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Non-arterial epidural hematoma vertex – case report, diagnostic problems and treatment strategy

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Abstract: Vertex epidural hematoma is a rare type of intracranial hematoma. Its source of bleeding is usually the superior sagittal sinus, not the meningeal artery, as with most epidural hematomas. It is often poorly visualized by axial computed tomography and is a diagnostic challenge. We present a case of a 49-year-old patient treated surgically for hematoma vertex. We reviewed the literature on this topic from 1971 to 2019, summarizing the treatment strategy, surgical techniques and prognosis.

Keywords: VEDH, vertex, hematoma, non-arterial, epidural

Introduction

Traumatic epidural hematoma is diagnosed in 1-2 % of patients with head trauma admitted to hospital. Vertex epidural hematoma (VEDH) is unusual consequence of head injury. The percentage of VEDH reported ranges from 1.2-8.2 % of all intracranial epidural hematomas [1,2]. Mortality rate of this kind of hematoma reported in the literature is high: 18% - 50% and depend on associated cerebral lesions. In most cases, the superior sagittal sinus (SSS) is the main structure involved in the origin of the bleeding [1]. Skull fractures crossing SSS or sagittal suture diastasis are associated in large number of cases (92%) [1-3].

According to references, there are specific pathophysiological disturbances and clinical findings following VEDH. Because of the hematoma overlies and compresses the SSS and venous lacune, it compromises the venous drainage of the cerebral hemispheries and impairs the absorption of cerebro-spinal fluid (CSF) [1,2]. Hence such cases present mainly with features of intracranial hypertension [1,2]. Authors emphasized that before computed tomography (CT) era localization of the hematoma was diagnostic problem [2,4]. Venous phase of the carotid angiogram demonstrated inferior displacement of the superior sagittal sinus from the inner table of the skull [2,3]. Nowadays in CT scans misinterpretation of the VEDH as an artifact isn't rare. CT scans can easily miss an VEDH unless high axial cuts have been taken and if the volume of clot is less than 50 cm3 [2]. The partial volume effect makes differentiating vertex blood difficult from bone [3]. Coronal CT scan reconstruction is highly recommended and much better in imaging of VEDH and should be performed if there are any doubts on axial scans, especially if skull fracture crossing sagittal suture or its diastasis has shown [1-4].

We describe a rare and extremely large VEDH in patient with rapid neurological deterioration and present the pathophysiological disturbances and technical comments on the planning and surgical treatment.

Case report

A 49-years-old man found lying on the street, probably fell from standing height. Initially, at the place of the incident, he was drowsy, confused and seemed drunken, Glasgow Come Scale (GCS) score was 13 (E3V4M6). After 40 minutes, upon admission at the emergency room, we observed rapid deterioration - he was unconsciousness, GCS was 7 (E2V2,M3), with bilateral myosis and left divergent squint, intoxicated of alcohol, and had a subcutaneous hematoma on the vertex scalp. Patient was intubated and transported to CT scan. A non- contrast brain CT scan showed a large epidural hematoma on the vertex region, fracture of frontal and parietal bone extending along sagittal suture, brain contusions and traumatic intracerebral hematoma in right frontal lobe (about 30 mL). Coronal (Figure 1) and sagittal (Figure 2) reconstruction revealed huge hematoma situated medially and spreading from fontal to parietal region, separation and displacement superior sagittal sinus for about 4 cm from the skull.

Figure 1. coronal CT with VEDH

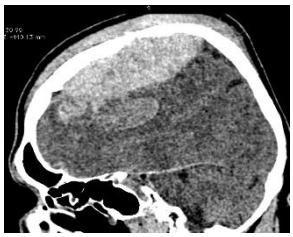

Figure 2. Sagittal CT with VEDH

The volume of the hematoma was of approximately 150 mL. Due to rapid deterioration caused by elevated intracranial pressure, the evident features of brain herniation, the patient was transferred immediately to the operating room. Total period from onset to admission and surgery was about 90 minutes.

The patient was positioned in supine position with about 20 degree flexion of the head. A bicoronal (Sutar) skin incision was made. After retraction of the scalp we identified linear skull fracture along sagittal suture (Figure 3), extending laterally to frontal bone. Two burr holes were done about 3 cm off the midline over the clot.

Figure 3. 3D CT with skull fracture

Now we performed vertex craniotomy, crossing the midline over superior downward shifted sagittal sinus with the length of 11 cm and width of 6 cm. We believe that performed craniotomy over the midline was safe because of SSS was displaced from inner table of the skull by the clot. The bone flap was elevated and about 200 cm^3 epidural clot was evacuated. The dura was separated from bone for about 4cm. Several area of bleeding was revealed. Bleeding from parasagittal venous lakes of dura and arachnoid granulations was controlled with gentle packing with hemostatic agent (spongostan and Tachsil). The exterior surface of SSS was inspected and, to our surprise, found to be intact. After incision of dura over right frontal lobe small cortioctomy was performed and using gentle suction with irrigation intrcerebral clot was removed. We placed strips of spongostan laterally to the epidural space and dural hitch stitches to the medial edge of parietal and frontal bone in order to prevent post-operative hematomas. The subdural spaces weren't inspected. Flap bone was restored with craniofix, extradural and subgaleal drains were placed.

A post-operative CT scan showed a good result, no evidence of mass effect, with minimal, insignificant residual hematoma at vertex region without clinical impact. There was also no intracerebral hematoma.

Discussion

We found twelve references from 1971-2019 describing the clinical nuances of VEDH comparable to our case. The reports of individual authors are presented below, together with conclusions and clinical comments in chronological order.

Bonner et al. (1971) described a case of vertex epidural hematoma was satisfactorily diagnosed and treated by twist drill aspiration. It is suggested that this method may occasionally be preferable to craniotomy for this lesion [4].

Borzone et al. (1979) in turn described fourteen cases of vertex epidural hematomas encountered in patients admitted over a 12-year period (1964-1976) at the University of Genoa Neurosurgical Clinic [5]. Borzone put emphasis on the large number of cases without a free interval. Clinical and neuroradiological findings, treatment and results are reported. A clinical classification of this traumatic pathology according to the epidural hematoma classification of Pecker et al is proposed [5].

Zuccarello et al. (1982) reported 14 cases of vertex epidural hematomas among 478 cases of epidural hematomas that were hospitalized in the Neurosurgical Department of the University Hospital of Padova during the period 1953–1980 [6].

Guha et al. (1989) described four cases of vertex epidural hematomas and emphasized the unique diagnostic and management problems distinguish them from their more common counterparts lower in the temporo-frontal region. Guha noted that vertex epidural hematomas are often missed by most common axial CT images [7]. Coronal CT scanning should be undertaken in all suspected cases. According to Guha, clinical symptoms exceeding the small volume of clot may be present due to venous obstruction and disruption of cerebrospinal fluid absorption [7]. Guha concluded that surgical evacuation of the clot usually lead to clinical improvement [7].

Plotkin et al. (1994) presented the case of a 27-year-old man who sustained a minor head injury and presented with complaints of headache and vomiting. The diagnosis of vertex epidural hematoma is discussed [8].

Miller et al. (1999) described two cases of successfully treated vertex epidural hematomas, in 33-year-old man with seizures and 11-year-old girl with headache and vomiting. Both hematomas were traumatic in origin and were associated with cranial fractures [9]. He emphasized that CT coronal scans are the optimal to visualize this type of hematomas and coronal images showed the extent of the hematoma much more clearly than did axial images [9]. In cases described by Miller, one case was treated surgically and the other conservatively. Miller et al. (1999) revealed that vertex epidural hematomas were thought to be underestimated or overlooked altogether when CT alone was used for diagnosis [9]. He emphasized that such hematomas were treated both by surgery and sometimes with conservative treatment [9].

Harbury et al. (2000) described neuroradiologic studies of four patients (CT in four, MR imaging and MR venography in one) were evaluated for EDH shape, size and appearance. He concluded that small vertex EDHs could be difficult to diagnose on routine CT [10]. MR imaging or thin section CT should be performed to exclude the diagnosis in patients with trauma to the skull vertex [10].

Server et al. (2002) in turn revealed in his study that vertex epidural hematomas were uncommon, and difficult to diagnose by axial CT direct coronal CT was useful in the proper diagnosis [11].

Yilmazlar et al. (2005) reported clinical and radiological findings, and management approaches used in 30 consecutive cases of traumatic epidural haematoma of nonarterial origin treated at one Centre [12]. He concluded that epidural haematoma of nonarterial origin should be suspected if preoperative CT shows a haematoma overlying a dural venous sinus or in the posterior fossa and convexity [12].

The sinus-origin group had a high frequency of fractures which crossed the sinuses, and this might be diagnostically and surgically useful in such cases [12].

Ramesh et al. (2017) analyzed 29 cases of VEDH encountered over a period of 17 years, including 26 males and 3 females [13]. Majority were due to car accidents. Headache, papilledema and lower limb weakness have been the major presenting features in cases described by Server. In his study, majority VEDH were managed conservatively with observation and serial CT imaging [13]. Four patients who had large VEDH with altered conscious were treated surgically. Ramesh noted that the source of bleeding was mainly from superior sagittal sinus [13]. He concluded that VEDH should be considered in patients with impact over the vertex and signs of high intracranial pressure. According to Ramesh, surgery was required in patient with progressive neurological deterioration and / or with hematoma volume more than 30 ml [13].

Fernandes-Cabral et al. (2017) described a case of 60-year-old man sustained a ground-level fall resulting in complete diastasis of the sagittal suture with underlying large VEH causing significant mass effect on the SSS and bi-hemispheric convexities [14]. Twenty-four hours later, the patient deteriorated, with decreased level of alertness and worsening asymmetric paresis on his lower extremities [14]. He subsequently underwent surgical evacuation of the hematoma, decompression of the SSS, and fracture repair. A modified bicoronal approach, with bilateral parasagittal craniotomies, was performed. A central island of bone was left intact to spare the diastatic fracture from the craniotomies [14]. This was done to ensure a stable anchor point for tacking-up the underlying displaced dura and SSS. The central bone prevents extensive bleeding from the diastatic fracture and eliminates the risk of further blood re-accumulation and tearing of a possible injured sinus during bone flap elevation. Fernandes-Cabral noted that vertex epidural hematoma (VEH) was uncommon presentation [14].

Kumar et al. (2017) described 35-year-old male patient was admitted to our department, with history of fall and lucid interval. Imaging studies showed contusion in the right frontal region with midline shift and bilateral EDH located at vertex which was misinterpreted as artifact or subdural hematoma [15]. We present this rare case and briefly review the literature regarding its etiopathology and associated clinico-radiological findings. The principles of management of this rare entity are also discussed [15]. Extradural hematomas (EDHs) of vertex are rarely seen and form a small percentage of all EDH. Usual cause of an EDH located at the vertex is tearing of the superior sagittal sinus [15].

Neto et al. (2019) described in turn 34-year-old male patient admitted to hospital after an injury on the left superior parietal region. The GCS was 6, and the left pupil of the patient was dilated [16]. The CT scan showed a large epidural hematoma on the vertex between the coronal e lambdoid sutures, and a fracture over the sagittal suture [16]. During the surgery, multiple burr holes were made laterally to the sagittal suture, and after inspection and no visualization of bleeding in SSS, Neto performed a standard biparietal craniotomy [16]. Neto noted that the patient was discharged three days after the surgery without any deficits. Currently, with the improvement in imaging modalities, more cases of VEH are being identified [16]. Identifying the etiology priorto the craniotomy is challenging in severe cases. Tears in the SSS can bleed profusely, and they demand strategies during the craniotomy [16]. With multiple burr holes parallel to the sagittal suture, we can visualize whether there is bleeding in the SSS and design a craniotomy with or without a central osseous bridge to anchor the dura. Neto emphasized that neurosurgeons must be prepared to plan a surgical strategy in cases of large VEHs. Due to its rare frequency and bleeding risks, VEHs have been considered challenging [16].

Conclusion

VEDH is a rare hematoma and can be often diagnostic challenge. It is most often non-arterial. Its treatment can be surgical or conservative. At the turn of the years, there are references describing VEDH cases along with the treatment strategy and clinical course.

Abbreviations

- CSF - cerebrospinal fluid
- CT - computed tomography

- GCS - Glasgow Come Scale
- SSS - superior sagittal sinus
- VEDH - vertex epidural hematoma

Declaration

• Competing Interests: The authors declare that they have no conflict of interest.

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