Managing tracheal extubation in infants with stridor and congenital neuraxial anomalies

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ABSTRACT

Stridor is a serious complication of congenital neuraxial anomalies, which though, can get completely resolved with early neurosurgical correction of the anomaly. However, stridor relief may or may not be achieved soon after surgery. Persistent postoperative stridor can potentially cause extubation failure that may be difficult to handle in small children. There are no extubation guidelines for difficult pediatric airways as yet, and fewer appropriate airway-assist devices for routine use. Management of an infant with occipital encephalocele, hydrocephalus and bilateral abductor vocal cord palsy, who developed post-extubation respiratory distress due to stridor is discussed, together with the relevant tracheal extubation issues in such cases.

Key words: Airway management, Arnold–Chiari malformation, congenital vocal cord palsy, pediatrics, stridor, tracheal extubation

Introduction

Stridor due to vocal cord (VC) palsy is an alarming complication, albeit infrequent, of congenital neuraxial anomalies, particularly Arnold–Chiari malformations (ACM); meningoencephalocele, encephalocele, and hydrocephalus may also coexist with the ACM.[1] Timely neurosurgery can relieve the stridor completely,[1,2] but not necessarily immediately, placing the affected children at risk of postextubation respiratory distress; decision regarding the optimal timing and method of tracheal extubation in them is hence vital. However, unlike intubation, extubation issues in pediatric neuraxial anomalies are neglected and barely discussed. Existing extubation guidelines for a known difficult airway largely address adults, and fewer airway-assist devices suitable for infants and neonates are available for routine use, especially in a resource-limited country like ours. Airway management in such children is thus often individualized as is highlighted by the following case description.

Case Report

A 2-month-old male child presented with a 3-day-old history of breathing difficulty and high-pitched inspiratory stridor. He had a large head (42 cm circumference), occipital swelling (12 cm × 15 cm size), tachycardia, tachypnea, nasal flaring, sternal and intercostal retraction, and 90% oxygen saturation (SpO₂). X-ray chest was normal, and magnetic resonance imaging brain revealed hydrocephalus, occipital encephalocele, ACM Type III, and visible traction on the brainstem [Figure 1]. Otolaryngology evaluation of VC using a flexible fiberoptic bronchoscope (FFB) revealed...
bilateral abductor VC paresis. The child was taken up for encephalocele repair and ventriculoperitoneal shunt insertion after administration of oxygen and steroids. Anesthesia was induced in the lateral position with sevoflurane and oxygen, and tracheal intubation achieved during spontaneous breathing in two attempts. The surgery was uneventful, and at the end, tracheal extubation was done following adequate anesthetic recovery; an infant FFB was not available to us. The stridor reappeared postoperatively causing strenuous breathing and hypoxia (SpO₂ 82%) that eventually necessitated reintubation. Direct laryngoscopy (DL) revealed impaired VC movements like before but no laryngeal edema. Subsequent FFB evaluations showed progressive improvement in VC function. FFB-assisted tracheal extubation was attempted after 72 hours with the otolaryngologist present; the endotracheal tube (ETT) was pulled out over the FFB placed prior in the trachea and completely removed only after ensuring satisfactory breathing. A faint stridor was present which gradually disappeared.

Discussion

Stridor develops in nearly one-third of children with coexistent ACM Type II, lumbar meningomyelocele, and hydrocephalus; bilateral abductor VC palsy is the cause in up to 12.5% of ACM patients. The palsy is mostly secondary to brainstem herniation with traction on vagal fibers that innervate VC abductor muscles; brainstem dysgenesis or ischemia and cranial nerve nuclei hypoplasia are infrequent causes. The brainstem traction can be completely relieved by early, simple correction of the encephalocele and hydrocephalus, thereby avoiding complicated craniovertebral decompression procedures for ACM in small children.¹ VC palsy may not resolve once irreversible brainstem damage occurs, necessitating prolonged airway support with tracheostomy, arytenoidectomy, or VC lateralization procedures.¹,² Stridor management involves VC examination and airway control where required. The latter may be problematic when a large occipital encephalocele and an over-sized hydrocephalic head accompany the stridor as in this case. Intubation in the lateral position, intubation on a raised platform with foam cushions, and intubation with the head off the table edge are some of the intubation modalities described for such cases.¹ The only available report focusing on airway management in ACM-associated VC palsy emphasizes on maintaining spontaneous breathing during intubation and readiness with various intubation aids, emergency tracheostomy facilities, and trained personnel.¹

Tracheal extubation concerns, such as “when and how” to safely remove the ETT, are also vital here. Although delaying extubation is otherwise not unusual in a neurosurgical scenario, it is not routinely practiced in children with neuraxial defects where the airway difficulty is expected to resolve following surgery. On-table extubation is mentioned in two earlier reports,¹,² but a clear policy on this issue has not emerged due to dearth of reported experience.

Safe extubation in a difficult airway scenario is best achieved by adopting a strategic, step-wise approach, and various guidelines to this effect have been proposed.¹⁴ These however pertain only to adults and there are no specific guidelines to direct extubation in pediatric difficult airways. Further, most airway aids that form an integral part of the extubation strategy in adults¹⁴ have limited routine use in children due to nonavailability of smaller sizes, inexperienced handling, and insufficient supporting literature.

Determining airway competence before extubation is ideal, but not easy. Presence of the ETT hinders clear VC visualization by DL or indirect laryngoscopy, while the cuff leak test is an insensitive predictor of extubation outcome in children.¹⁵ Use of a FFB with a laryngeal mask airway (LMA) is advocated for assessing preextubation VC status and also facilitating extubation and reintubation in adults;¹⁶ however, lesser availability of smaller-sized FFBs and LMAs and need for high operator expertise preclude the widespread use of this method in neonates and infants. Laryngeal ultrasound is a noninvasive and easily reproducible adjunct to FFB and has proven useful for VC evaluation in intubated adults; however, its application in small children needs further study.¹⁶ Airway exchange catheter (AEC) is a promising reintubation guiding tool that can be retained in the trachea for long and also provide supplemental oxygen.¹⁷ However, it can potentially exacerbate airway reactivity and obstruction in infants whose tracheas are smaller compared to the AEC. In a study evaluating the utility of AECs in pediatric difficult airways, two infants required reintubation due to airway obstruction, possibly caused by the AEC itself.¹⁸ In view of its yet uncertain risk/benefit ratio, use of AECs in infants requires caution.

Thus, management of tracheal extubation in small children with stridor and neuraxial anomalies is yet unestablished and is largely based on individual preferences. A FFB-guided, on-table extubation trial appears to be a reasonable option at present.
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Conflicts of interest
There are no conflicts of interest.

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