as a “patch” combined with compression repair. Faiz [24] also reported a similar case where methods similar to ours were used; the operation was a success, but the patient died subsequently from an infection. The method described here is a very useful and easy to employ method for the management of torcular herophili EDH, but studies or case reports of this condition are still rare, as can be seen in searches of PubMed or Medline.

Conclusions

Unusual, acute, and delayed torcular herophili epidural hematoma can lead to malignant encephalocele, and this is a highly lethal complication. Pre-operative detailed medical history and physical examination can help understand the components of TBI injury mechanism, as contrecoup injury is the most important cause of delayed epidural hematoma. Pre-operative CT or CTA can be used to confirm a diagnosis, so the pre-operative CT must be studied carefully. Especially for bone fracture in contrecoup injury patients, the CT re-examination should be done as soon as possible when encephalocele occurs during the operation and delayed epidural hematoma is highly

suspected. Intra-operative controlled decompression technique can maximize the incidence of delayed epidural hematoma, and it is safe and effective to use occipital fascia to repair the damaged dura of the torcular herophili. Therefore, pre-operative suspicion and pre-operative imaging study, intra-operative re-examination, and operative technique are very important, and early diagnosis, a fast operation, and proper surgical technique are keys to a good outcome.

Conflict of interest

None.

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