RESEARCH PAPER

Meticulous Anaesthetic Management of Craniosynostosis Repair in an Infant with Right Unicoronal Synostosis: A Case Report

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Abstract
Craniosynostosis is a congenital cranial deformity resulting from premature fusion of cranial sutures, often requiring surgical intervention. Anaesthetic management is challenging due to anticipated difficult airway, significant blood loss, venous air embolism, and temperature instability. We report the successful perioperative management of an 11-month-old infant with right unicoronal craniosynostosis undergoing cranial vault reconstruction under general anaesthesia. Thorough preoperative evaluation, meticulous airway planning, vigilant intraoperative monitoring, and timely blood transfusion contributed to a favourable perioperative outcome.

Keywords: Craniosynostosis, Unicoronal synostosis, Paediatric anaesthesia, Difficult airway, Blood loss
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Introduction

Craniosynostosis is described as the premature fusion of one or more cranial sutures, leading to abnormal skull growth and craniofacial deformities with potential neurodevelopmental consequences[1,2]. Unicoronal synostosis results in anterior plagiocephaly with orbital asymmetry and harlequin eye deformity. Definitive management is surgical correction; however, it presents multiple anaesthetic challenges including difficult airway, major blood loss, venous air embolism, and maintenance of intracranial dynamics[3].

Case Report

An 11-month-old male infant weighing 8.1 kg, born to parents with a second-degree consanguineous marriage, presented with abnormal head shape since 3 months of age and delayed developmental milestones. There was a history of bilateral squint and spontaneous clonus at 4 months of age, with no history of seizures. Developmental assessment revealed partial milestone attainment.

On examination, the child was alert with stable vital parameters (HR: 102/min, RR: 28/min, BP: 90/60 mmHg, SpO_2: 99% on room air). Craniofacial abnormalities included right frontal flattening, harlequin eye deformity, retrognathia, depressed nasal bridge, and bilateral squint. Airway assessment suggested a difficult airway. Laboratory investigations were within normal limits. Echocardiography revealed normal cardiac structure and function. The patient was classified as ASA Physical Status II.

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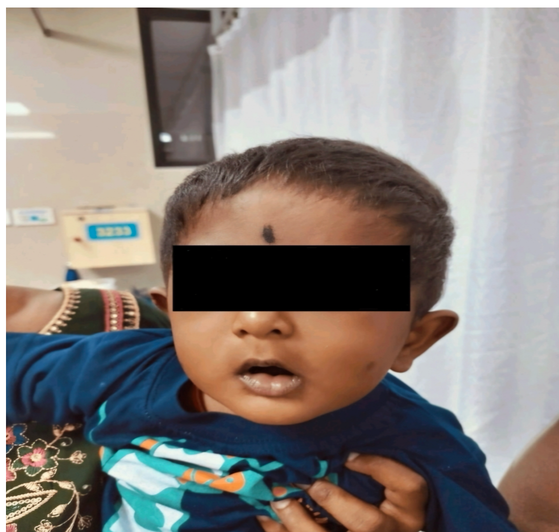
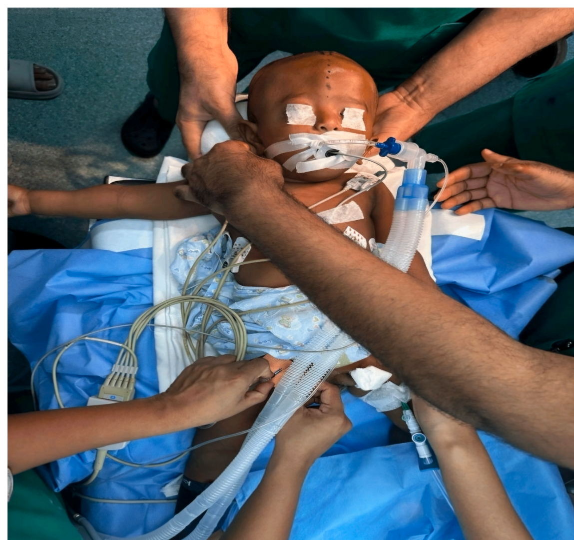
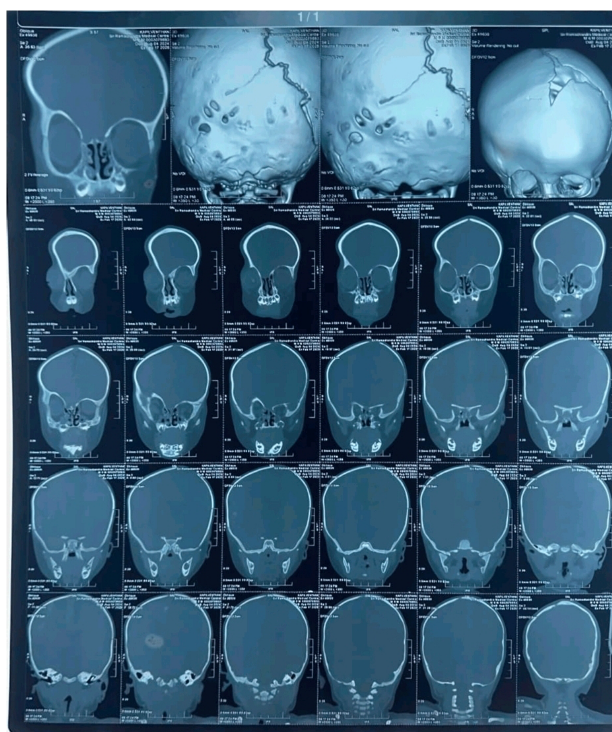
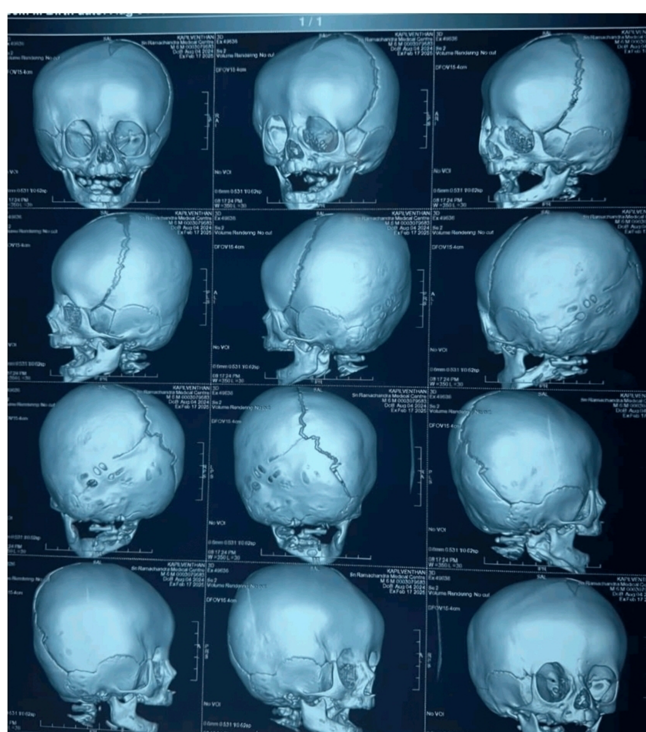




Radiological Findings
Computed tomography demonstrated complete fusion of the right coronal suture with partial fusion of the right lambdoid suture, consistent with anterior plagiocephaly and orbital asymmetry. Magnetic resonance imaging confirmed right unicoronal craniosynostosis without intracranial abnormalities.





Anaesthetic Management
After obtaining informed consent, the patient was shifted to the operating room and standard ASA monitors were applied. A difficult airway cart was prepared in anticipation of airway difficulty.

Intraoperative monitoring included continuous electrocardiography, pulse oximetry, invasive arterial blood pressure, end-tidal carbon dioxide, and temperature monitoring. Adequate peripheral venous access and arterial cannulation were secured for fluid management and serial blood pressure monitoring. Urine output was monitored throughout the procedure.

Induction and Airway Management
Anaesthesia was induced with fentanyl (2 µg/kg), propofol (2-3 mg/kg), and atracurium (0.5 mg/kg).

Tracheal intubation was achieved using a 4.5-mm uncuffed endotracheal tube under gentle laryngoscopy.

Maintenance
Anaesthesia was maintained with sevoflurane (1–2%), in an oxygen–air mixture, along with intermittent atracurium and fentanyl for analgesia.

Intraoperative Course
The duration of surgery was approximately 3 hours. Estimated blood loss was 250 mL. The estimated blood volume (EBV) was calculated as 80 mL/kg × 8.1 kg ≈ 648 mL.

Thus, the estimated blood loss was approximately 38–40% of the total blood volume, consistent with the significant blood loss commonly encountered during craniosynostosis surgery. [4,7]

This was managed with packed red blood cell transfusion, isotonic crystalloid infusion, and warmed fluids and blood products. Hemodynamic parameters remained stable without vasopressor requirement.

The child was extubated uneventfully at the end of surgery and shifted to the paediatric intensive care unit for postoperative monitoring.

The postoperative period was uneventful without neurological or respiratory complications.

Discussion
Craniosynostosis repair in infants presents multiple anaesthetic challenges. Airway management is often difficult due to craniofacial abnormalities such as retrognathia and midface hypoplasia[3,6].

Significant intraoperative blood loss is a major concern due to the vascular nature of cranial bones and scalp[4,7]. In this case, approximately 40% of the estimated blood volume was lost and effectively managed with timely transfusion, preventing hemodynamic instability.

Venous air embolism (VAE) is another potential complication during cranial vault reconstruction due to exposure of venous sinuses, especially in the sitting or head-up position. Early detection using vigilant monitoring (sudden drop in $EtCO_2$, desaturation, or hemodynamic changes) and prompt management are crucial[9].

Maintenance of normothermia is particularly important in infants due to their high surface area-to-volume ratio and immature thermoregulatory mechanisms. Infants are highly susceptible to hypothermia, which can worsen coagulopathy and increase blood loss. Active warming strategies and use of warmed fluids are therefore essential.

Preoperative imaging plays a vital role in identifying the type and extent of suture fusion, associated craniofacial abnormalities, and helps in anticipating airway difficulty and surgical complexity[5].

A multidisciplinary approach involving anaesthesiologists, neurosurgeons, and pediatricians is key to optimizing perioperative outcomes in such high-risk procedures[10].

Conclusion
Anaesthetic management of craniosynostosis repair requires meticulous planning with emphasis on airway preparedness, anticipation and management of significant blood loss, and vigilant intraoperative monitoring. Successful outcomes depend on meticulous perioperative planning, vigilant monitoring, and timely management of intraoperative complications.

Key Message
Anticipation of difficult airway and prompt management of major blood loss are crucial for safe perioperative care during craniosynostosis repair.

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