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Review

Perspectives on neonatal and infant tracheostomy

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SUMMARY

Neonates and infants may need a tracheostomy for many different reasons, ranging from airway obstruction to a requirement for long term mechanical ventilator support. Here, we present the pathophysiology of the many congenital and acquired conditions that might be managed with a tracheostomy. Decisions about tracheostomy demand consideration of not only the benefits, but also the potential side-effects, which may differ in the short and long term and may be attributable to underlying conditions as well as the tracheostomy. Evaluation of potential advantages of tracheostomy will influence decisions about optimal timing. In many cases, an infant may 'graduate' from dependence on a tracheostomy and resume a natural airway, although some will require reconstructive airway surgery.

1. Why perform tracheostomy in an infant?

A tracheostomy may be considered for an infant with congenital or acquired structural airway problems that are not amenable to a simple surgical correction or if there is a need for long term support from a mechanical ventilator. The indications for tracheostomy have changed as our care of infants, especially extremely preterm infants, has evolved (Fig. 1) [1]. These are best characterized by whether the etiology is congenital or acquired, by the level of obstruction, and by whether the obstruction is due to an anatomic or a functional issue.

As with many decisions, the risks of this invasive intervention must be weighed against the benefits. The clinician must consider the risk:benefit ratio of tracheostomy both for the short term as well as for the long term, in the context of the infant's other comorbidities. Whereas tracheostomy as a surgical procedure is relatively straightforward, there are many important aspects of caring for infants with tracheostomies that require knowledge, experience, and an appreciation for the impact of tracheostomy on both the infant and the family.

In this review, we discuss indications for tracheostomy, considerations about timing of tracheostomy placement, and short and long term outcomes after tracheostomy in infants.

2. Indications for infant tracheostomy

2.1. Congenital airway anomalies

2.1.1. Extrathoracic airway obstruction

Because infants are obligate nose breathers, obstruction of the nasal passages by choanal atresia, piriform aperture stenosis, or in rare instances a tumor such as a glioma, encephalocele, teratoma, or dermoid can be debilitating. Nasal obstruction usually manifests as immediate postnatal respiratory distress, which can often be relieved with an oral airway. Obstruction of the oral or extrathoracic airway may occur from severe micrognathia or retrognathia, cervical teratomas, head/neck vascular or lymphatic malformations, or deeper anomalies such as congenital elliptical subglottic stenosis, laryngeal cleft, severe laryngomalacia, and airway hemangiomas. A rare cause of airway obstruction in the neonate is congenital high airway obstruction syndrome (CHAOS). CHAOS results from obstruction at the laryngeal or tracheal level from laryngeal or tracheal atresia, laryngeal cyst, or intraluminal web. CHAOS may be diagnosed prenatally with features such as distension of the tracheobronchial tree and enlarged, echogenic lungs [2]. Fetuses with CHAOS may require delivery at a quaternary center capable of performing ex-utero intrapartum treatment (EXIT) to secure the airway.

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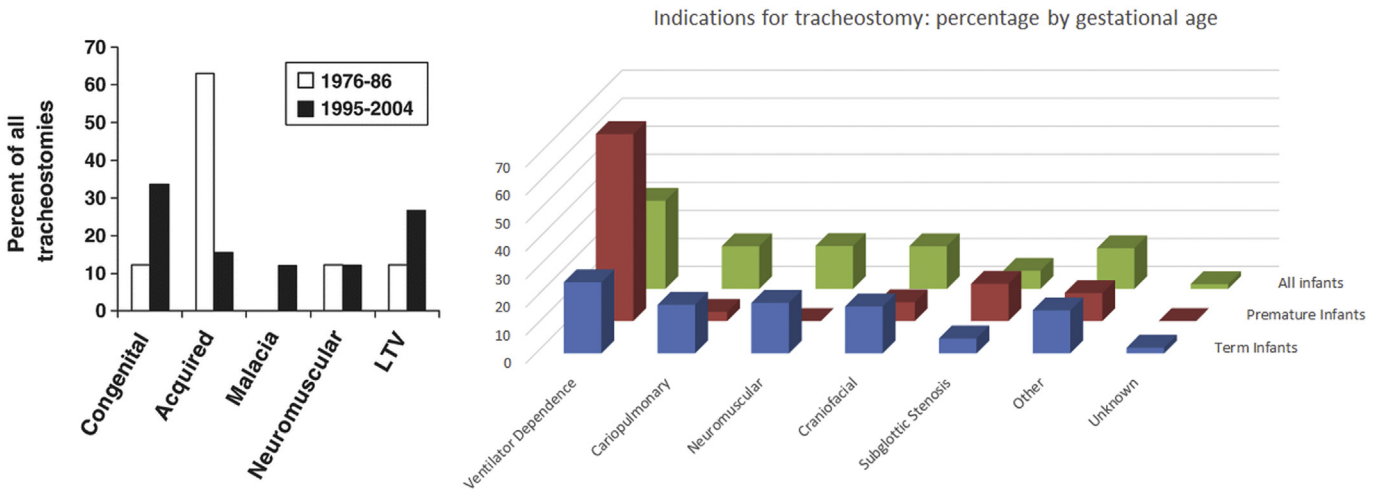

Fig. 1. Two perspectives on changing indications for tracheostomy: (a) variation in indications with epoch of care (reprinted from Corbett et al. [1] © 2007 with permission from Elsevier); (b) variation in indications based on gestational age category. (Data from Mercy Children's Hospital in Kansas City provided by Dr. Julie Wei.)

2.1.2. Intrathoracic airway obstruction

Tracheomalacia results from deficiency of supporting tracheal cartilage rings or extrinsic compression from a vascular ring or sling (Fig. 2a) [3]. Bronchomalacia may occur in conditions such as tetralogy of Fallot with absent pulmonary valve syndrome, where the dilated main pulmonary arteries compress the mainstem bronchi [4]. Strategies to help these infants breathe include "stenting" the airways with high pressures, which may require chronic mechanical ventilation.

Malformation of cartilaginous structures in the trachea and bronchi may lead to stenosis; for example, in Pfeiffer syndrome, the

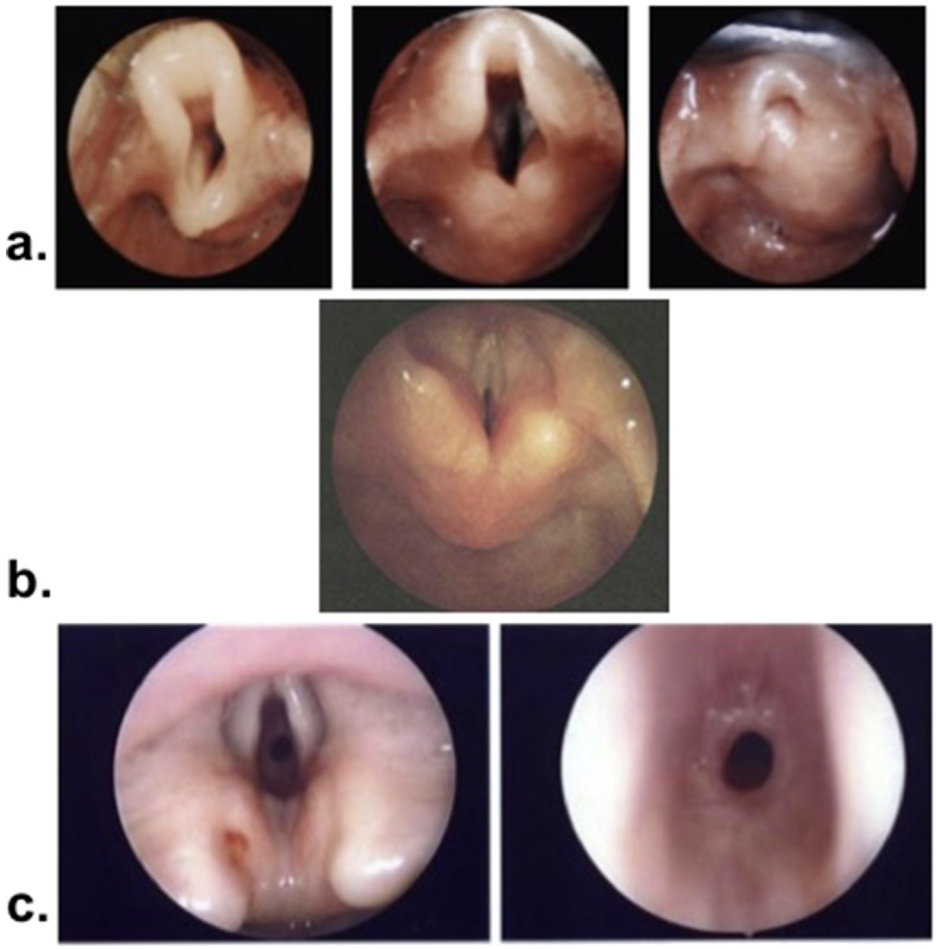

Fig. 2. Airway anomalies necessitating tracheostomy: (a) laryngomalacia, (b) bilateral vocal cord paralysis, (c) subglottic stenosis. (Courtesy of Dr Julie Wei (a, c) and Dr Steven Sobol, The Children's Hospital of Philadelphia Neonatal Airway Program (b).)