

Neonatal Direct Rigid Laryngoscopy and Bronchoscopy: A Near Miss

Dennis E. Feierman^{1*}, Mark Kronenfeld¹, Jacob Sutton², Gil Zoizner³, Evan P. Salant¹

¹Department of Anesthesiology, Maimonides Medical Center, New York, USA

²Rutgers Robert Wood Johnson University Hospital, New Brunswick, USA

³Meir Hospital, Clalit Health Services, Kefar Sava, Israel

Email: *dfeierman@maimonidesmed.org, MKronenfeld@maimonidesmed.org, jsutton000@citymail.cuny.edu, Gil.zoizner@gmail.com, ESalant@maimonidesmed.org

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Abstract

Airway management is a skill necessary for healthcare providers who manage patients. Intubation is a skill that both anesthesiologists and intensivists use daily. We present a case of a neonate that developed significant worsening stridor after a successful intubation for a hernia repair. After 4 intubation attempts, with easy visualization of the vocal cords and unsuccessful placement of the endotracheal tube, the patient was emergently brought to the operating room for evaluation.

Keywords

Neonate, Direct Laryngoscopy, Intubation

1. Introduction

Neonatal intubation is a critical intervention that can significantly impact infant survival. It is a fundamental skill commonly performed for neonates by highly trained healthcare professionals: pediatric anesthesiologists, or neonatal intensivists, for example. Despite being frequently performed, it is a procedure wrought with complications and adverse events. Complications of neonatal intubation are known to be increased with emergency intubation, increased number of attempts, or ventilation failure. We present a case of a difficult intubation, where the neonate had previously been intubated and ventilated without difficulty, that was not a result of an inability to visualize structures but an inability to successfully maintain ventilation due to subglottic stenosis that was probably caused by a prior intubation.

2. Case Presentation

The infant was 1 of 3 born at 31 weeks after *in vitro* fertilization. Now 11 weeks old, she presents to the OR for direct laryngoscopy and bronchoscopy. Past surgical history was significant for bilateral inguinal hernia repair at 8 weeks old under general anesthesia without complication. Intubation for this surgery was easily performed with a Miller 1 blade, and a cuffed 3.5 standard ET tube was placed. The patient was easily ventilated and uneventfully extubated approximately 2 hours later. Her medical history included congestive heart failure, Persistent Pulmonary Hypertension of the Newborn, a large patent ductus arteriosus with a significant left to right shunt, mitral insufficiency with dilated left atrium, and a small PFO. Over the course of her NICU stay, she had several desaturation and apneic events. She was being treated with racemic epinephrine for worsening stridor. She was evaluated at the bedside by ENT, and flexible scope showed normal vocal cords, choanal narrowing, and some posterior edema but could not rule out subglottic stenosis. The patient's stridor worsened, and treatment with racemic epinephrine had little effect. Bedside intubation was performed twice by the NICU director (directly laryngoscopy) and twice with a flexible fiber optic by ENT, however, each time the patient was placed on the ventilator, the tube popped out.

The patient's condition was thoroughly discussed with the parents and informed consent was obtained. The patient was brought emergently to the OR for an exam under anesthesia, possible tracheostomy and/or tracheal dilatation.

On arrival to the operating room, standard monitors were applied, and the patient ventilation was assisted until the pulse ox reading was 100%. A new 24 g IV was placed. The patient received 20 mcg/kg of atropine. We were able to maintain saturations with a nasal cannula while spontaneously breathing under propofol sedation. Direct rigid laryngoscopy and bronchoscopy were performed. The laryngeal structures were normal down to the level of the vocal cords. Below the cords, in the subglottic region, there was web that obstructed a 98-99% of the lumen (**Figure 1**). The scope was removed, and the patient's ventilation was assisted until the saturations improved. The surgeon decided to attempt to pass a 2.5 endotracheal tube over the bronchoscope to secure the airway. However, they were not successful, bag-mask ventilation was now no longer successful, and the patient started to desaturate. A decision was made to perform an emergent tracheostomy. The neck was exposed, and a vertical incision was made. The trachea was palpated, and a dissection performed. An attempt was made to ventilate via a small needle cricothyroidotomy and to stabilize the patient, without success. At this point in time the patient deteriorated with bradycardia: chest compressions were started, and a full PALS protocol initiated. The performance of CPR on the neonate made the tracheostomy extremely difficult because of the movement of the patient and a crowded operative field. At this point we performed direct laryngoscopy with a Miller 1 blade, and the vocal cords were easily visualized. A 2.5 endotracheal tube with a coated stylet protruding from the tip

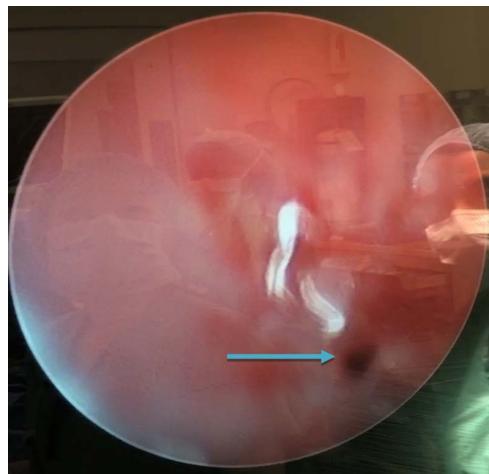


Figure 1. Bronchoscopic view of the subglottic obstruction. The little pinhole at the lower right portion of the picture (blue arrow) was the passage via which the patient was exchanging air.

of the tube was utilized. The tube was easily placed into the airway but had to be bluntly forced pass the stenotic lesion. Ventilation was achieved and confirmed by ETCO₂ as well as checking for bilateral breath sounds. The patient returned to spontaneous circulation. A decision was made to proceed with the tracheostomy. The tracheostomy was performed, and a 3.5 cuffless neonatal tube was inserted. The patient was then transferred back the NICU without further complication.

3. Discussion

Neonatal intubation is a critical intervention that can significantly impact infant survival, and is a fundamental skill commonly performed for neonates by highly trained healthcare professionals. Although a fundamental skill, neonatal intubation is often a complicated process. The first attempt success rate is low, with as many as four attempts often needed for successful intubation [1]. This makes it a dangerous neonatal procedure, as more attempts results in greater chances of complications.

A study by Foglia and colleagues looked at the rates of intubation complications and adverse events in infants admitted to the NICU [2]. This prospective observational cohort study found an adverse event rate of 22%, with the most complications being esophageal intubation, mainstem intubation, oral/airway trauma, emesis, and cardiac arrest. Severe oxygen desaturation, defined as a decrease of 20% or greater, occurred in 51% of encounters. A similar study by Hatch and colleagues found the adverse event rate of neonatal intubations to be as high as 39%, with a higher percentage linked to the number of intubation attempts [3].

Subglottic stenosis is a potential airway complication of intubation [4] [5]. It is possible that the patient was born with a congenital subglottic web; however,

congenital subglottic webs are an uncommon cause of stridor in neonates [6] and furthermore, the patient was easily intubated and ventilated less than 4 weeks before this operation. On reviewing the previous anesthesia record, the neonate was less than 39 weeks gestational age, weighed 2.3 kgs and was intubated with a standard 3.5 cuffed tube. This, in theory, could have been a partial reason for this new subglottic stenosis. The opening in the subglottic stenosis was so small, that this was probably the reason why the endotracheal tube ‘popped out’ when the patient was placed on the ventilator.

Neonatal tracheostomy is a critical intervention that can significantly impact infant survival [7]. They can be difficult to perform in premature neonates simply because of their size. In this case, the ability to perform an emergency tracheostomy was further hindered by the need for CPR. The chest compression crowded the surgical field in addition to causing the field to move. At that moment, to avoid stopping CPR for a significant period of time in order to make the tracheostomy “easier”, it was decided to try to intubate from above. The anesthesiologist felt the stylet pop through the small stenotic opening and then using a twisting movement of the tube, was able to force the endotracheal tube beyond the subglottic stenosis. Perhaps, in retrospect, it might have been better to perform the tracheostomy while the patient was able to spontaneously breath and bag-mask ventilation was still possible. After the endotracheal tube was in place and there was return of spontaneous circulation, the tracheostomy was uneventfully performed. At later date the patient underwent 2 separate balloon dilation procedures. The results from the balloon dilation were temporary. The patient was referred out for an open airway reconstruction.

4. Conclusion

Although we cannot be sure of the extent of the subglottic stenosis prior to the bedside attempts at intubation, we feel that too many attempts were performed. This probably resulted in further stenosis. Given the history of a previous easy intubation without problems, and easy visualization of the vocal cords and placement of the endotracheal tube at the bedside, the patient should have been urgently scheduled for the operating room and evaluated. The popping out of the tube when the patient was placed on the ventilator highly suggested subglottic stenosis. Once this diagnosis was confirmed via directly rigid laryngoscopy, and the extent to the stenosis, an immediate tracheostomy should have been performed.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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