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Beyond the 30 mL rule: rapid auto-decompression and conservative management of a massive (100 mL) extradural hematoma in a toddler

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Keywords
Extradural hematoma, Pediatric head injury, Conservative management, Auto-decompression, Sutural diastasis

Abstract

Background: Pediatric extradural hematoma (EDH) management is traditionally dictated by volumetric thresholds, with evacuation recommended for collections >30 mL. However, the unique compliance of the young child's cranium can allow for atypical clinical stability despite massive internal hemorrhage.

Case Description: A 2-year-old boy presented with a 100 mL EDH following a minor fall. Despite the volume, the child remained neurologically intact (GCS 15). Managed conservatively, the hematoma demonstrated a rapid 40% volume reduction within 24 hours.

Conclusion: This case illustrates the "redistribution phenomenon," where extradural blood vents into the subgaleal space via patent sutures. We argue that in neurologically stable children, the mechanism of auto-decompression should weigh more heavily than static volumetric measurements in surgical decision-making.

Introduction

In the realm of pediatric neurotrauma, the extradural hematoma (EDH) remains a "classic" lesion, yet its management in the very young continues to evolve. While accounting for only 1-2% of pediatric head injuries [1,2], EDH in toddlers presents a unique physiological landscape. The firm dural adhesion and calvarial elasticity of the two-year-old child often limit hematoma expansion; conversely, when a large bleed does occur, the presence of patent sutures provides a potential "safety valve" not found in adults [3].

Traditionally, any EDH exceeding 30 mL is branded a surgical emergency. However, strictly adhering to adult-derived volumetric thresholds may lead to unnecessary intervention in children who are clinically stable [2]. We present the remarkable case of a neurologically intact toddler with a 100 mL EDH, highlighting the physiological "grace period" afforded by the pediatric

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skull and the mechanism of rapid spontaneous redistribution [3,5].

Case Presentation

A 2-year-old boy was brought to the emergency department six hours after a three-foot fall from a bed. The clinical history was reassuring: immediate crying, no loss of consciousness, and no vomiting. On arrival, the child maintained a Glasgow Coma Scale (GCS) score of 15/15. Physical examination revealed a prominent, fluctuating cephalohematoma over the right parietal scalp, but no focal neurological deficits.

A non-contrast computed tomography (CT) scan (Figure 1) revealed a massive right frontotemporoparietal biconvex hyperdensity. Utilizing the ABC/2 method, the volume was calculated at approximately 100 mL (11 × 5 × 3 cm). Despite this volume, the midline shift was restricted to a mere 3 mm. High-resolution bone-window imaging was reviewed; no linear or depressed fractures were identified, although the hematoma was noted to be in close proximity to the coronal and lambdoid sutures.

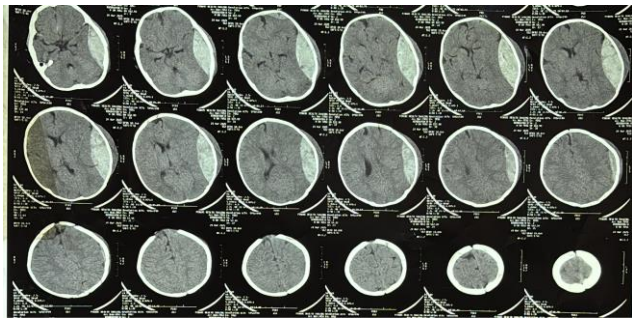

Figure 1. Non-contrast CT head on admission, showing a massive right frontotemporoparietal biconvex extradural hematoma (~100 mL, 11 × 5 × 3 cm) with only 3 mm of midline shift.

The juxtaposition of a "surgical" 100 mL volume with a GCS of 15 prompted intensive multidisciplinary dialogue. Given the child's clinical stability and minimal mass effect, the team opted for aggressive conservative management in the Neurosurgical ICU [1,2]. Due to the significant volume of blood sequestered in the extradural space, the patient's hemoglobin dropped from 11.0 g/dL to 8.2 g/dL, necessitating a packed red blood cell transfusion.

Follow-up imaging at 24 hours revealed a dramatic shift: the EDH volume had decreased to 60 mL. Clinically, the scalp swelling (cephalohematoma) became significantly more tense and expansive. This inverse relationship suggested that the extradural blood was "venting" through the patent sutures into the subgaleal compartment [3,5]. By day 4, the intracranial collection had reduced to 30 mL (Figure 2). The scan after one month showed no residual EDH (Figure 3).

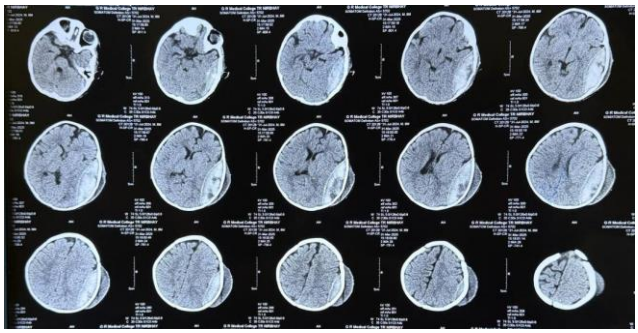

Figure 2. Non-contrast CT head on day 4, showing reduction of the extradural collection to approximately 30 mL.

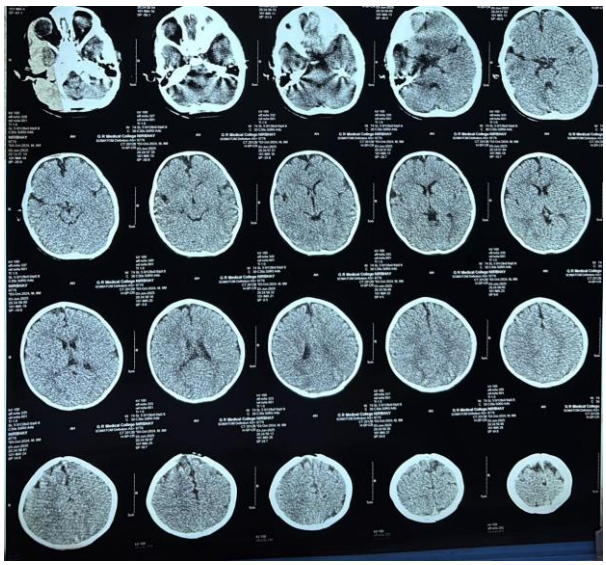

Figure 3. Non-contrast CT head at one-month follow-up, showing complete resolution of the extradural hematoma.

Discussion

This case challenges the "volume-as-destiny" approach. The primary question is how a child tolerates 100 mL of intracranial blood without deterioration.

In adults, the skull is a closed box; in a two-year-old, it is a dynamic system. We propose that the rapid 40% volume reduction within 24 hours represents a redistribution phenomenon [3]. Even without a fracture, high-pressure extradural blood can

decompress through patent or slightly dehisced sutures into the subgaleal space [5]. This "extracranial venting" stabilizes intracranial pressure, explaining the minimal midline shift and preserved consciousness [3].

Recent literature supports GCS-led management over static volumetric rules [1,2,8]. This case positions itself within a mechanistic spectrum where the pediatric skull acts as a pressure-relief valve. If a child is neurologically intact and imaging shows evidence of redistribution, surgery may be safely deferred under strict ICU observation [1,7].

Conclusion

The successful non-operative management of a 100 mL EDH underscores that we treat patients, not scans. The ability to auto-decompress via sutural redistribution provides a unique window for conservative management. Future protocols should prioritize the rate of volume change and clinical GCS over initial static measurements.

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