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Guideline for Extubation in PICU Patients

Purpose: To ensure patient safety, the patient with a temporary, artificial translaryngeal airway should have the device removed at the earliest appropriate time. Occasionally, acute airway obstruction of the artificial airway due to mucus or mechanical deformation mandates immediate removal of the artificial airway. (This guideline pertains to the decision processes surrounding the removal of an artificial translaryngeal airway, and the procedure referred to as extubation.)

Who may perform: RCP or M.D. RCP should be at bedside prior to procedure.

1. Prior to extubation, exclude the various clinical factors associated with extubation failure:
    a. Normalizing respiratory physiology (improvement in the disease process that resulted in respiratory failure, improved chest X-ray, ABG values at baseline while weaning ventilator, low FiO2 requirements)
    b. Protective airway reflexes present: gag reflex with oropharyngeal stimulation, cough reflex with tracheal suctioning
    c. No airway obstruction (e.g. macroglossia, adenotonsillar hypertrophy, supraglottic or subglottic edema, retropharyngeal abscess etc.)
    d. Empty stomach (NPO for 4-6 hours at least)
    e. Weaning sedation, good respiratory drive
    f. Manageable respiratory secretions (does not require pulmonary toilet or frequent suctioning)
    g. Stable hemodynamic function, with no signs of pulmonary hypertension (if patient was on iNO, weaned to $\leq$2ppm)
    h. No signs of increased ICP
    i. No signs of diaphragmatic dysfunction

2. For at least 2 hours, place the patient on:
    a. CPAP at 5 cmH_2O; OR
    b. CPAP at 5 cmH_2O with Pressure Support (PS) of 5 cmH_2O; OR
    c. SIMV with rate of 4-8 bpm, PEEP of 5 cmH_2O ± Pressure Support (PS) of 5 cmH_2O; OR
    d. Volume Support (VS) with Vt 6 ml/kg, PEEP of 5 cmH_2O

    …..and monitor the patient's spontaneous respiratory rate (RR), spontaneous Vt (if on Pressure Support) or PIP (if on Volume Support). To qualify for extubation, the patient must maintain:
    - RR $\leq$45 bpm (0-2 years) RR $\leq$30 bpm (2-10 years) RR $\leq$20 bpm (10-16 years), *AND*

- spontaneous Vt ≥5.5 ml/kg if on Pressure Support ***OR*** PIP ≤20 cmH_2O if on Volume Support
- If an ABG if obtained, check that the Oxygenation Index (OI) is less than 6 ($OI=100\times MAwP\times FiO_2 / PaO_2$)

3. For all patients ≤ 2 years, if patient has been intubated for >48 hours, start Dexamethasone (0.5 mg/kg IV [max dose 10 mg] Q6hrs X 4 doses); first dose given at least 12 hours prior to extubation.
4. For all other age groups, if the patient
    a. has required multiple attempts at intubation, or
    b. was intubated more than once, or
    c. has failed extubation within 48 hours, or
    d. has undergone airway surgery

    → Start Dexamethasone therapy (0.5 mg/kg IV [max dose 10 mg] Q6hrs X 4 doses), with first dose given 12 hours prior to extubation.
5. If the patient is at risk for subglottic edema, consider performing a Leak Test prior to extubation. An audible leak heard (not with the stethoscope) at ≤30 cmH_2O is a reasonably good predictor for extubation success.
6. If patient is at risk for neuromuscular weakness, consider monitoring the Negative Inspiratory Pressure generated spontaneously by the patient. A negative inspiratory pressure (NIP) of ≥20 cmH_2O is a reasonably good predictor for extubation success.
7. Respiratory Therapist to prepare nebulized Racemic Epinephrine (2.25%, 0.25–0.75 mL, add NS up to 3 mL) for extubation.
8. If the respiratory status remains stable after extubation, restart feeds at 6 hours after extubation, reduce IV fluids accordingly.

Bibliography:

1. Francois,Bruno, 12-h pretreatment with methylprednisolone versus placebo for prevention of postextubation laryngeal oedema: a randomized double-blind trial.*The Lancet* Vol 369 March 31, 2007

2. Anene,Okechukwu, Neert,Kathleen, Dexamethasone for the prevention of postextubation airway obstruction: A prospective,randomized double-blind, placebo-controlled trial. *Critical Care Medicine* 1996 volume 24 Issue 10

3. Jaber, Samir, Jung,Boris, Effects of steroids on reintubation and post-extubation stridor in adults: meta-analysis of randomized controlled trials. *Critical Care* 2009 13:R49

4. Newth, Christopher, Venkataraman,Shekhar., weaning and extubation readiness in pediatric patients. *Pediatric Critical Care Medicine* 2009 Volune 10 No.1

Extubation Readiness Procedures

Assess patient at 6AM ± 2 hours for:

- Spontaneous breathing with RR within range
- Exclude conditions associated with failure
- Patient tolerates CPAP or CPAP+PS or SIMV±PS or VS for a minimum of 2 hours
- If ABG, check OI < 6 ($OI=100\times MAP\times FiO_2 / PaO_2$)

→ If **NO**, then continue current plan

→ If **YES**, then test extubation readiness

Testing Readiness for Extubation

1. Temporarily stop enteral feeds, increase IV fluids
2. If FiO_2 not 0.4, set FiO_2 to 0.4
3. If PEEP not 5 cmH_2O, set PEEP to 5 cmH_2O
4. Evaluate SpO_2 after making these changes:
   a. If SpO_2 is $\geq$95%, change ventilator to PS
      (PS is set at 10 cmH_2O if ETT is 2.5-3.5 mm
      8 cmH_2O if ETT is 4.0-4.5 mm
      6 cmH_2O if ETT is >5 mm)

→ Monitor SpO_2 ($\geq$95%), Vt ($\geq$5 ml/kg), RR (at goal)

   b. If SpO_2 $\geq$95%, change ventilator to VS (Vt 6ml/kg)

→ Monitor SpO_2 ($\geq$95%), PIP ($\leq$20cmH_2O), RR (at goal)

Passed – Ready for Extubation (from a pulmonary perspective) if all are present for at least 2 hours:

1. SpO_2 at least 95%
2. Exhaled Vt at least 5 ml/kg
3. Respiratory rate at goal for age:
   RR $\leq$45 bpm (0-2 years)
   RR $\leq$30 bpm (2-10 years)
   RR $\leq$20 bpm (10-16 years)
4. Start Decadron (0.5 mg/kg IV [max dose 10 mg] Q6hr X 4 doses), first dose given 12 hours before extubation

→ **If passed**, keep on existing settings, patient is ready for extubation from a pulmonary perspective; if indicated, consider performing a Leak Test and/or measure Negative Inspiratory Pressure.

→ **If not passed from a pulmonary perspective**, return to pre-test ventilator settings, restart enteral feeds, adjust IV fluids, and retest the next day **at 6AM ± 2 hours.**

→ **If not passed from a sedation perspective**, return to pre-test ventilator settings, titrate sedation and retest at **2 PM ± 2 hours.**