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Anaesthetic Management of a Child Posted for Wound Closure of Upper Lip Injury - A Difficult Airway?

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Abstract: ***Paediatric patients with facial trauma present significant challenges for airway management due to anatomical and physiological considerations. This case report describes the anaesthetic management of a 6-year-old child with a Grade 3 dog bite avulsion injury to the upper lip and incisor, necessitating primary wound closure. Airway assessment was complicated by limited mouth opening, making both mask ventilation and intubation potentially difficult. A strategic approach including ketamine and fentanyl induction, two-hand C&E mask ventilation, and nasal intubation with a cuffed endotracheal tube ensured successful airway control. Intraoperative maintenance included sevoflurane and vecuronium, and the child was successfully reversed and monitored postoperatively without complications. This case highlights the importance of thorough preoperative evaluation, preparation for difficult airway scenarios, and adaptation of standard techniques to individual patient needs in paediatric anaesthesia.***

Keywords: Paediatric airway management, difficult airway, facial trauma, nasal intubation, anaesthetic management, paediatric anaesthesia, dog bite injury.

1. Introduction

- Airway management in paediatric patients presents unique challenges due to anatomical and physiological differences compared to adults. Children have a larger head-to-body ratio, a relatively larger tongue, a more cephalad and anterior larynx, and a narrower airway diameter, all of which increase the risk of difficult airway scenarios1. Additionally, facial trauma can exacerbate these challenges by introducing airway edema, bleeding, altered anatomy, and risks of aspiration. Trauma to the upper lip and incisor region, as seen in this case, can restrict mouth opening, making both mask ventilation and direct laryngoscopy more difficult.
- Difficult mask ventilation (DMV) is characterized by ineffective chest movement and failure to maintain adequate oxygenation (SpO_2 < 90%). The presence of facial trauma increases the likelihood of DMV due to soft tissue swelling, anatomical disruption, and potential airway obstruction2. Effective preoperative assessment and preparation for alternative airway management strategies are crucial in ensuring successful anaesthetic outcomes. Preoperative planning with a difficult airway cart, selection of appropriate induction agents, and modifications in airway techniques significantly contribute to optimal airway control3.
- Bag-mask ventilation remains a fundamental airway rescue technique, especially in scenarios where direct airway access is compromised. In cases of limited mouth opening, alternative airway techniques such as supraglottic airway devices (SGAs) or nasal intubation may be preferred to ensure a patent airway.

2. Case Report

A 15 kg, 6-year-old male with a Grade 3 dog bite avulsion injury over the upper lip and incisor was scheduled for primary wound closure.

Preoperative Assessment and Intraoperative Anaesthetic Management

- Airway Examination: Limited interincisor distance (1.5 fingers); Modified Mallampati could not be assessed. Cardiovascular and Respiratory Examination: Unremarkable. Vitals and Laboratory Investigations were Normal.
- Informed consent was obtained, and nil-by-mouth status was confirmed. A difficult airway cart was kept ready. Intravenous access was secured, and standard monitoring was applied. Premedication: Inj. glycopyrrolate 0.15 mg was administered. Induction: Inj. ketamine 8 mg was given initially, followed by preoxygenation for 3 minutes. Additional induction agents included Inj. fentanyl 20 mcg and Inj. ketamine 20 mg. Mask ventilation difficulty due to facial trauma was managed using a two-hand C-E technique with a larger mask. Muscle relaxation was achieved with Inj. succinylcholine 30 mg. Anticipating difficult laryngoscopy, a thick gauge piece was placed in the space formed by the injured upper lip and incisor. A 5 mm cuffed endotracheal tube (ETT) was successfully passed nasally, confirmed by ETCO2 detection and chest rise. Throat packing was performed.

Maintenance and reversal

- Sevoflurane 2%, O_2:N_2O (50:50), and vecuronium. Adequate intraoperative analgesia was provided. The child was reversed uneventfully, extubated, and monitored in the post-anaesthesia care unit (PACU) for 2 hours.

3. Discussion

Difficult mask ventilation (DMV) is characterized by ineffective chest movements and failure to maintain adequate oxygenation (SpO2 < 90%). Paediatric patients with facial injuries pose significant challenges due to the risk of bleeding, airway edema, and aspiration. The potential for tissue edema and leak contributes to difficult mask ventilation, while upper lip injuries and dental trauma may lead to complications in laryngoscopy due to the altered anatomical space.

This case highlights key considerations in paediatric difficult airway management. According to Walas and Aleksandrowicz[1], preoperative planning, including readiness with alternative airway techniques and equipment, is crucial. The choice of ketamine and fentanyl for induction facilitated hemodynamic stability while maintaining spontaneous respiration initially, a technique supported by Krishna et al.[2] Mask ventilation was challenging but effectively managed using the two-hand C-E technique, ensuring an airtight seal. Jagannathan and Asai et al.[3] emphasize the importance of modifying standard airway approaches based on individual anatomical variations, as was done in this case by inserting a thick gauge piece to optimize visualization during laryngoscopy.

The use of a cuffed ETT was essential in minimizing the risk of displacement and aspiration, in line with current recommendations for paediatric airway management. Postoperative monitoring ensured a smooth recovery, minimizing risks such as airway obstruction or emergence agitation.

Preoperative airway assessment was limited due to the nature of the injury, which prevented an adequate Mallampati classification. Limited mouth opening (interincisor distance of 1.5 fingers) raised concerns about potential difficulty in both direct laryngoscopy and bag-mask ventilation. As highlighted, thorough preoperative planning, including the availability of a difficult airway cart and preparation for alternative airway techniques, is crucial in paediatric airway management[1].

The choice of ketamine for induction, in combination with fentanyl, facilitated a stable hemodynamic profile while maintaining spontaneous respiration initially, which aligns with best practices in paediatric difficult airway management[2]. Succinylcholine was used to provide muscle relaxation, ensuring optimal conditions for intubation.

Mask ventilation was anticipated to be challenging due to the facial trauma, and difficulties were managed using the two-hand C-E technique with a larger mask, as recommended in difficult airway scenarios. Krishna et al.[3] has emphasized that ensuring effective preoxygenation and optimizing mask ventilation are critical in paediatric airway management, especially in patients with abnormal airway anatomy.

The use of a thick gauge piece to maintain upper lip and incisor space highlights an innovative approach tailored to this specific case, ensuring adequate visualization during laryngoscopy. Modifying standard airway management techniques based on individual patient anatomy is essential for successful paediatric airway control[3].

A cuffed 5mm endotracheal tube (ETT) was chosen for nasal intubation, which provided a secure airway while minimizing the risk of tube displacement. ETCO2 confirmation and chest rise assessment ensured proper placement. Maintaining anaesthesia with sevoflurane and vecuronium facilitated smooth intraoperative management. Literature supports the use of cuffed ETTs in paediatric patients as they provide a better seal, reduce the need for tube changes, and lower the risk of aspiration[3].

The patient was successfully reversed and extubated without complications. As recommended in the literature, careful postoperative monitoring in the PACU is essential to detect any residual airway obstruction, aspiration risk, or emergence agitation[2]. In this case, the child was monitored for two hours postoperatively to ensure a stable recovery.

4. Conclusion

This case highlights the importance of meticulous planning, preparedness for difficult airway scenarios, and individualized modifications to standard airway management techniques in paediatric anaesthesia. Strategies employed align with best practices outlined in current literature, emphasizing preoperative assessment, appropriate induction techniques, and intraoperative vigilance. In paediatric patients with facial trauma, thorough airway evaluation and preparedness significantly improve intraoperative and perioperative outcomes.

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