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Case Report

Mini-Craniectomy for Traumatic for Posterior Fossa Acute Liquid Epidural Hematomas in Paediatric Patient: A Case Report

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Abstract

Posterior fossa epidural hematoma (PFEDH) is a rare condition, accounting for only 0.1-0.3% of all traumatic brain injuries. Patients can rapidly deteriorate due to brainstem compression caused by bleeding in the posterior cranial fossa. Timely surgical intervention is critical, but currently, there is no consensus on the surgical indication and technical approach for pediatric PFEDH. Case Presentation: A five-year-old boy presented with occipital trauma, headache, vomiting, and altered consciousness after a fall from a 1-meter height. Primary survey was clear with a Glasgow Coma Scale (GCS) score of E3M6V4 and slow pupillary reflexes while secondary examination revealed a 1x2 cm cephalhematoma over the right posterior fossa region. Head CT scan revealed a posterior fossa liquid epidural hematoma measuring 5.4 x 2.2 x 4cm with cerebellar displacement. The patient underwent a mini-craniectomy and recovered with a relatively short operative duration, minimal blood loss, and a short hospital stay without neurological deficits. Mini-craniectomy emerges as a viable and promising alternative procedure in the management of carefully selected pediatric PFEDH cases, particularly those that are liquid or of moderate volume, allowing for efficient evacuation with minimal surgical morbidity with a good prognostic outcome.

Keywords: Mini-craniectomy, posterior fossa epidural hematomas, paediatric

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Introduction

Traumatic epidural hematomas (EDH) commonly occur in the supratentorial area, making posterior fossa epidural hematoma (PFEDH) a rare case in paediatric traumatic brain injury (TBI) that comprises merely 1.2% to 12.9% of EDHs and 0.1–0.3% of all TBI.[1,2] Patients with PFEDH may rapidly deteriorate due to brainstem compression and cerebellar tonsillar herniation, with a mortality rate of up to 25%.[1,3] Conservative treatment has been reserved only for cases with minimal bleeding and stable neurological status, but surgical intervention is recommended for cases with indications.[4] However, guidelines on the surgical indications and optimal surgical techniques for paediatric PFEDH are still not available until now.[3] This case highlights the successful use of mini-craniectomy, a minimally invasive alternative, for the management of paediatric PFEDH.

Case

Anamnesis

A five-year-old boy presented to the emergency department, appearing sleepy with a chief complaint of a severe headache, sudden-onset vomiting, and a posterior head lump for 15 hours before admission. The symptoms occurred

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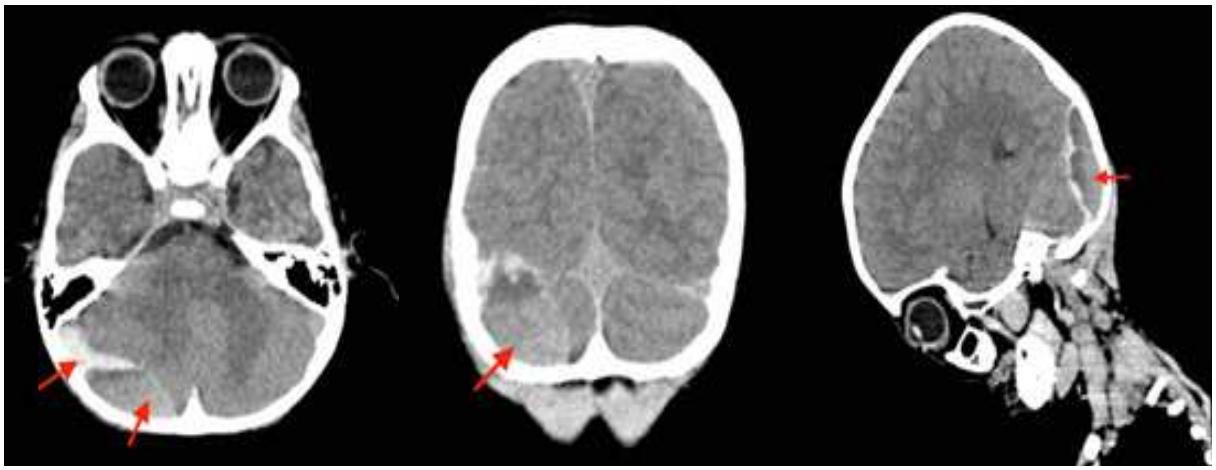

Figure 1. (A) Axial section (B) Coronal section and (C) Sagittal section showing mixed hypodense hyperdense biconvex lesion in the right occipital region without underlying skull fracture.

after falling from a height of approximately one meter at home the previous evening. There was no history of loss of consciousness, seizures, or bleeding from the nose or ear. No medical history, allergies, or significant family history were noted.

Physical Examination

Primary survey findings included a clear airway, normal symmetrical chest movement with a normal respiratory rate, and SpO_2 of 99% on room air. Circulatory assessment revealed a heart rate of 84 bpm, blood pressure of 106/73 mmHg, and warm extremities. The patient had a Glasgow Coma Scale (GCS) score of E3M6V4, symmetrical diameter (3 mm bilaterally), and slow pupillary reflexes, with no signs of lateralization. On secondary examination, the patient had a normocephalic head shape, with a noticeable 1x2cm cephalhematoma over the right posterior fossa region. Thoracic, cardiovascular, and abdomen examinations yielded no abnormal findings.

Laboratory tests

Laboratory tests revealed no anemia (Hemoglobin of 14.1 g/dL) and a platelet level of 392.000. A non-contrast head CT scan was done and showed a mixed hyperdense and hypodense biconvex lesion at the posterior convexity (right occipital region), measuring 5.4x2.2x4cm, indicating an active bleeding EDH with cerebellar displacement to the left by 0.7cm. Grey-white

Figure 2. The patient was positioned in a prone position with preoperative markings (A). The operative site was expanded using a retractor after a successful hematoma evacuation (B).

The patient underwent a mini-craniectomy with burr hole evacuation under general anesthesia. The patient was positioned prone, with all pressure points adequately padded. A 3-5cm incision was made in the occipital region, followed by a single burr hole on the hematoma location based on the CT scan. Upon perforation, liquid hematoma gushed out, confirming the diagnosis of active bleeding EDH. The burr hole was enlarged using a rongeur by approximately 1–2cm to evacuate the remaining hematoma. A silicone drain was then placed in the epidural space, and the opening was closed using bone debris. The surgery lasted for approximately 30–40 minutes with a total blood loss of less than 50cc. On

twelve hours of postoperative follow-up, the patient was conscious, had a GCS of E4M6V5, had no complaints, and could mobilize without neurologic deficits. After two days of observation, the patient was discharged from the hospital.

Discussion

Posterior fossa EDH is a rare and life-threatening condition, with a higher incidence in children due to higher skull plasticity.[2,5] This may explain why, while PFEDH is often associated with occipital fractures,[5] some cases, including this one, occur without an associated fracture, as trauma can still detach the periosteal dura and rupture venous sinuses.[6] Diagnosing PFEDH is challenging, as the classic lucid interval seen in supratentorial EDH is often absent.[1] Instead, patients may present with sudden onset, rapid progression, and high risk due to limited space in the posterior cranial fossa, leading to brainstem compression.[3] Thus, early CT imaging is a critical decision in suspected cases, ensuring timely intervention.[2,6]

Until now, there have been no guidelines regarding the indications for a surgical versus conservative approach in managing PFEDH.[1,7] Conservative management has been increasingly explored in selected cases, but surgical evacuation has been the standard of care.[1,4,5] The distinct anatomical challenge in PFEDH compared to other types of EDH lies in the proximity to critical brainstem structures, which potentially cause rapid brainstem compression. This underscores the importance of early and aggressive intervention to mitigate the risk of life-threatening complications.[3,6] While conservative management has been considered as an option in patients with small hematoma volumes, stable neurological status, and the absence of mass effect on the fourth ventricle or basal cistern;[3,4] its primary limitations include prolonged resorption time (15–45 days) and the potential for complications, warranting a timely surgical intervention, even in the absence of immediate neurological deficits.[2,3]

Previous studies have proposed the defining criteria for surgical interventions such as hematoma volume (>10-15mL), thickness (>10-15mm), midline shift (>5mm), peri-mesencephalic cistern obliteration, displacement of the fourth ventricle, and presence of hydrocephalus.[1,7,8] Others have included a criterion that of GCS under eight should undergo surgical intervention in less than 12 hours.[5] Some authors suggested that hematoma thickness may be a more clinically relevant determinant than total volume. Thin, smeared extra-axial hematoma may have a much greater volume and be thinner in size with no mass effect, while extra-axial hematomas with smaller volumes but significant thickness may cause mass effect or midline shift, particularly hematoma in a narrow space such as the posterior fossa.[9] In this case, the CT scan revealed a posterior fossa hematoma measuring 5.4 x 2.2 x 4cm with an estimated volume of approximately 23.76mL. Imaging also revealed a cerebellar displacement of 0.7cm. The hematoma volume, thickness, and the presence of mass effect on the cerebellum required urgent evacuation. Clinically, the patient presents with a GCS of E3V4M6 with clinical signs suggesting increased intracranial pressure, such as vomiting, severe headache, and slower pupillary reflex, but without anisocoria and lateralization. In addition, the CT scan showed a mix of hyperdense and hypodense areas, indicating active bleeding in the hematoma, potentially leading to hematoma expansion and further neurological deterioration. These further reinforced the need for surgical intervention, which aligns with previous studies.

Various approaches in surgical technique have been proposed. Traditional craniotomy involving a small bone window or bone flap craniotomy remains widely accepted for hematoma evacuation, especially in cases involving solid clots. However, this approach is associated with longer operative duration, greater intraoperative blood loss, and increased surgical trauma. Paediatric patients commonly have low body weight, lower effective blood volume, and low surgical tolerance for prolonged procedures, making this technique less favorable in paediatric patients.[3] Thus, minimally invasive techniques are more viable alternatives. Approximately 85% of PFEDH cases are resulted from venous origin (from the dural sinuses, venous vasculature, or

emissary veins) rather than arterial bleeding, with most studies reported liquid in nature. This makes minimally invasive evacuation an effective option for liquefied hematomas that do not require decompressive craniotomy.[3,10] This case highlights the successful application of mini-craniectomy with burr hole evacuation in the management of traumatic PFEDH in a pediatric patient due to the liquid nature of the hematoma and the goal of minimizing surgical trauma. The procedure was done in a relatively short operative time of 30-40 minutes with minimal intraoperative blood loss (<50cc). Within 12 hours postoperative, the patient demonstrated a rapid neurological recovery without any deficits and had a relatively short hospital stay of two days. These highlight the feasibility and effectiveness of our approach to the case. Previous studies have reported several minimally invasive techniques in managing PFEDH. One study that used burr hole drainage for liquid EDH in pediatric patients reported shorter operative time (33.38 ± 6.99 minutes) and shorter hospital stays (9.85 ± 1.07 days) compared to craniotomy.[11] This technique is more suitable for purely liquid EDH, while our case demonstrated a mix of liquid and clot. Our case uses a modification of burr hole drainage where a small section of bone is removed, and the burr hole is expanded ~1-2cm using a rongeur. This technique allows for better decompression and hematoma evacuation compared to a single burr hole while avoiding the need for a large craniotomy. Comparative studies have demonstrated that minimally invasive techniques accomplished complete or partial hematoma drainage with a comparable treatment outcome to craniotomy but achieved with a simpler procedure and minimal surgical trauma. Furthermore, minimally invasive procedures had significantly shorter surgical times and lower intraoperative blood loss.[3] However, the utility of mini-craniectomy is restricted in cases involving larger, solid hematomas, where a more extensive craniotomy may be required for complete evacuation in such cases.

Conclusion

This case emphasizes the role of mini-craniectomy as a minimally invasive management of PFEDH in paediatric patients with reduced surgical time, minimal blood loss, and good prognostic outcomes in selected cases.

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