Case Report

A Rare Case of Rapidly Progressing Vertex Epidural Hematoma in A Child: Diagnostic Pitfalls and Management Considerations

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Abstract

Vertex Epidural Hematoma (EDH) is a rare condition, often caused by injury to the superior sagittal sinus or parietal bone fractures, typically involving diploic veins. It can be associated with sudden death. This case highlights a rapidly progressing vertex EDH in a child within 12 hours, despite initial mild symptoms. A 10-year-old boy sustained a head injury and experienced a 10-minute loss of consciousness. Upon arrival at Ngoerah General Hospital, his Glasgow Coma Scale (GCS) score was E4V5M6, and a head CT showed a small vertex EDH. Conservative management was started. Twelve hours later, the child reported worsening headaches and drowsiness, and his GCS decreased to E3V5M6. A repeat CT scan revealed significant hematoma expansion, prompting emergency surgery. During surgery, a linear fracture of the parietal bone was found, with approximately 60cc of hematoma due to diploic vein rupture. Post-surgery, the patient's GCS improved without neurological deficits. As conclusion the Vertex EDH in children, though rare, demands careful monitoring. This case underscores the importance of early reevaluation, prompt imaging, and timely surgical intervention to avoid irreversible neurological damage

Keywords: Epidural hematoma, head injury, vertex

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Introduction

Vertex Epidural Hematoma (VEDH) is a rare and challenging type of epidural hematoma (EDH) that typically occurs in the vertex region of the skull. This condition is often complicated by its tendency to extend beyond the anatomical limits of the vertex, potentially involving the parietal and occipital regions of the cranium. The majority of VEDH cases result from traumatic impact to the vertex area, where skull fractures often disrupt key vascular structures, including the sagittal sinus and meningeal arteries. Trauma that causes a fracture crossing these structures leads to the rupture of underlying vessels, resulting in the accumulation of blood in the epidural space. The anatomical complexity of this region, combined with the potential for rapid bleeding, presents a significant challenge both in terms of diagnosis and clinical management.[1,2] The etiology of VEDH primarily involves high-energy trauma that leads to skull fractures capable of damaging the meningeal arteries or venous sinuses. Such fractures frequently cause a diastasis fracture of the sagittal suture, disrupting the vascular structures and initiating hemorrhage into the epidural space. Approximately 60% of VEDH cases are attributed to significant skull fractures, underscoring the direct correlation between trauma severity and the likelihood of hematoma development. Additionally, certain underlying medical conditions, including Paget's disease, which leads to abnormal bone remodeling and vascularization, can predispose individuals to fractures that are more prone to causing vascular injuries. Vascular anomalies such as arteriovenous fistulas can further complicate the condition, contributing to the formation of hematomas even

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in cases of relatively mild trauma.[4-6] Diagnosing VEDH is particularly difficult due to its location and the nature of its radiological presentation. The vertex area is challenging to visualize on standard axial CT scans, making it difficult to detect hematomas in the initial imaging studies. In many cases, the hematoma may be subtle and localized in such a way that it is not easily identifiable on conventional cuts. As a result, clinicians are often required to use advanced imaging techniques, such as coronal or sagittal CT scans, to improve the sensitivity and specificity of detection. Studies have shown that multi-planar reconstructions significantly enhance the ability to identify VEDH, improving detection rates from approximately 65% to 85%. This increased accuracy in imaging allows for earlier diagnosis, which is critical for initiating timely intervention. Moreover, the presence of subtle or non-specific symptoms at presentation further complicates the diagnostic process, making it essential to maintain a high index of suspicion for VEDH in appropriate clinical scenarios.[5-6]

In addition to diagnostic challenges, VEDH can mimic other intracranial pathologies, such as subdural hematomas or traumatic subarachnoid hemorrhage, particularly when the clinical presentation is ambiguous. Therefore, differentiating VEDH from other similar conditions requires careful consideration of the patient's clinical history, physical examination findings, and radiological features. The pattern and extent of skull fractures are crucial in determining the type and severity of the hematoma. The involvement of the sagittal sinus or the meningeal arteries directly influences whether the hematoma is venous or arterial in origin, and this, in turn, affects the clinical management strategy. Additionally, pediatric patients pose a unique challenge, as their anatomical and physiological differences make them more susceptible to subtle presentations, which may not immediately raise suspicion for a significant head injury. In pediatric cases, early diagnosis is crucial to prevent neurological deterioration and optimize outcomes.[4-6] This case report aims to increase awareness of the diagnostic difficulty of vertex EDH in pediatric patients, particularly in those with subtle initial symptoms. Due to the rarity of VEDH and the difficulty in diagnosing it, particularly in children, there is a necessity for heightened vigilance in recognizing this condition. By presenting a rare case of pediatric vertex EDH, this report seeks to emphasize the importance of advanced imaging techniques and a multidisciplinary approach to diagnosis and management. It is hoped that this case will highlight the significance of timely intervention, which can greatly influence the clinical outcome in patients with VEDH.

Case

History

A 10-year-old male patient was referred to RSU Prof IGNG Ngoerah Hospital following a motorcycle accident 16 hours prior to admission. According to witnesses, the patient briefly lost consciousness for approximately 10 minutes immediately after the accident. Upon regaining consciousness, he complained of a severe headache, which was followed by forceful vomiting. There was also noticeable swelling on the scalp over the parietal region. On presentation to the hospital, the patient was conscious and alert, with no evident neurological deficits.

Physical Examination

On initial physical examination, the patient was fully conscious and oriented, with a Glasgow Coma Scale (GCS) score of E4V5M6. There were no signs of neurological deficits, and cranial nerve examination was unremarkable. The scalp showed swelling over the parietal region, likely secondary to trauma. No signs of focal neurological deficits, such as weakness or sensory loss, were observed. Pupillary reactions were normal, and there was no evidence of neck rigidity or other signs of meningitis. Vital signs were stable, and no signs of systemic complications were present.

Supporting Exams

A head CT scan was performed upon admission, which revealed a small hyperdense lesion located in the vertex region, consistent with an epidural hematoma. Additionally, there was a diastasis fracture of the sagittal suture. Given the small

Table 1. Supporting Exams

Examination	Findings	Comments
Initial CT Scan	Vertex EDH ±2cc	Diastasis fracture of the sagittal suture
Repeat CT Scan	Vertex EDH ±51cc	Indication for surgery due to significant hematoma enlargement

volume of the hematoma (approximately 2cc), conservative management was initially chosen. Over the following 24 hours, the patient's headache worsened, though no vomiting was noted. A repeat head CT scan was conducted, which revealed a significant increase in the size of the hematoma (51cc). Based on these findings, urgent surgical intervention was deemed necessary.

Anesthesia Management

General anesthesia was induced for the surgical procedure, using standard protocol. Preoperative assessment confirmed no contraindications to anesthesia. The patient was premedicated with intravenous sedatives and pain management, and an appropriate-sized endotracheal tube was placed for controlled ventilation. Anesthesia was maintained with isoflurane and intravenous propofol, with appropriate monitoring of vital signs, including heart rate, blood pressure, oxygen saturation, and end-tidal CO_2. The patient was positioned supine on the operating table with the head fixed using a Mayfield skull clamp, ensuring proper access to the vertex region for the craniotomy.

Post-Surgical Management

Post-operatively, the patient was extubated successfully and regained full consciousness immediately upon emergence from anesthesia. Neurological examination revealed no new deficits, and the patient maintained stable vital signs. The scalp incision was well-approximated, and there were no signs of infection or other complications. A postoperative head CT was performed to confirm complete evacuation of the hematoma, and no residual bleeding or

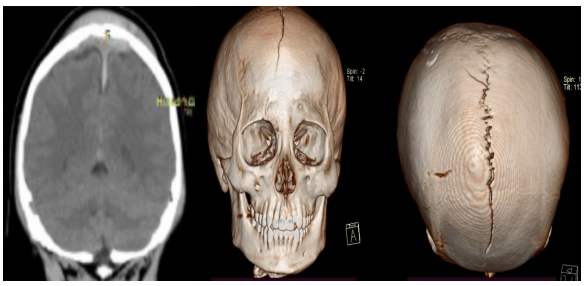

Figure 1. 1st head CT-Scan that was taken before admittance to the hospital

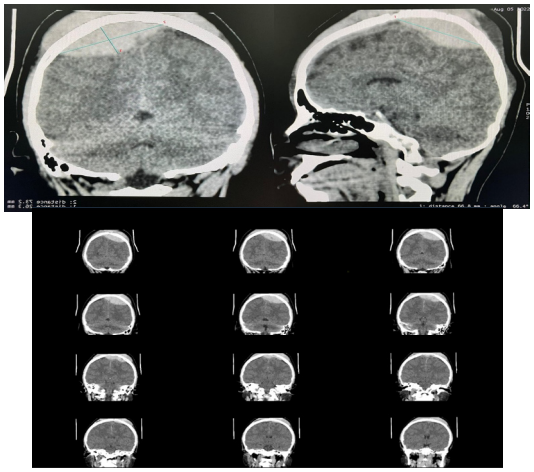

Figure 2. 2nd CT-Scan that was taken 1 day after admittanc

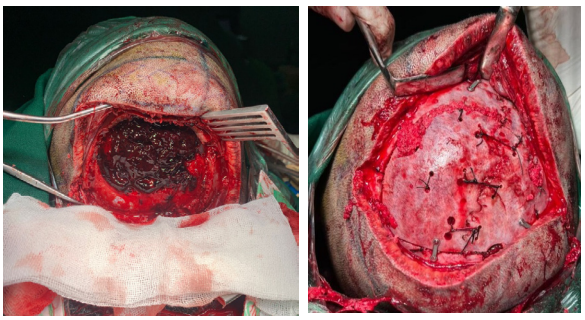

Figure 3. Epidural Hematoma on the vertex and Region Dural Tact Up done to the bone flap

complications were identified. The patient was monitored in the intensive care unit for the first 24 hours post-surgery for close neurological observation.

Postoperative analgesia was provided, and intravenous antibiotics were administered as a prophylactic measure against infection. After 3 days of uneventful recovery, with stable neurological function and no postoperative

complications, the patient was discharged home. Follow-up appointments were scheduled to monitor for any potential sequelae, but the patient was discharged with no neurological deficits and a full recovery.

Discussion

VEDH is an uncommon yet significant consequence of closed head injury, with an incidence ranging from 2% to 25% of all epidural hematomas. This condition is particularly challenging in both diagnostic and surgical management due to the location of the hematoma in the vertex, which often makes it difficult to detect on standard axial CT scans. The vertex region is anatomically complex, and VEDH may be obscured by surrounding bone structures, leading to missed diagnosis in initial imaging studies. In this case, a repeat head CT scan with coronal and sagittal views was crucial for detecting the significant enlargement of the hematoma, highlighting the importance of using multi-planar imaging techniques in diagnosing VEDH. Given the rarity and diagnostic difficulties associated with this condition, particularly in pediatric patients, it is essential to maintain a high index of suspicion when assessing head trauma, even when symptoms initially appear mild.[6-8]

The progression of VEDH can be rapid and may resulted in significant neurological deterioration if not managed promptly. In the case presented, the hematoma initially appeared small on the first CT scan but showed rapid enlargement within 24 hours, emphasizing the importance of close monitoring in cases involving vertex trauma. The patient's headache, which worsened despite initial conservative management, served as a warning sign of increased intracranial pressure. This highlights the necessity for frequent re-evaluation of the clinical status and imaging follow-up in pediatric patients with vertex head trauma, particularly when there is a suspicion of epidural bleeding. The decision to proceed with surgical intervention was made based on the increasing size of the hematoma and the potential risk of herniation, which is known to occur when pressure exceeds the brain’s compensatory mechanisms.[6-8] Surgical management of VEDH requires careful consideration due to the location of the hematoma, especially near critical structures such as the superior sagittal sinus. In the current case, the bleeding source was identified as originating from the parietal bone, with involvement of the venous diploic veins and diffuse dural stripping. This underscores the importance of understanding the vascular anatomy in this region and the potential sources of bleeding, including fractures that involve the venous sinuses and dural attachments.[7,8] The surgical approach in such cases involves controlling the bleeding thoroughly, evacuating the hematoma completely, and ensuring proper dural closure.[7-9] In this case, a dural tack-up technique was employed to securely attach the dura to the inner surface of the skull, preventing postoperative bleeding and minimizing the risk of recurrence.

The management of pediatric patients undergoing neurosurgical procedures presents unique challenges, particularly regarding anesthesia. The pediatric patient in this case required careful anesthetic management, which included precise monitoring of intracranial pressure and maintaining adequate ventilation throughout the surgery.[10,11] Pediatric patients have distinct physiological responses to trauma and anesthesia, making the perioperative period particularly delicate. A comprehensive anesthesia protocol, including the management of fluid balance, blood pressure, and temperature, is essential to minimize complications and ensure optimal surgical outcomes. Additionally, the role of intraoperative monitoring, such as the use of brain oxygenation and ICP monitoring, is crucial in these high-risk procedures to prevent further neurological compromise.[10-12] Comparing the outcomes of this case to similar reports in the literature reveals that early surgical intervention in pediatric VEDH cases significantly improves prognosis. Several case reports and studies have documented the successful management of rapidly progressing VEDH in children, emphasizing the need for prompt identification and surgical intervention before irreversible brain injury occurs.[10-12] The use of advanced imaging

techniques and meticulous surgical techniques is consistently associated with better outcomes in such cases. Furthermore, research suggests that routine 24-hour monitoring protocols for minor head trauma with vertex fractures may help identify patients at risk for developing VEDH, allowing for timely interventions.[10-13] This case highlights the importance of implementing such monitoring protocols to detect complications early, especially in pediatric patients who may not present with overt neurological symptoms initially.

Conclusion

Early identification and prompt intervention in VEDH are critical to prevent neurological deterioration, particularly in pediatric patients. Multiplanar imaging and close monitoring are essential for accurate diagnosis and timely management of this rare condition.

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