Prevention and management of Post Extubation Stridor

1. Introduction and Who Guideline applies to

The following policy outlines the prevention and management of post-extubation stridor on PICU/CICU. It applies to Medical and nursing staff on PICU/CICU involved in the management of patients at risk of or with post extubation stridor

This guidance can be used as an aid and learning tool by medical, nursing and allied health professional staff involved in the in the management of patients at risk of or with post extubation stridor in paediatric patients within East Midlands Congenital Heart Centre and Leicester Children’s Hospital.

2. Guideline Standards and ProceduresOverview:

Post-extubation stridor (PES) is a well-recognised complication of intubation particularly in children owing to their anatomically narrower upper airway. It is a manifestation of trauma associated laryngeal-subglottic oedema and inflammation caused by pressure of the endotracheal tube. PES has associations with increased morbidity including prolonged hospital stay, risks of failed extubation – reintubation, airway trauma and nosocomial infection. In some instances, PES may also result from poor clearance of secretions, brainstem dysfunction, vocal cord paralysis, vocal cord granuloma, or subglottic stenosis.

Most cases resolve spontaneously but a minority develop more serious complications such as subglottic or tracheal stenosis, necrotising tracheobronchitis and tracheal perforation.
**Incidence:**
Variable, 1.6-6%

**Risk Factors:**
- Patient related factors: age (1 - 4 years), pre-existing tracheal irritation (GOR, infection) or airway pathology, neurological impairment
- Tube/intubation related factors: Incorrect size, cuff pressure too high (>25 cmH2O), traumatic or repeated intubation attempts
- Care related factors: excessive movement of tube in trachea (fixation/sedation) aggressive tracheal suctioning, presence of NG tube, self extubation, excessive coughing with an ETT in place

**Important PICU differentials - Vocal cord palsy**

Vocal cord palsy is a complication of cardiothoracic surgery occurring as a consequence of the recurrent laryngeal nerve damage; unilateral or bilateral. Incidence 4 - 20%; Association with Aortic arch surgery, Norwood procedure.

Diagnosis: laryngoscopy.

Consequences: failed extubation, prolonged mechanical ventilation, delayed oral feeding (aspiration has been described in almost half of cases. (7) Spontaneous recovery occurs in 1/3-2/3 patients; usually within 6 months. (8) In a small number of patients, the widening of the glottic space or very rarely tracheostomy may be indicated.

**Prevention of Post - Extubation Stridor:**

- Factors associated with reducing incidence post extubation stridor:
  - Using correct size tube
  - Monitoring cuff pressure (keep below 20cmH2O, but not deflated as ridges cause trauma)
  - Preventing friction of tube in trachea (adequate fixation and keeping child comfortable)
  - Prevention of unplanned extubation
• High risk patients:
  o Traumatic/multiple airway instrumentation
  o Intubation for more than 14 days
  o Previous failed extubation

• Steroids:
  o Cochrane review (2008) looking at use of prophylactic steroids to reduce re-intubation rates showed 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 6h before extubation and every 6h for up to 24 h after extubation[^6]. Some more recent studies looking at similar factors showed that corticosteroids are effective in the prevention of laryngeal oedema if started several hours before extubation[^2]. This conclusion was also supported by two meta-analyses done subsequently – incidence of laryngeal oedema and hence stridor is reduced if intravenously administered corticosteroids are started well in advance and if multiple doses are administered[^2 & ^3]. It was also observed that in various studies, dexamethasone was given 4 – 6h before extubation and carried on thereafter post-extubation every 6h to next 24h, had the best results[^2; 3 & 4]. Over the last few years, much knowledge has been gathered into this area and a trend is seen at using lower dose of dexamethasone (0.2mg/kg)[^2, 3 & 4]. A recent study on adults showed no difference at low v’s high dose of dexamethasone used for post extubation stridor[^10].

• Dose of steroids:
  o Dose of dexamethasone - 0.2mg/kg given 6h before extubation and every 6h for up to 24h after extubation (the prescribed dose could be rounded off to the nearest whole number; max 0.25mg/kg/dose)
Management of Post - Extubation stridor

- Reassurance, sit child up, humidified supplemental oxygen

- Adrenaline nebulizer - 0.4ml/kg per dose (max 5ml) of 1:1000 Adrenaline dilute into 2-4ml of 0.9% Sodium chloride via facemask [Ref: BNF and UpToDate]

  (Adrenaline will only be effective if laryngeal oedema is present. No studies of its efficacy in post extubation failure). Can be repeated up to 3 times every 15 - 20min (watch for rebound phenomena after 2-4 hours) [9]

- Budesonide nebuliser via facemask and O2 – 1 mg for two doses 30 minutes apart and then a 12h until clinical improvement [1, 3 & 4]

- Dexamethasone 0.2 mg/kg iv or oral QDS (6h before and every 6h for up to 24 h after extubation)

- If re-intubation is required use of a smaller un-cuffed tube is recommended to avoid additional trauma to the airway

Treatment options include vasoconstrictor nebulisations (adrenaline) and use of corticosteroids. However these are associated with their own risks and expense. There is a growing interest in the use of inhaled steroids, however their efficacy as compared to systemic steroids in the treatment of PES yet need to be proved. As per the latest evidence, application of non-invasive ventilation or use of helium/oxygen mixture is not indicated as it does not improve outcome and increases the delay to intubation [2 & 3]. However, NIV such as high flow, CPAP and/or BiPAP could possibly be used as rescue therapy or bridge while waiting for adrenaline/steroids to work or definitive treatment modality, which could be re-intubation. Similarly, for use of heliox too, modern day evidence is lacking; possibly the justification for its use could be very similar to non-invasive ventilation.

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. In the recent studies, intravenous corticosteroids have shown benefit in preventing/reducing the laryngeal oedema and stridor by more than 50% if used appropriately. Management is by providing reassuring environment, oxygen and re-intubation with a smaller tube if necessary. Current treatment of choice includes nebulised adrenaline and corticosteroids - intravenous and nebulized in the management of post extubation stridor; however efficacy of both individually as well as the combination of both has
not been established in clinical trials for the use of post extubation stridor (unlike in viral croup). Heliox and NIV do not reduce laryngeal oedema and therefore stridor and hence not recommended – however 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. On-going awareness is promoted through the induction and continuous bedside teaching. Training is provided for medical staff during lunchtime teaching (Wednesdays) and other sessions, and at junior doctors’ induction training. Nursing education is supported by the Practice Development teams, and nursing educators.

4. Monitoring Compliance

<table>
<thead>
<tr>
<th>What will be measured to monitor compliance</th>
<th>How will compliance be monitored</th>
<th>Monitoring Lead</th>
<th>Frequency</th>
<th>Reporting arrangements</th>
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<tbody>
<tr>
<td>Adherence to the guideline</td>
<td>Audit</td>
<td>PICU Cons</td>
<td>On-going</td>
<td>CPM/RISK</td>
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</tbody>
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5. Supporting References (maximum of 3)

1. Chiwane S, Sarnaik A. Postextubation Stridor: What’s All That Beyond the Noise? Paed Crit Care; 2017 (May); 18 (5). DOI: 10.1097/PCC.0000000000001143


6. Key Words Post extubation stridor, steroids, laryngeal oedema, vocal cord palsy

<table>
<thead>
<tr>
<th>CONTACT AND REVIEW DETAILS</th>
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<tbody>
<tr>
<td>Guideline Lead (Name and Title)</td>
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<td>Bedangshu Saikia Consultant</td>
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<th>REVIEW RECORD</th>
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<tr>
<td>Description Of Changes (If Any)</td>
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<tr>
<td>• Added Vocal cord palsy as important PICI differential</td>
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<tr>
<td>• Dose of Adrenaline neb changed according BNF</td>
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<td>• Added inhal steroids as a treatment option</td>
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<tr>
<td>• Added comment about Heliox/NIV</td>
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<td>• Dose of Dexamethasone unified to 0.2 mg/kg a 6h</td>
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