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## **COMPREHENSIVE MANAGEMENT OF PEDIATRIC EPIDURAL AND SUBDURAL HEMATOMAS FOLLOWING TRAUMATIC BRAIN INJURY: A CASE REPORT**

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### **Abstract**

*This case report details the management of a 13-year-old male with Epidural Hematoma (EDH) and Subdural Hematoma (SDH) following a traumatic brain injury from a fall. Treatment involved decompressive craniotomy to relieve intracranial pressure and cranioplasty to reconstruct the cranial vault. This case highlights the complexities of pediatric neurosurgery, particularly in managing EDH and SDH, which necessitate prompt surgical intervention. The decompressive craniotomy was crucial for alleviating intracranial pressure and minimizing cerebral injury. Potential postoperative complications, such as cerebrospinal fluid leaks, infections, and seizures, required vigilant care and monitoring. The successful management, with immediate surgery and comprehensive postoperative care, illustrates the effectiveness of current treatment protocols. This report underscores the importance of a multidisciplinary approach in the long-term rehabilitation of pediatric patients, ensuring optimal recovery and development. This case contributes to understanding the management of traumatic brain injuries in children, emphasizing the significance of timely surgical intervention, careful monitoring for complications, and a holistic approach to patient care. By highlighting these aspects, the report aims to improve outcomes and provide insights for managing similar cases in the future.*

**Keywords:** Epidural Hematoma, Subdural Hematoma, Traumatic Brain Injury, Craniotomy Decompression, Pediatric

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## INTRODUCTION

Intracranial hemorrhages following head trauma are a significant cause of morbidity and mortality, particularly in young adults and children. Among these, Epidural Hematoma (EDH) and Subdural Hematoma (SDH) are two predominant types that pose unique challenges in diagnosis and management. These conditions not only represent a spectrum of acute neurological emergencies but also provide insight into the intricate dynamics of intracranial pathology. This case report delves into the clinical journey of a 13-year-old male patient who suffered severe head trauma, leading to the development of both EDH and SDH, and underscores the critical aspects of their management. The discussion aims to elucidate the pathophysiology, epidemiology, and treatment modalities of EDH and SDH, while highlighting the complexities and nuances involved in the surgical and medical care of such cases. Through this report, we aim to contribute to the broader understanding of these conditions, emphasizing the importance of timely intervention and comprehensive care in improving patient outcomes in the realm of neurosurgery. (Tenny & Thorell, 2023)

## CASE REPORT

A 13-year-old boy presented to the neurosurgery department on September 23, 2023, primarily complaining of a mild headache that began a month earlier following surgical intervention for a critical head injury. This injury occurred on August 18, 2023, as a result of a fall from the second story of his residence. The initial surgical procedure involved a decompressive craniectomy and cranioplasty, and he was scheduled for a subsequent cranial vault reconstruction on September 23, 2023. Additionally, he reported eyelid swelling but no fever, nausea, or vomiting. His medical history included the aforementioned head trauma and surgeries, a complete immunization record, and normal growth and development for his age.

Physically, the patient appeared moderately unwell but remained conscious and alert. Vital signs were stable with a blood pressure of 111/63 mmHg, heart rate of 60 bpm, respiratory rate of 20 breaths per minute, body temperature at 36.8°C, and an oxygen saturation of 99% on room air. He weighed 55 kg and was 170 cm tall. A sutured wound was noted in the left

temporoparietal area, but other physical and neurological examinations were normal.

Laboratory tests from August 18, 2023, showed normal erythrocyte, hemoglobin, hematocrit, MCV, MCHC, and eosinophil levels, with standard bleeding and clotting times, blood glucose, and creatinine levels. Imaging on the same date revealed a left frontoparietal epidural hematoma with an accompanying subdural hematoma, subfalcine herniation, brain swelling, and a fracture in the left frontoparietal bone. Prior to the surgeries, the patient received a regimen of ceftriaxone, cefixime, omeprazole, paracetamol, phytomenadione, and tranexamic acid. The diagnosis included post-cranioplasty due to bone defect, post-decompressive craniectomy for a severe head injury with left subdural and epidural hematoma, and a fracture in the left temporoparietal area.



Figure 1. Patient's Craniotomy Decompression CT Scan Result

The importance of decompressive craniotomy and cranioplasty in the management of severe head injuries with subdural and epidural hematoma cannot be overstated. Decompressive craniotomy, a critical surgical procedure, is often employed to alleviate intracranial pressure resulting from such injuries. This process involves removing a portion of the skull to provide space for swollen brain tissue and reduce the risk of further brain damage. Cranioplasty, which follows, involves reconstructing the cranial vault to protect the brain and restore the skull's integrity and appearance. These procedures are vital for preventing long-term neurological damage and improving patient outcomes in severe head injury cases.

## RESULT AND DISCUSSION

Epidural Hematoma (EDH) and Subdural Hematoma (SDH) represent two distinct types of intracranial hemorrhages that occur beneath the skull but outside the brain tissue. EDH, commonly resulting from arterial bleeding, develops between the dura mater and the skull, often following trauma to the temporoparietal region, and is particularly prevalent in young adults and children due to their dura's lower adherence to the skull. SDH, typically venous in origin, accumulates between the dura mater and the arachnoid mater and varies from acute to chronic forms, with acute cases usually arising from significant head trauma and chronic forms more frequently seen in the elderly due to cerebral atrophy and increased fragility of the dural border cell layer. (Khairat & Waseem, 2023; Pierre & Kondamudi, 2023; Tenny & Thorell, 2023)

The epidemiology of surgically treated acute subdural and epidural hematomas has been explored in a population-based study. The results revealed that among the patients requiring surgery, 49% presented with Subdural Hematomas (SDHs), 33% with Epidural Hematomas (EDHs), and 19% with both conditions. The median age of the patients was 45 years, with males constituting 80% of the cohort. The predominant causes of injury were falls (51%), motor vehicle collisions (30%), and assaults (11%). Of these patients, 61% were transferred from referring hospitals, while 39% arrived directly without going through an intermediate facility. Postoperatively, there were 18 deaths, accounting for 26% of the cases. However, 63% of the patients (44 out of 70) showed good outcomes at 6 months post-surgery, as assessed by the Glasgow Outcome Scale. (Aromatario et al., 2021; Tallon et al., 2008)

In pediatric cases, the management of Epidural Hematoma (EDH) and Subdural Hematoma (SDH) presents unique challenges and considerations due to the distinct anatomical and physiological characteristics of children. EDH in the pediatric population is often the result of arterial bleeding, occurring between the dura mater and the skull, typically following trauma to the temporoparietal region. It is more prevalent in young adults and children, attributed largely to the dura's reduced adherence to the skull in these age groups. (Cremonini et al., 2020; Zigouris, 2022) SDH in children, while less common than in adults, can be particularly concerning. It typically arises from venous bleeding and accumulates

between the dura mater and the arachnoid mater. Acute SDH in children is usually the result of significant head trauma, whereas chronic SDH, though rarer in this demographic, may occur in certain clinical scenarios, including non-accidental trauma. The treatment approach for both EDH and SDH in children often necessitates decompressive craniotomy, especially in cases with significant mass effect or elevated intracranial pressure. (Derakhshanfar et al., 2020; Haydel et al., 2023; Novania et al., 2023)

This surgical procedure is crucial for removing the hematoma and alleviating brain swelling. The subsequent step of cranioplasty, aimed at reconstructing the cranial vault, is particularly important in the pediatric population to ensure the protection and structural integrity of the developing brain. (Bandyopadhyay et al., 2022; Iaccarino et al., 2020; Klieverik et al., 2019) Medical management is an integral component of treating pediatric EDH and SDH. This includes meticulous intracranial pressure monitoring, management of any coagulopathy, seizure prophylaxis, and comprehensive supportive care. Pediatric patients require specialized care, considering their ongoing development and the potential impact of brain injuries on their growth and cognitive development. Furthermore, in pediatric cases, the long-term follow-up and rehabilitation are critical to address any residual neurological deficits and to support the child's developmental needs. This multidisciplinary approach often involves pediatric neurologists, rehabilitation specialists, and child psychologists, ensuring a holistic recovery and optimal development post-injury. (Araki et al., 2017; Binder et al., 2021; Horvat et al., 2016; Law et al., 2021; Shook et al., 2016)

The study on the complications associated with decompressive craniectomy (DC), which has shed light on its various postoperative risks, was conducted by the NIHR Global Health Research Group on Neurotrauma at the University of Cambridge, United Kingdom. This research highlights that DC, primarily employed to manage intractable rises in intracranial pressure due to stroke and traumatic brain injury, can lead to a significant increase in the proportion of patients who are severely disabled, despite reducing mortality. Complications arising from DC, stemming from alterations in cerebral blood and CSF flow dynamics, can manifest days to months after the surgery. These include life-threatening

new or expanding hematomas in the early postoperative period, detectable through CT scans, and long-term complications such as the syndrome of the trephined and neurological deterioration due to paradoxical herniation. The research underscores the importance of the craniectomy's size and the timing of cranioplasty in reducing these risks. The study by the NIHR Global Health Research Group on Neurotrauma thus provides critical insights into the complexities of managing patients undergoing DC for severe head injuries. (Gopalakrishnan et al., 2018; Kwan et al., 2019; Shah et al., 2021)

In summary, while decompressive craniotomy and cranioplasty are pivotal in managing severe head injuries, it is crucial to be cognizant of their associated risks and side effects, including the prevalence of postoperative headaches. Careful patient monitoring, postoperative care, and a comprehensive approach to addressing any complications are essential components of the overall treatment plan. (Bandyopadhyay et al., 2022; Iaccarino et al., 2020)

## CONCLUSION

The presented case report of a 13-year-old male patient with both Epidural Hematoma (EDH) and Subdural Hematoma (SDH) following traumatic brain injury underscores the complexity and critical nature of managing such cases in the pediatric population. This report highlights the crucial role of decompressive craniotomy in alleviating elevated intracranial pressure and mitigating further brain damage, followed by cranioplasty to restore the structural integrity and aesthetics of the cranial vault. The successful outcome in this case was largely attributable to the timely surgical intervention and the comprehensive postoperative medical management, including intracranial pressure monitoring, coagulopathy management, seizure prophylaxis, and supportive care. This case also brings attention to the potential complications associated with decompressive craniotomy, such as cerebrospinal fluid leaks, infections, brain herniation, hemorrhages, seizures, and the risk of hydrocephalus. It emphasizes the importance of early detection and management of these complications, particularly in the pediatric context where the implications for growth and cognitive development are significant. Moreover, this report adds to the existing literature on the

epidemiology of EDH and SDH in pediatric traumatic brain injuries, providing valuable insights into their incidence, risk factors, and the outcomes of surgical treatments. It also serves as a reminder of the necessity for a multidisciplinary approach in the long-term follow-up and rehabilitation of pediatric patients, ensuring their full recovery and optimal developmental progress post-injury.

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