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A Successful Evacuation of Vertex Epidural Hematoma; A Case Report

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Vertex epidural hematoma (VEH) is an uncommon presentation of all epidural hematomas and presents with a wide range of symptom and signs. Diagnosis as well as treatment of VEH is also difficult because of its location adjacent to superior sagittal sinus (SSS). A 43-year-old male visited our hospital after fall down and was diagnosed with VEH. While evaluating its location and patency of SSS, he was deteriorated and urgently underwent evacuation of VEH. Bilateral craniotomies on each side, leaving a central bony island to avoid bleeding of midline structure and provide an anchor for dural tack-ups. After the operation, VEH was totally removed and the patient has restored.

Keywords: Vertex; Epidural hematoma; Extra-axial hematoma

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INTRODUCTION

Vertex epidural hematoma (VEH) is an unusual presentation of traumatic brain injury, estimated to represent as 1% to 8% of all extra-axial intracranial hematomas [1]. They might present with unusual clinical signs and symptoms that could delay diagnosis and present a dilemma as to indication for timing of surgery [2,3]. Due to its location, VEH sometimes presents with a wide range of symptoms, ranging from lower-extremity weakness relating to compression of the motor cortex bilaterally and acute intracranial hypertension secondary to blockage of the arachnoid granulations and superior sagittal sinus [1,4,5]. Even though the patients were diagnosed with VEH, it is hard to decide the operation because of its difficulty of adjacent dangerous structures. Literature regarding surgical management, particularly surgical technique, is lacking and due to the infrequent incidence of this extra-axial hematomas, neurosurgeons might hesitate to evacuate the hematomas. Importantly, the displacement and potential disruption of the superior sagittal sinus (SSS) increases surgical morbidity and mortality, which mandates appropriate surgical planning and strategy. In this ar-

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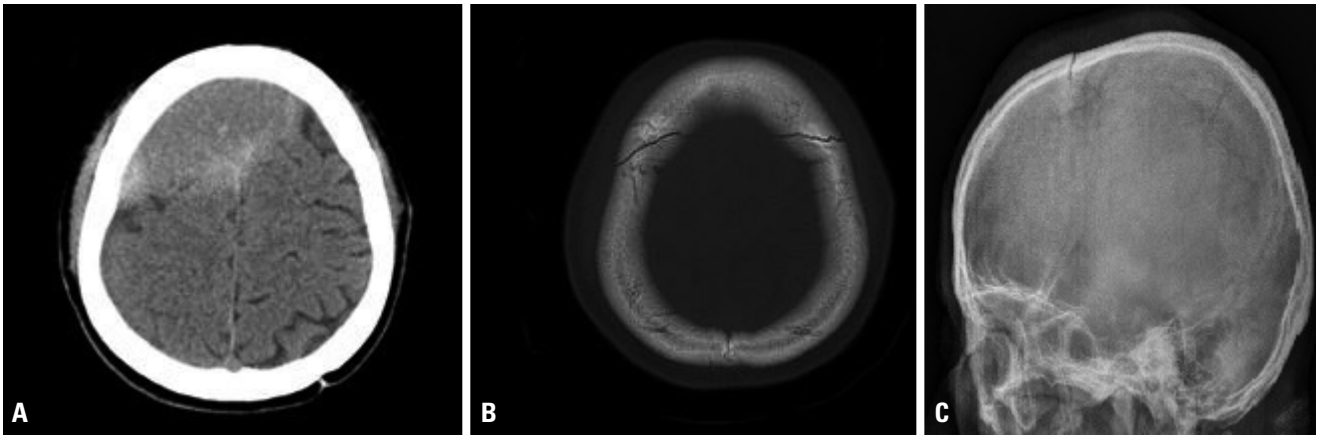

Fig. 1. (A) Initial brain CT with brain setting shows VEH. (B) Right parietal bone fracture with diastatic fracture of coronal suture was seen. (C) Diastatic fracture of coronal suture was seen in Skull X-ray image. CT: computed tomography, VEH: vertex epidural hematoma.

ticle, we'll introduce our experience of successful evacuation of VEH with adequate surgical techniques.

CASE REPORT

A 43-year-old male visited our emergency center after falling down the stairs from the 2nd floor which he sustained a head trauma. Initially, he was drowsy with scalp laceration and seemed little drunken. Initial Glasgow Coma Scale score was 14 (E3V5M6). Neurologic examination showed equal and reactive pupils, eyes opening to voice, ability to obey the commands and no motor weakness. A non-contrast brain computed tomography (CT) was performed within 2 hours of trauma and demonstrated a VEH overlying the SSS with a diastatic fracture of the coronal suture and linear skull fracture of right parietal bone (Fig. 1).

CT angiogram and venogram was directly performed to better characterize the lesion and revealed that the SSS was detached from the vertex bone and compressed with hematomas. Its patency was conserved fortunately, however, there seemed extravasation of contrast (Fig. 2). While performing the CT venogram, the patient was deteriorated rapidly and the right pupil was dilated and fixed with 5-mm size. Decorticated posture was seen and following CT scan was performed immediately 1-hour after the initial CT scan. Following images showed the progression of the hematoma with downward herniation

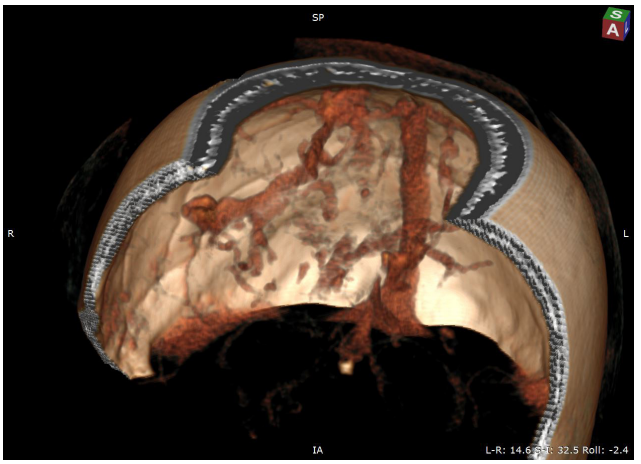

Fig. 2. Detached SSS with extravasation of contrast was observed in 3D reconstruction of CT venogram. SSS: superior sagittal sinus, CT: computed tomography.

(Fig. 3). The decision was made to urgently evacuate the hematoma.

Surgical procedure

The patient was placed supine with mild flexion of the head. A bi-coronal incision was made with a posterior releasing incision form the coronal suture towards the occipital area, in order to exposure the bilateral broad fronto-parietal area. Subperiosteal dissection was performed, reflecting the scalp flap forward and laterally on each side. After the reflection of the scalp, diastatic fracture of coronal suture was identified, and a linear fracture of right parietal lesion running anteriorly to the diastatic fracture.

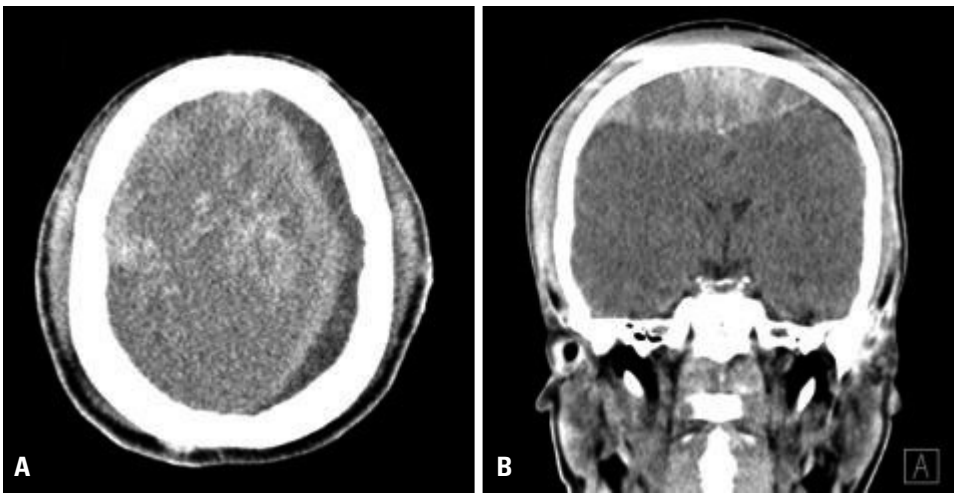

Fig. 3. (A) Axial cut of 2-hours follow-up brain CT shows expension of VEH. (B) Coronal cut of follow-up brain CT reveals downward herniation of brain which lead the patient deteriorated. CT: computed tomography, VEH: vertex epidural hematoma.

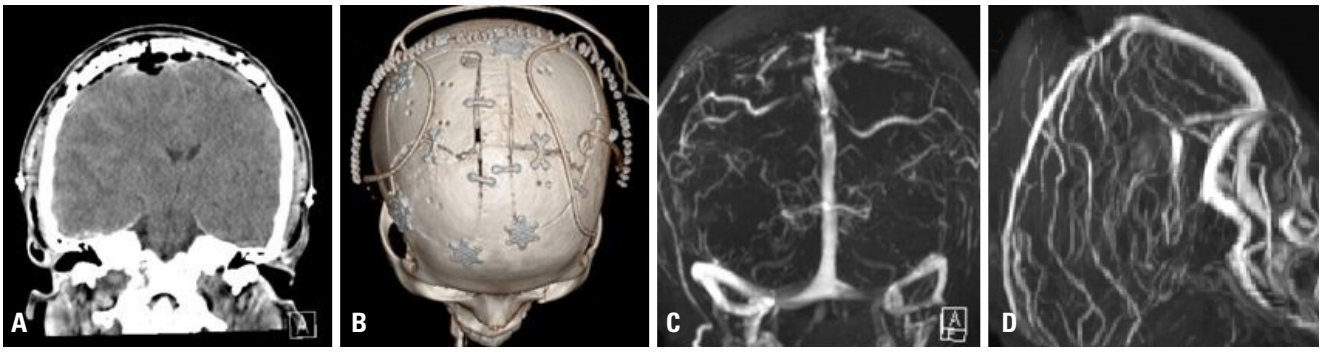

Fig. 4. (A) Coronal cut of postoperative brain CT shows successful evacuation of VEH. (B) 3D reconsctruction image of skull. (C) MR venogram, AP. (D) MR venogram, Lat. CT: computed tomography, MR: magnetic resonance, VEH: vertex epidural hematoma. AP: anterior-posterior, Lat.: lateral.

Copious venous bleeding from the diastatic fracture was controlled with hemostatic agents. Then, parasagittal craniotomy on both side, leaving a central island of bone about 2 cm-width to avoid elevating the bone flap in the midline in the setting of potential sinus injury and at the same time providing an anchor for dural tack-ups on each side of the sagittal sinus in the event of sinus laceration, was planned. The craniotomies were tailored to the size of the epidural hematomas, with 3 burr holes on either side with the length of 12 cm and width of 6 cm. The bone flaps were elevated and a huge epidural hematoma was identified under significant pressure. The hematoma was gently evacuated and coagulation of the bleeding focus was done. The SSS was subsequently identified and exposed. It was displaced inferiorly, with compression. Bleeding from the SSS and parasagittal arachnoid granulations was controlled with gentle packing with hemostatic agent (SPONGOSTAN Standard [Ethicon Inc., Somerville, NJ, USA], FLOSEAL [Baxter, Deerfield, IL, USA], and Tachosil [Takeda Pharm., Tokyo, Japan]). Using a high-speed drill, multiple holes were made in the edges of the central island of bone to be used for dural tack-ups in order to obliterate the epidural space on either side of the sagittal sinus. This step required care in order to avoid injury to the bridging veins and lacunae. Before securing the bone flap, multiple holes were made in the bone flaps for performing the epidural tenting in order to prevent postoperative hematomas. The scalp was reapproximated in the usual fashion and epidural and subgaleal drains were placed on each side.

Postoperative course

Following operation, the patient underwent neuro-critical care in intensive care unit for six days. A post-operative

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CT scan showed no evidence of residual hematoma or newly developed lesions. The surgical reconstruction was also appreciated in 3D reconstruction images and the patency of SSS was also preserved in the magnetic resonance venography (Fig. 4). The patient got improved without complications and neurologic deficits. He discharged 2 weeks later.

DISCUSSION

Differing from the common epidural hematomas which were usually located under the squamous portion of temporal bone, VEH are commonly overlooked when evaluating plain brain CT. Clinical diligence must be exercised by taking into consideration patient's symptoms and mechanism of injury when evaluating a patient with traumatic brain injury. When vertex EDH is suspected, coronal reconstruction of brain CT should be utilized in order to visualize the suspected lesion and confirm diagnosis [6-9]. Magnetic resonance imaging might be helpful, however, it may delay treatment and increase the cost of care. Additionally, CT-venogram should be performed to visualize the SSS for patency and integrity. Thrombosis or active bleeding from a sagittal sinus injury requires urgent management to prevent secondary brain injury due to venous hypertension, edema and infarction, and a rapidly expanding hematoma, respectively [10].

Because of its interhemispheric location, VEH usually causes lower extremities weakness when the hematoma compress the medial portion of precentral gyrus [1,4,5]. Moreover, VEH may present with a wide range of symptoms, which are caused by either complete obstruction of the SSS by an intraluminal traumatic thrombus, secondary to obstructed cerebrospinal fluid reabsorption, or by external compression by blood clots within the epidural space above the SSS [10-12]. The most important step when evaluating VEH is the source of bleeding: the diastatic fracture, a traumatic tear in SSS, a combination of both, or the others. The periosteal layer of the SSS dura is not tightly attached to the sagittal suture, which represents an important anatomical feature allowing blood originating from the diastatic fracture and diploic channels to cross the midline and compress the SSS [10]. The potential presence of a sinus injury makes advisable to plan a surgical approaches that allows both easy access and effective repair of the SSS without increasing further venous injury during the operation. Therefore, a key point to consider performing surgical evacuation of VEH is to spare the midline anatomy from the craniotomies to ensure a stable anchor point for tacking-up the underlying displacement dura and SSS preventing further re-accumulation, extensive bleeding from the diastatic fracture and eliminating the risk of further tearing in an injured sinus during bone flap elevation [13]. If the injured SSS is needed for direct repair, the sagittal island of bone can be subsequently removed, and dural or fascial flaps then used to repair the sinus when indicated.

The existing medical literature regarding surgical management of VEH is scant, lack of details, and outdated. Although previous reports have addressed VEH, none of them have provided a detailed step-wise and illustrated approach that could serve as an aid for neurosurgeons facing this otherwise uncommon presentation of traumatic extra-axial bleeding [13]. The use of bilateral craniotomies with preservation of the middle island of bone allows for dural tack-ups and prevention of further bleeding. In case of a diastatic fracture which might include sinus injury, preservation of the middle bone strip is a critical decision that must be emphasized by the surgeons in order to prevent further hemorrhage form the SSS, and for a better and more stable bone reconstruction.

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