Airway management in neonates and infants with congenital airway lesions

Airway management in a neonate and an infant is a challenge even for an experienced anesthesiologist. The anatomical differences from the adult airway and the use of Miller laryngoscope blade may make a person, not used to managing such cases regularly, uncomfortable. A lower functional residual capacity reserve makes them prone to hypoxia and this demands that an experienced anesthesiologist perform the tracheal intubation. An airway lesion or a difficult airway in this age group can be a nightmare for the physician managing the case.

In this issue of the journal, Saxena *et al*. present the successful airway management of an infant with a compromised upper airway scheduled for resection of a nasopharyngeal mass.[1] The patient presented in the report had a cleft palate with large nasopharyngeal mass, suspected to be a teratoma. The patient had difficulty in feeding and made a grunting sound on spontaneous breathing. The authors describe the management of this difficult airway using an unconventional method.

An infant's larynx and trachea are significantly smaller than an adult's. The vocal cords of the newborn infant are 6–8 mm long. The vocal processes of the arytenoids are comparatively large, extending to one-half of that length. The transverse length of the posterior glottis is approximately 4 mm, while the subglottis is 5–7 mm in diameter. The trachea is about 4 cm long with a diameter of 3.6 mm. The safety margin for obstruction in an infant is thus low and a small reduction in the diameter, as in mucosal edema, can lead to significant changes in airway caliber.

Neonates and infants breathe through the nose because the entire length of their large tongue abuts against the hard and soft palates and occludes the passage of air through the mouth. The high position of their epiglottis (at the level of the third and fourth cervical vertebrae compared with the fifth and sixth vertebrae in adults) also increases the resistance of the oral airway. The above factors make them preferential nasal breathers. Nasal obstruction thus can lead to significant respiratory distress.

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Stridor is produced by turbulent airflow caused by a partial airway obstruction. Stridor in a neonate/infant is indicative of a compromised airway and can be fatal. In a neonate/infant, it may range from mild stridor without respiratory distress and good feeding to severe airway compromise requiring immediate intervention.[2] In case the stridor is associated with significant suprasternal tug and intercostal recession, it indicates that the airway may be less than a millimeter away from complete obstruction.

Nasal obstruction in infants/neonates can cause significant airway compromise and can be life-threatening. Management of the neonate born with choanal atresia is described in literature, but there are few reports and no guidelines for management of the neonate or young infant who presents with nasal obstruction and airway compromise, but does not have choanal atresia.[3]

Teratomas are the most common congenital tumors, but teratomas of the nasopharynx are rare and seen almost exclusively in infants, especially in neonates.[4] Teratomas occur in 1 of 4000 live births and show a female predominance of 5:1.[5] Head and neck teratomas account for 1–10% of the total reported cases, and are most common in the neck with the nasopharynx being the second commonest location.[6] In a neonate, it may present as difficulty to wean a newborn after initial emergent securing of the airway for respiratory distress.[7] Other congenital airway lesions in neonates/infants, causing airway obstruction, include laryngo-tracheo-bronchomalacia, sub-glottic stenosis, choanal atresia, laryngeal cysts, and mucopolysaccharidosis. Fiberoptic endoscopy, with miniaturized devices available today, helps in assessing the lesion and may help excise the lesion more completely.[7]

Maternal ultrasound screening alerts the clinicians early about a possibility of airway obstruction in the fetus. Airway obstruction is more likely if there is maternal polyhydramnios (esophageal and tracheal compression limits swallowing of the fetus) and elevated alfa-fetoprotein levels.[8,9] Extension of the fetal head *in utero* indicates airway compression as a mass may limit head flexion. Prenatal magnetic resonance imaging (MRI) can be useful to provide information on the anatomy of a mass in relation to the airway.[10] MRI scans

provide more accurate diagnoses of the etiology of fetal masses than ultrasound.[11]

Stridor in a neonate/infant should alert the anesthesiologist of potential airway difficulties. A difficult airway management cart and a person skilled in fiberoptic intubation must be available. The airway should be maintained on spontaneous ventilation to minimize airway compromise till it is secured. Intravenous access must be obtained before the intervention. Continuous oxygen insufflation is mandatory, using a nasopharyngeal airway device in the other nostril. Administration of muscle relaxant for cases of difficult airway remains controversial, and in case it is used, it should be restricted to a short-acting agent such as succinylcholine. Tracheal intubation with the aid of a gum elastic bougie has been reported,[12] whereas in other reports, successful intubation was achieved during spontaneous respiration after wearing off of the effect of administered muscle relaxants.[13] Vocal cords are possibly viewed more easily and it is easier to intubate the trachea during spontaneous respiration, especially after induction of anesthesia with sevoflurane.[14] A supraglottic airway device must be available as a rescue airway. Finally, an otorhinolaryngologist, skilled in performing emergency tracheostomy in a neonate/infant, must be available.

Saxena *et al*. successfully intubated the trachea of the infant, atraumatically, after local anesthetic blockade and sedation using the right molar approach, after failing to do so with a fiberscope and using standard laryngoscopy with tracheal manipulation maneuvers.[1] Although awake intubation in infants has been described earlier, the technique is potentially traumatic, especially when laryngeal structures are not visible, and may cause stress-induced physiological changes and a rise in anterior fontanelle pressures.[15] The technique should be reserved for expert hands and that too as a last resort measure.

Postoperative airway complications such as laryngeal edema, bleeding, and laryngospasm are expected in such cases, and therefore postoperative respiratory care and observation for bleeding or airway edema are recommended. Judicious administration of a systemic steroid can help. Preoperative information on orientation of the lesion assists in positioning the patient and minimizes the degree of dynamic obstruction. Finally, neonates/infants with stridor should be managed by an experienced team of an otolaryngologist, a pediatric anesthesiologist, and a neonatologist in an institution with the requisite infrastructure for adept management of the airway.

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