

## Paediatric Intensive Care Unit

# Prevention and management of Post Extubation Stridor

Staff relevant to:	Medical, nursing and allied health professionals on PICU & CICU
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### 1. Introduction and Who Guideline applies to

The following guideline outlines the prevention and management of post extubation stridor in paediatric patients within the East Midlands Congenital Heart Centre on PICU and within the Leicester Children's hospital on CICU.

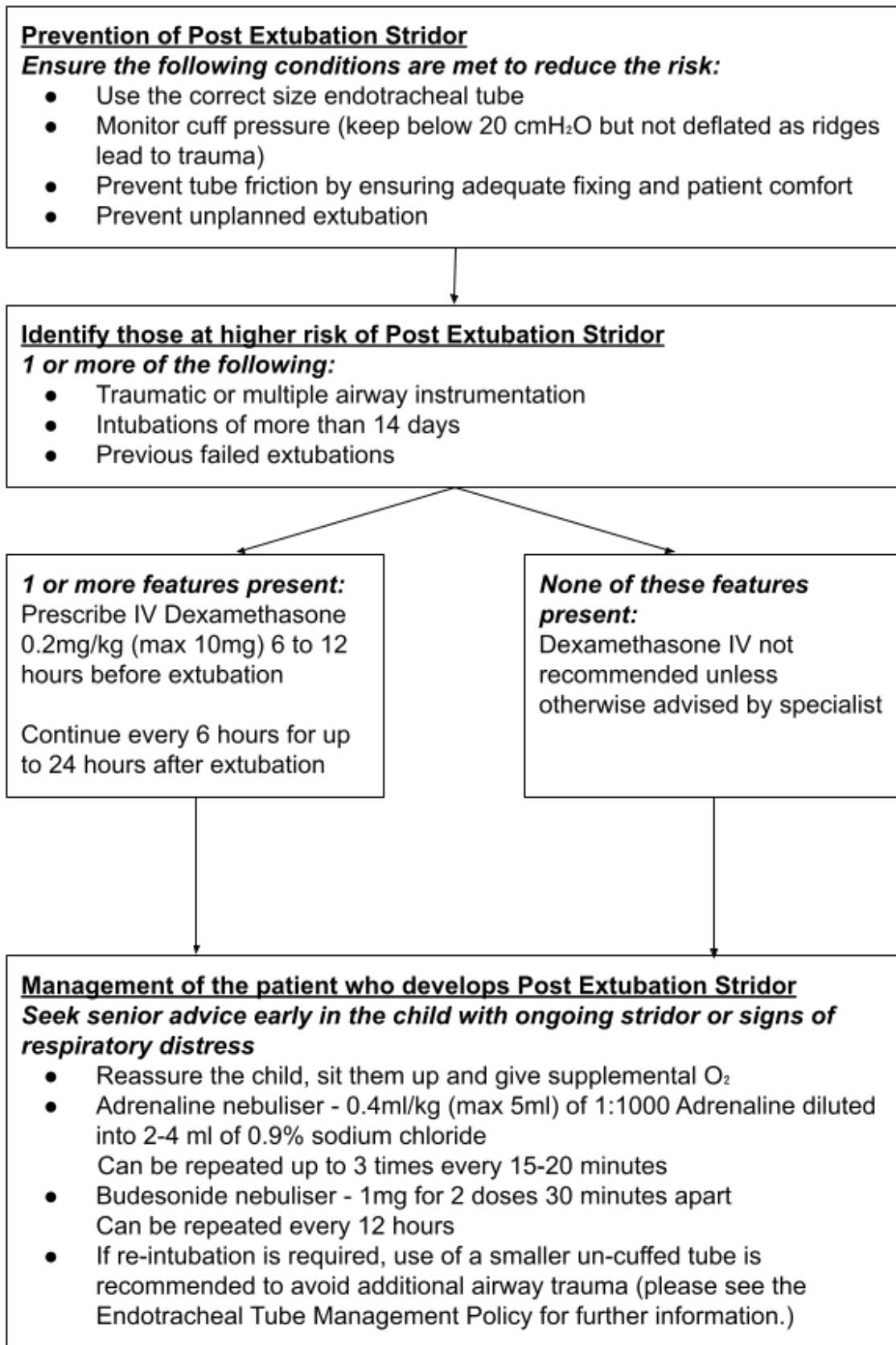
It can be used as an aid and learning tool by medical, nursing and allied health professionals involved in the management of those paediatric patients at risk of or with post extubation stridor.

### 2. Guideline Standards and Procedures

**Figure 1 on page 2 summarises the Prevention and Management of Post Extubation Stridor.**

Post extubation stridor (PES) is a well-recognised complication of intubation particularly in children, owing to their anatomically narrower upper airway. PES is associated with increased morbidity due to; prolonged hospital stay, risk of failed extubation, reintubation airway trauma and nosocomial infection. Incidence is variable depending on patient factors; however, a 2020 European study showed an incidence of 18.7%<sup>1</sup>, and this hasn't changed over time<sup>11</sup>.

PES is most commonly a manifestation of trauma associated laryngeal-subglottic oedema and inflammation caused by pressure from the endotracheal tube. In most of these cases, the oedema and inflammation resolve spontaneously, although a minority develop more serious complications such as subglottic or tracheal stenosis, necrotising tracheobronchitis and tracheal perforation. PES can also be due to poor clearance of secretions, brainstem dysfunction, vocal cord paralysis, vocal cord granuloma or pre-existing subglottic stenosis.



## **Risk Factors**

- Patient related factors: Age (1-4 years), pre-existing tracheal irritation (such as Gastroesophageal Reflux or infection), airway pathology and neurological impairment
- Tube / intubation related factors: Incorrect size of endotracheal tube, cuff pressure over 25 cm H<sub>2</sub>O, traumatic or repeated intubation attempts
- Care related factors: Excessive movement of the tube in the trachea (due to inadequate sedation or fixation), aggressive tracheal suctioning, presence of an NG tube, self extubation or excessive coughing with an endotracheal tube in place

## **Vocal Cord Palsy**

This is caused by recurrent laryngeal nerve damage and can be unilateral or bilateral. It can occur as a complication of cardiothoracic surgery, in particular following aortic arch surgery and Norwood procedures. Diagnosis is made at laryngoscopy. Consequences can include; failed extubation, prolonged mechanical ventilation and delayed oral feeding (with aspiration described in almost half of cases.)<sup>(2)</sup> Spontaneous recovery occurs in a third to two thirds of patients, usually within 6 months.<sup>(3)</sup> In a small number of patients, surgical widening of the glottis space, or rarely tracheostomy may be required.

## **Evidence for Pre Extubation Dexamethasone and continuing doses regime**

The 2009 Cochrane review<sup>(4)</sup> of the use of prophylactic steroids to reduce reintubation rates showed that there was a trend in neonates and adults towards fewer re-intubations in patients pre-treated with steroids, which was more pronounced in patients at high risk, though it never reached statistical significance. Dose of dexamethasone used in the studies ranged from 0.25-0.5mg/kg given 6 hours before extubation and every 6 hours for up to 24 hours after extubation. Subgroup analysis revealed that post extubation stridor could be reduced in adults with a high likelihood of post extubation stridor when corticosteroids were administered as multiple doses begun 12-24 hours prior to extubation compared to single doses closer to extubation.

Subsequent studies in adults found that dexamethasone given 4 to 6 hours before extubation and carried on thereafter post-extubation every 6 hours for the next 24hours, had the best results.<sup>(5)</sup> A later 2020 meta-analysis in children showed that the use of corticosteroids was associated with significant reductions in post extubation stridor and the need for reintubation (with doses ranging from 0.15mg/kg to 0.5mg/kg.)<sup>(6)</sup>

A 2016 study in adults showed low dose dexamethasone regimes were equally as effective in preventing post extubation stridor as higher dose regimes.<sup>(7)</sup>

Based on this evidence as described above, a dose of 0.2mg/kg dexamethasone IV administered 6-12 hours pre-extubation and continued based on the need every 6 hours for up to 24 hours is recommended. Maximum dose should not exceed 10mg per dose. Oral dexamethasone at the same dose and frequency could be given if needed as per the clinical circumstances (eg: no iv access /waiting for iv access).

### **Evidence for Post Extubation Stridor Treatments**

Nebulised adrenaline (vasoconstrictor) and budesonide (steroid) are recommended as they reduce laryngeal oedema. A randomised controlled trial showed both drugs were equally effective in the acute management of post extubation stridor, although adrenaline showed a more sustained effect.<sup>(9)</sup> There have been previous concerns regarding rebound phenomenon following the use of nebulised adrenaline, however a 2019 meta-analysis found that although symptoms may return, they are not worse than at baseline and are reduced by concurrent administration of oral or parenteral steroids.<sup>(10)</sup>

As per the latest evidence, application of non-invasive ventilation is not indicated as it does not improve outcomes and increases the delay to intubation.<sup>(5)</sup> However, NIV such as high flow, CPAP and / or BiPAP could possibly be used as rescue therapy or bridge while waiting for adrenaline or steroids to work or for definitive treatment modality - which could be re-intubation. Similarly, for the use of Heliox in post extubation stridor, large clinical trial evidence is lacking and therefore its use as a treatment for post extubation stridor is not recommended. However, in the same way as NIV, it could be considered as a possible rescue or bridging therapy until definitive treatment.<sup>(5)</sup>

### **Conclusions**

Post extubation stridor is a not uncommon complication of short and long term intubation in children. It may be prevented by paying attention to details of paediatric intubation (correct tube, correct fixation), by repeated measurement of cuff pressure if used and adequate sedation of the agitated child.

Studies have shown pre extubation administration of corticosteroids reduce the occurrence of post extubation stridor and the need for reintubation. Therefore prescription of these should be considered in children at higher risk of this condition.

Management of post extubation stridor entails providing a reassuring environment, administering oxygen and re-intubation with a smaller tube without cuff (if lung condition allows) if necessary. To note, a recent study by Bibl et al. did not find any difference in the incidence of PES with the use of cuffed and uncuffed tubes in smaller children<sup>11</sup>. Be aware that oxygen and NIV can mask severity of upper airway obstruction and desaturation in this context means impending respiratory arrest. If there is need for oxygen supplementation or NIV, PREPARE FOR INTUBATION. Current treatments of choice include nebulised adrenaline and corticosteroids.

Heliox and NIV do not reduce laryngeal oedema and therefore stridor and hence are not recommended treatments. However, they could be used to buy time to establish definitive solution for upper airway obstruction.

### **3. Education and Training**

Training and raising awareness are on-going processes. Awareness is promoted through induction and bedside teaching. Training is provided for medical staff during weekly scheduled teaching and other sessions including junior doctors' induction. Nursing education is supported by the Practice Development teams, and nursing educators.

#### **4. Monitoring Compliance**

What will be measured to monitor compliance?	How will this be measured?	Monitoring lead	Frequency	Reporting arrangements
Guideline adherence	Audit	PICU Consultant	On-going	CPM/RISK

#### **5. Supporting References**

1. Veder LL, Joosten KF, Schlink K, Timmerman MK, Hoeve LJ, van der Schroeff MP, Pullens B. Post-extubation stridor after prolonged intubation in the pediatric intensive care unit (PICU): a prospective observational cohort study. *European Archives of Oto-Rhino-Laryngology*. 2020 Jun;277(6):1725-31.
2. Truong MT, Messner AH, Kerschner JE, Scholes M, Wong-Dominguez J, Milczuk HA, Yoon PJ. Pediatric vocal fold paralysis after cardiac surgery: rate of recovery and sequelae. *Otolaryngology—Head and Neck Surgery*. 2007 Nov;137(5):780-4.
3. Joo D, Duarte VM, Ghadiali MT, Chhetri DK. Recovery of vocal fold paralysis after cardiovascular surgery. *Laryngoscope*. 2009;119(7):1435-1438.
4. Markovitz BP, Randolph AG. Corticosteroids for the prevention and treatment of post-extubation stridor in neonates, children and adults (Cochrane Review). *The Cochrane Library*. Oxford, Update Software. 2000(2).
5. Pluijms WA, van Mook WN, Wittekamp BH, Bergmans DC. Postextubation laryngeal edema and stridor resulting in respiratory failure in critically ill adult patients: updated review. *Critical Care*. 2015 Dec;19(1):1-9
6. Kimura S, Ahn JB, Takahashi M, Kwon S, Papatheodorou S. Effectiveness of corticosteroids for post-extubation stridor and extubation failure in pediatric patients: a systematic review and meta-analysis. *Annals of intensive care*. 2020 Dec;10(1):1-9.
7. Chang-Yi Lin, Kuang-Hua Cheng, Li- Kuo Kou. Comparison of High- and Lowdose Dexamethasone for Preventing Postextubation Airway Obstruction in Adults: A Prospective, Randomized, Double blind, Placebo-controlled Study. *International Journal of Gerontology* 10 (2016) 11e16.
8. Markovitz BP, Randolph AG, Khemani RG. Cochrane review: Corticosteroids for the prevention and treatment of post-extubation stridor in neonates, children and adults. *Evidence-Based Child Health: A Cochrane Review Journal*. 2008 Dec;3(4):1123-45.
9. Sinha A, Jayashree M, Singhi S. Aerosolized L-epinephrine vs budesonide for post-extubation stridor: A randomized controlled trial. *Indian pediatrics*. 2010 Apr;47(4):317-22.

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10. Sakthivel M, Elkashif S, Al Ansari K, Powell CVE. Rebound stridor in children with croup after nebulised adrenaline: does it really exist? *Breathe (Sheff)*. 2019 Mar;15(1):e1-e7.
11. Bibl K, Pracher L, K  ng E, et al. Incidence of Post-extubation Stridor in Infants With Cuffed vs. Uncuffed Endotracheal Tube: A Retrospective Cohort Analysis. *Front. Pediatr*. 2022 (May). Vol 10:864766. doi: 10.3389/fped.2022.864766

## **6. Key Words**

Post Extubation Stridor, steroids, laryngeal oedema, vocal cord palsy

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**The Trust recognises the diversity of the local community it serves. Our aim therefore is to provide a safe environment free from discrimination and treat all individuals fairly with dignity and appropriately according to their needs. As part of its development, this policy and its impact on equality have been reviewed and no detriment was identified.**

CONTACT AND REVIEW DETAILS	
<b>Guideline Lead (Name and Title)</b> Dr R Mallavarapu – PICU clinical fellow Dr B Saikia - Consultant	<b>Executive Lead</b> <b>Chief Medical Officer</b>
<b>Details of Changes made during review:</b> Added oral dose of dexamethasone  Added a recent study which shows the incidence of PES with cuffed vs. uncuffed ETT.  No change in the incidence of PES	