



# Unanticipated Difficult Airway in a Neonate: Are we Prepared for this CHAOS?

Bir Yenidoğanda Beklenmeyen Zor Havayolu: Bu KAOS İçin Hazırlıklı mıyız?

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Unanticipated difficult airway in a neonate is a challenging situation with many difficulties because of inherent anatomical variations. To complicate the situation there is a lack of appropriate equipment, expertise and established guidelines on the management of difficult airway in neonates and infants. There are few published reports regarding the use of available devices for emergency front-of-neck access. We report the case of airway management of a neonate with an unanticipated finding of subglottic stenosis. Subglottic stenosis is one of the aetiologies of congenital high airway obstruction syndrome, which may be diagnosed antenatally based on ultrasonography findings.

**Keywords:** Congenital high airway obstruction syndrome, difficult airway, front-of-neck access, subglottic stenosis

Yenidoğanda beklenmedik zor havayolu, doğuştan var olan anatomik varyasyonlardan dolayı birçok zorlukla ortaya çıkan bir durumdur. Yenidoğanlarda ve infantlarda zor havayolu yönetimi konusunda kılavuzların, uygun donanımın ve uzmanların yetersizliği durumu daha da karmaşıklştırmaktadır. Acil ön-boyun girişi için mevcut cihazların kullanımıyla ilgili yayınlanmış çok az sayıda rapor bulunmaktadır. Bu çalışmada beklenmeyen subglotik stenozu olan bir yenidoğanın havayolu yönetimi sunulmaktadır. Subglotik stenoz, ultrason bulgularına dayanarak antenatal olarak tanı konulan konjenital yüksek havayolu obstrüksiyonu sendromunun etiolojilerinden birisidir.

**Anahtar Sözcükler:** Konjenital yüksek havayolu obstrüksiyonu sendromu, zor havayolu, ön-boyun girişi, subglotik stenoz

## Introduction

Congenital high airway obstruction syndrome (CHAOS) is caused by defective canalisation of the upper airways around the 10<sup>th</sup> week of gestation (1). Congenital subglottic stenosis is one of the aetiologies of CHAOS, with an incidence of <0.2% (2). Antenatally undiagnosed subglottic stenosis can present as an emergency that requires resuscitation at birth, and in this scenario, 'cannot intubate, cannot oxygenate' situation can be disastrous. In addition, there is minimal published data on front-of-neck access (FONA) in neonates. We report a case of neonate (weight, 2.8 kg) with an unexpected finding of subglottic stenosis during resuscitation in the obstetric operation theatre.

## Case Presentation

The neonate was delivered via an elective caesarean section to a mother afflicted with polio. Antenatal scans were normal, except for moderate polyhydramnios. The baby did not cry after birth. Bag and mask ventilation was initiated after failure to stimulate respiration with suctioning, warmth and opening the airway. However, the ventilation was inadequate. Hence, intubation was attempted with a 3-, 2.5- and 2-mm ID endotracheal tube (ETT) but was unsuccessful. Igel number 1 was inserted, however, ventilation was suboptimal. The heart rate decreased to <100 beats min<sup>-1</sup>, and saturation was <70% after 10 minutes of resuscitative attempts. The otorhinolaryngologist was called in the theatre for tracheostomy. FONA was performed using a 16-G cannula by palpating the trachea, and cannula tracheotomy was performed. The 16-G cannula was attached to a 3 cc syringe with an 8-mm ID ETT connector, and the patient was ventilated using a JR circuit. The heart rate and saturation improved. Tracheostomy was performed by ENT surgeons, and a 3.5 mm ID tracheostomy tube was inserted. The period between birth and tracheostomy was 20 min. The neonate succumbed after 4 h. The postmortem report showed subglottic stenosis. Written informed consent was obtained from the patient's parent.

## Discussion

Congenital high airway obstruction syndrome is characterised by a dilated trachea, hyperechoic lungs, flattened diaphragm, foetal ascites and polyhydramnios on the antenatal care scan (1). If diagnosed antenatally, these patients can undergo the Ex utero Intrapartum Treatment procedure, and the airway can be secured by either intubation or tracheostomy (3). A high index of suspicion should be considered in cases with polyhydramnios in late pregnancy with respect to not only tracheoesophageal fistula but also laryngeal and tracheal abnormalities. In undiagnosed cases, if intubation fails and ventilation is inadequate, FONA becomes the next logical step. However, there are certain anatomical and technical issues that make performing a FONA more challenging compared with that in adults. Furthermore, there is a dearth of guidelines regarding the management of difficult airway in neonates and infants. The DAS guidelines are intended for patients between the age of 1 and 8 years.

In neonates, the cricothyroid membrane (CTM) has a mean length of only  $2.6 \pm 0.7$  mm and a width of  $3 \pm 0.63$  mm. Even the 2-mm ID ETT has an external diameter of 3 mm. Thus, the smallest endotracheal tube cannot be passed through CTM without damaging the larynx (4). Moreover, identifying CTM is difficult because the thyroid cartilage may be below the hyoid, making the hyoid and cricoid more prominent. In children, the trachea is anatomically easily accessible because it extends higher above the sternal notch than that in adults. Hence, it is recommended to not perform a scalpel cricothyroidotomy in children aged <5 years. Cote et al. (5) described that a trans-tracheal puncture with the head in extension and soft tissues pulled up and away as much as possible is a far safer procedure. A Teflon-made ventilation catheter (Ravussin), which is kink resistant and has a lateral flange for fixation, can replace the IV cannula. It is recommended to use a pressure-regulated jet ventilation system to ventilate such patients. There are devices for low pressure oxygenation, such as Enk Oxygen Flow Modulator, Ventrain and Rapid O<sub>2</sub>. However, there are no published reports regarding the use of these devices in neonates and infants (5). A definitive tracheostomy should be performed, or else, dangerous plasma CO<sub>2</sub> levels may build up. There is also a risk for dislodgement of the cannula and resultant subcutaneous emphysema and pneumomediastinum.

## Conclusion

There is a need to develop guidelines for the management of difficult airway for children aged <1 year. Anaesthesiologists are facile with the use of a needle but not so much with a scalpel. There is still lack of expertise and limited availability of appropriate size equipment. Hence, it is desirable that we train on simulators, manikins, cadavers, etc. to select a

technique that we are most comfortable with. Developing an institutional protocol for the management of such scenarios is the need of the hour.

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## References

- Viadef AC, Szmuk P, Mastrobattista JM. More or less CHAOS: case report and literature review suggesting the existence of a distinct subtype of congenital high airway obstruction syndrome. *Ultrasound Obstet Gynecol* 2007; 30: 114-7. [\[CrossRef\]](#)
- Kundal R, Bharadwaj A, Dogra N. Anaesthetic Management of Unexpected Subglottic Stenosis in a Neonate with Tracheoesophageal Fistula. *JCR* 2013; 3: 217-9. [\[CrossRef\]](#)
- Artnuc Ulkumen B, Pala HG, Neese N. Prenatal Diagnosis of Congenital high airway obstruction syndrome: Report of Two Cases and Brief Review of Literature. *Case Rep Obstet Gynecol* 2013; 2013: 728974.
- Navsa N, Tossel G, Boon JM. Dimensions of the neonatal cricothyroid membrane-how feasible is a surgical cricothyroidotomy? *Paediatr Anaesth* 2005; 15: 402-6. [\[CrossRef\]](#)
- Coté CJ, Hartnick CJ. Pediatric transtracheal and cricothyrotomy airway devices for emergency use: which are appropriate for infants and children? *Paediatr Anaesth* 2009; 19: 66-76. [\[CrossRef\]](#)