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CASE REPORT OPEN ACCESS

Anaesthetic management in nonsyndromic craniosynostosis: A pediatric case of fronto-orbital advancement surgery

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Abstract

A 17-month-old female child with nonsyndromic right coronal craniosynostosis underwent fronto-orbital advancement under general anaesthesia. Although her condition was nonsyndromic, airway assessment revealed retrognathia and head asymmetry, suggesting a potentially difficult airway. Anticipating difficult airway, video laryngoscopy was used to achieve safe endotracheal intubation. Intraoperative challenges included significant blood loss managed with tranexamic acid and transfusion guided by arterial blood gas monitoring. Postoperative care involved lung-protective ventilation, with successful extubation on the same day. This case highlights the importance of individualized anaesthetic planning and multidisciplinary coordination in achieving optimal outcomes in paediatric craniofacial surgery.

Keywords: craniosynostosis; paediatric anaesthesia; fronto-orbital advancement; difficult airway; video laryngoscopy

Introduction

Craniosynostosis is a condition in which premature fusion of one or more of the cranial sutures occurs, leading to abnormal skull development and head shape [1]. Craniosynostosis affects approximately 1 in 2,500 live births, and if left uncorrected, may lead to raised intracranial pressure, neurodevelopmental delays, and psychosocial consequences due to craniofacial deformity. Though surgical correction is generally safe, it carries potential risks and is often performed early in life.

While cranioplasty with fronto-orbital advancement has become the standard corrective approach, it poses significant anaesthetic challenges due to difficult airway, substantial blood loss, raised ICP and risk of venous air embolism [2]. Anaesthetic management is intricate, requiring thorough preparation for anticipated airway difficulties, significant intraoperative blood loss, and postoperative stabilization. This case report outlines the perioperative anaesthetic management of a 17-month-old female undergoing corrective surgery for right coronal craniosynostosis. It highlights the application of evidence-based strategies in airway management, transfusion practices, and critical care emphasizing the value of multidisciplinary coordination in achieving a successful outcome.

Case report

A 17-month-old female child weighing 7.2 kg presented with head asymmetry since birth. She was born preterm at 32 weeks via caesarean section and had a low birth weight of 1.95 kg. Developmental milestones were age-appropriate, with no history of seizures or irritability or feeding difficulties (Figure 1).

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On examination, the child was alert, and vital signs were within normal limits. Systemic evaluation revealed no cardiovascular or respiratory abnormalities. Craniometry revealed asymmetrical head and retrognathia indicating a potentially difficult airway. A preoperative CT brain showed premature fusion of the right coronal suture with ipsilateral frontal bone flattening and anterior plagiocephaly. No raised intracranial pressure or hydrocephalus was noted. Routine blood investigations, ECG, and 2D echocardiography were within normal limits.

Figure 1: Pre-operative image of a 17-month-old baby with right coronal craniosynostosis. Planned surgical markings for fronto-orbital advancement are visible. The child is placed in the supine position under general anaesthesia, awaiting the cranial remodelling surgery.

Intraoperative management

The child was scheduled for elective fronto-orbital advancement under general anaesthesia. After securing IV and arterial access, anaesthesia was induced with sevoflurane, fentanyl (14 mcg), and vecuronium (3.5 mg). Anticipating a difficult airway, intubation was performed using a C-Mac video laryngoscope, and a 4.0 mm microcuffed flexometallic tube was placed successfully. Anaesthesia was maintained with sevoflurane (MAC 0.8–1.0) and FiO_2 40–50%.

Intraoperatively blood loss was 350ml and ABG showed drop in haemoglobin to 7.0 g/dL. Tranexamic acid was administered in accordance with the weight of the child and one unit of PRBC was transfused. Intraoperative acidosis was corrected, and vital signs were stable throughout the surgery (Figure 2).

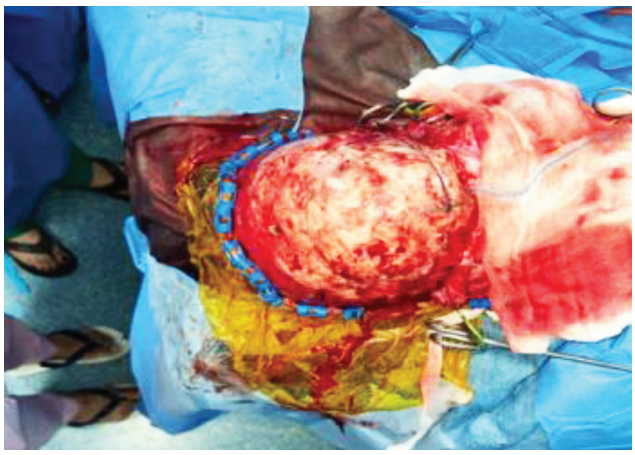

Figure 2: Intraoperative picture of a fronto-orbital advancement where the cranial vault is exposed through a bicoronal incision and flap elevation of the scalp. The surgical field is prepared for osteotomies and reshaping.

Postoperative course

Postoperatively, the child was shifted to PICU with elective ventilation on SIMV+PS mode (FiO_2 35%, PEEP 5 cm H_2O). One unit each of RDP and FFP was administered based on coagulation parameters. Respiratory efforts were adequate, and extubation was performed the same day. The child was alert and hemodynamically stable and was discharged on day 5.

Discussion

Craniosynostosis repair presents significant anaesthetic challenges due to factors such as difficult airway, risk of massive blood loss, and potential hemodynamic instability. While syndromic craniosynostosis is more commonly associated with difficult airway due to midface hypoplasia and maxillary retrusion, this case illustrates that even nonsyndromic single-suture craniosynostosis may present with these features, warranting advanced airway preparation.[1]

Cranioplasty procedures are done under general anaesthesia with concerns of difficult IV access, blood loss, difficult airway [3]. Literatures consistently supports the use of video laryngoscopy in craniofacial procedures as it enhances glottic visualization and reduces the number of intubation attempts, thus minimizing airway trauma and risk of hypoxia [4-6].

The invasive surgeries required for correction of craniosynostosis are of long duration and carry the risk of extensive blood loss and hypothermia [2,7]. Average transfusion in craniosynostosis surgery can range from

50 to 100 mL/kg [2, 5]. In our case, the patient lost approximately 350 mL (nearly 49 mL/kg), a significant volume for her 7.2 kg body weight. This was managed with timely transfusion of one unit PRBC and administration of tranexamic acid, an antifibrinolytic shown to reduce transfusion requirements in paediatric craniosynostosis procedures [8, 9]. Additional transfusions of RDP and FFP in the immediate postoperative period were guided by laboratory parameters.

Timely detection and correction of metabolic acidosis through intraoperative arterial blood gas (ABG) analysis played a crucial role in optimizing the patient's recovery and reducing postoperative morbidity. In high-risk paediatric neurosurgical cases, ABG monitoring is indispensable for early identification of acid–base disturbances. In our patient, a metabolic acidosis was identified during surgery and was promptly managed, contributing to a stable postoperative course. Following surgery, the child was ventilated with lung-protective settings (FiO_2 35%, PEEP 5 cm H_2O) in SIMV+PS mode. This approach facilitated gradual normalization of acid–base balance and ensured adequate oxygenation without exacerbating intracranial pressure. Given the patient's stable respiratory effort and corrected metabolic parameters, extubation was safely performed on the same day. Our case also supports the practice of early extubation when clinical conditions permit following major craniofacial surgery [10].

This case also highlights the importance of coordinated multidisciplinary care involving anaesthesiologists, neurosurgeons, paediatric intensivists, and nursing teams.

Compared to similar reports, our patient had a higher airway risk despite nonsyndromic diagnosis, yet meticulous planning was done in order to avoid complications [5]. Early extubation was done in our case in contrast to the practice of delayed extubation that helped in reduced post of morbidity and hospital stay.

Conclusion

This case highlights that even nonsyndromic craniosynostosis can present with significant anaesthetic challenges, including a potentially difficult airway and substantial intraoperative blood loss. Through careful preoperative assessment, proactive airway planning using video laryngoscopy, intraoperative monitoring with ABG, and timely transfusion guided by physiological parameters, a safe and successful outcome was achieved. The case emphasizes the importance of individualized anaesthetic strategies and multidisciplinary coordination in ensuring optimal perioperative care in paediatric craniofacial surgery.

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Conflict of Interest

The authors declare no conflicts of interest.

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