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Unanticipated difficult airway in a neonate: no child's play

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Keypoints

Neonates may present with unpredictably demanding airways. The absence of requisite societal guidelines on the management of difficult neonatal airways makes the management challenging.

Abstract

Neonatal intubations can be challenging despite unremarkable external findings and optimal laryngoscopic views. A 4-day-old, pre-term, was scheduled for an exploratory laparotomy. Our first attempt at intubation with a Miller's blade was unsuccessful. After two unsuccessful attempts, a senior anesthesiologist was called for help. Mask ventilation was resumed between all the attempts. Hemodynamic instability was identified and treated. Fiberoptic bronchoscopy revealed a laryngeal anomaly, and further attempts were deferred. Spontaneous respiratory efforts returned, and the surgery was rescheduled. The neonate developed respiratory distress that evening. An emergency tracheostomy was deemed necessary and a tracheostomy tube was placed. With a surgical airway in place, we proceeded with exploratory laparotomy. The child was stable throughout the surgery.

Neonates may present with unpredictably demanding airways. The absence of requisite societal guidelines on the management of difficult neonatal airways makes the management challenging.

Keywords

Difficult airway; Neonate; Tracheostomy; Intubation; Ventilation; Surgical airway.

Introduction

An unanticipated difficult airway is a nightmare from the anesthesiologist's perspective. In contrast to adults, neonates have lower oxygen reserves, smaller closing capacities and higher oxygen consumption rates [1]. These physiological differences make them prone to rapid desaturation. Consequently, an unanticipated difficult airway in a neonate is practically catastrophic. The NECTARINE study done in 2021 concluded that more than 2/3rds of difficult neonatal airways were unanticipated [2]. Lack of adequate resources and preparedness, compounded by the lack of adequate and uniformly implementable 'neonatal difficult airway algorithms' add to the complexity while dealing with these difficult airway situations [3]. We report a case of a neonate with an unexpected laryngeal pathology leading to an unanticipated difficult airway.

Case report

A 4-day-old, pre-term neonate, weighing 1.5 kgs, suspected to have duodenal atresia, was posted for exploratory laprotomy. The neonate was born at 36 weeks of gestation by lower segment cesarean section. He developed respiratory distress soon after birth and was initiated on Continuous positive airway pressure (CPAP) supports. Owing to the respiratory distress, the neonate was being monitored in the neonatal intensive care unit. He was hemodynamically stable with a heart rate of 178 beats/min and saturation of 100% on Bubble CPAP supports with fiO_2 of 21% and a positive end-expiratory pressure (PEEP) of 6 cm of water. A detailed pre-anaesthetic evaluation revealed no syndromic features such as cleft lip, cleft palate, hypertelorism or micro/macrocephaly. Features suggestive of Down's syndrome were particularly ruled out, owing to its association with duodenal atresia. Features suggestive of respiratory distress such as stridor, weak cry, laboured breathing, and chest retractions were also ruled out.

After obtaining a written informed consent, the neonate was shifted to the operation theatre. The standard American Society of Anesthesiologist's (ASA) -recommended monitors (pulse oximeter, five lead ECG, and an automated non-invasive blood pressure monitor) were attached in the operation theatre. A 22 G Intravenous catheter was in-situ over the dorsum of the left upper limb and was functional.

We pre-medicated the neonate with intravenous(IV) Inj. Glycopyrolate 15 mcg. The neonate was positioned with a head ring and a bolster to support the neck, to achieve optimal intubating conditions. After pre-oxygenation with 100% oxygen, Induction of anaesthesia was achieved with IV Inj Fentanyl 1.5 mcg and IV Inj Propofol 5 mg. After confirming the adequacy of bag-mask ventilation, skeletal muscle paralysis was achieved with IV Atracurium 0.7 mg. Endotracheal intubation was attempted with a Miller blade (size 0) using an uncuffed 2.5 mm ID Endotracheal tube (ETT). Direct laryngoscopic view was noted to be Cormack-Lehane grade 2. However, we were unable to pass the tube beyond the vocal cords. Bag and mask ventilation was reinitiated. We were able to ventilate the neonate and achieve adequate chest rise. The neonate was hemodynamically stable and maintained a saturation of 100% and a heart rate of 162 beats/min.

In our 2nd attempt at intubation, we used a Mac blade (size 00) and an uncuffed 2.5 mm ID ETT with a stylet. We were unable to pass the tube beyond the vocal cords. Mask ventilation was re-initiated. Adequate ventilation and chest raise was achieved. An unanticipated difficult airway scenario was declared. A senior anaesthetist was called for help. Concurrently, we tried to place a supraglottic airway device. A size 1 Proseal Laryngeal Mask Airway was inserted; we could not ventilate the child. The supraglottic airway device was removed, and mask ventilation was re-initiated. The neonate was maintaining a saturation of 97% and a heart rate of 137 beats/min at this point.

The 3rd attempt at endotracheal intubation was made by a senior anesthesiologist. This time we used a Mac blade (size 0) and uncuffed 2.5 mm ID ETT with a stylet. We were unable to pass the tube beyond the vocal cords. The child's saturation dropped precipitously (to 60%) and bradycardia (Heart rate up to 90 beats/min) set in. In concert with reinitiating bag-mask ventilation, bradycardia was promptly corrected with a bolus of IV Inj. Atropine 30 mcg. The hemodynamics improved, and the child maintained a saturation of 97% and a heart rate of 110 beats/min. Concurrently, the neonatal intensivists were called for additional help. After discussing with the neonatologists, it was decided to attempt a fiberoptic-guided bronchoscopy with the paediatric bronchoscope available in our institute (2.8 mm), to evaluate for the inciting factor.

We were unable to negotiate the working channel of the fibroscope beyond the vocal cords. We noted a flap-like mucosal membrane beneath the vocal cords which prevented further advancement. We suspected a laryngeal pathology- subglottic stenosis and laryngeal web, being

the two main differential diagnoses. Consequently, we halted further attempts of endotracheal intubation and planned to secure an airway by emergent tracheostomy. After discussing with the surgeons and the parents, it was concurred to evaluate the neonate further and postpone the surgery. Anaesthetic agents were tapered off, and spontaneous breathing efforts were noted. Breathing efforts were assisted till the child could take adequate tidal volume breaths. The neonate was shifted to NICU on CPAP supports.

Subsequently, that evening, the neonate developed chest retractions, laboured breathing, and stridor. An emergency tracheostomy was planned. After obtaining high-risk written informed consent, the neonate was shifted to the operation theatre. In the OT, standard ASA-recommended monitors were attached and mask ventilation with 100% O2 was initiated using the Jackson Rees circuit.

After adequate local infiltration with 0.5 ml of 2% Lignocaine, an emergency tracheostomy was attempted. Since an adequately sized tracheostomy tube was not available, a size 3 uncuffed tracheostomy tube, was cut and resized and fixed at a depth of 1.5 cm. Oxygenation with bag-mask ventilation was continued throughout the procedure. The tracheostomy tube position was confirmed with capnography. The neonate was hemodynamically stable throughout the procedure.

Since the airway was secured, it was decided to proceed with exploratory laparotomy under general anaesthesia. Induction of general anaesthesia was with IV Inj Fentanyl 1.5 mcg, IV Inj Propofol 3 mg; once bag-mask ventilation was deemed adequate, skeletal muscle paralysis was achieved with IV Inj Atracurium 0.7 mg. The tracheostomy tube was attached to a Jackson-Rees circuit and the neonate was hand-ventilated throughout the procedure. Depth of anaesthesia was maintained using Sevoflurane to target a MAC of 0.8-1.0 as per the hemodynamics. Air and oxygen were employed at the ratio of 1:1. Intraoperatively, we employed multi-modal analgesia in the form of intravenous Inj. Paracetamol at the dose of 11.5 mg and Inj. Morphine 75 mcg, along with local infiltration of local anaesthetic 1.5 ml of 0.25% Levobupivacaine at the site of the incision.

Though the neonate was hemodynamically stable throughout and tolerated the procedure well. He was sedated at the end of the procedure and shifted to NICU on ventilatory support for further monitoring and evaluation (Figures 1, 2)

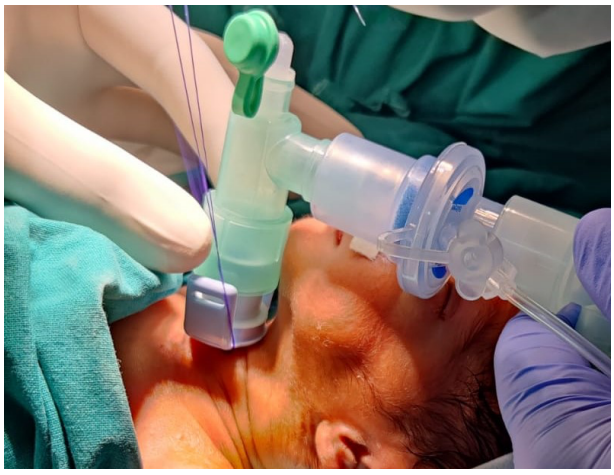

Figure 1. Neonate with the surgical airway in-situ

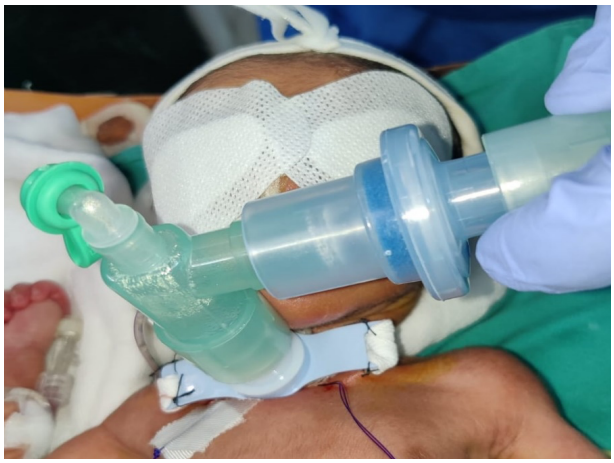

Figure 2. General anaesthesia induction via tracheostomy tube

Discussion

Endotracheal intubation is an essential, life-saving procedure in the skill set of an anesthesiologist. A difficult airway is a clinical situation wherein a conventionally trained anesthesiologist experiences difficulty with face mask ventilation, placement of supraglottic airway devices, or endotracheal intubation [4]. Although there is a multitude of tests and scoring systems to predict a challenging airway, none of them is infallible [5]. Predicting

a difficult airway in infants can be more challenging than in adults. Neonates have a larger occiput, a larger tongue, an anteriorly located larynx and a floppy epiglottis compared to adults making laryngoscopy and intubation difficult. Neonates are physiologically more prone to hypoxia than adults. This makes the management of a difficult neonatal airway all the more challenging. Although difficult airway algorithms, such as the Difficult Airway Guidelines [6] have been formulated for paediatrics, most cater to children aged 1-8 years [1].

Congenital airway anomalies comprise a wide range of tracheal and laryngeal pathologies such as laryngomalacia, laryngeal webs, tracheoesophageal fistulas, subglottic stenosis, tracheal stenosis, vocal cord paralysis, laryngeal cysts, and tumours [7]. Most of these conditions present with similar symptoms of respiratory distress, weak cry, stridor, and laboured breathing [8]. Very often, these conditions are asymptomatic and require a high index of suspicion to diagnose and intervene early [8].

In our case, since the neonate did not present with craniofacial anomalies, syndromic features or signs of airway compromise such as noisy breathing, stridor, or weak cry; therefore, we had not anticipated difficulty securing a successful airway. In accordance with the Vortex approach [9] and the BAPM 2020 framework [10] , we declared a difficult airway scenario after two attempts at intubation and called for help. A senior anesthesiologist took the lead in the management of the airway. We reviewed our options and resources available to tackle the situation while we simultaneously tried to recognize the pathology that was inciting the difficult airway. Our options were limited with minimal resources and airway equipment catering to a pre-term neonatal airway. After our best attempt at intubation failed, we were left with either obtaining a front of neck access (FONA) or postponing the surgery and further evaluating the neonate. Concurrently, the surgeons and the parents were involved in the decision-making process, and we proceeded with the latter. A few hours later, the neonate developed stridor and chest retractions, which warranted an immediate airway intervention. This time, we were better prepared, and the emergency tracheostomy was performed by an experienced ENT surgical team.

Airway management in a neonate can be challenging and distressing despite unremarkable external findings. It is important to be adequately prepared and equipped to manage an unanticipated difficult neonatal airway. Preformed airway management algorithms help in achieving more efficient teams and environments. There is a dire need to have adequate airway management algorithms catering to infants [10]. Although front-of-neck access is a critical component of an anesthesiologist's skill set, we are more proficient with the needle than we are with the scalpel [11]. The lack of sufficient implementable checklists, compounded by the lack of adequate equipment in resource-poor settings, adds to the woes of an anesthesiologist while dealing with such difficult situations. It is therefore crucial, that centres, where pediatric and neonatal anaesthetic care is provided, have adequate infrastructure in terms of appropriately sized difficult airway equipment and pediatric difficult airway carts.

Disclaimer:

Written informed consent for publication was obtained from the parents of the neonate.

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