

## Baby Trachs: Use of the Passy-Muir® Valve in the NICU to Optimize Swallowing and Feeding



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## What are the Challenges?

- Limited information, much of it anecdotal, yet compelling
- Implications of tracheostomy for neonates not always well understood by NICU staff
- Benefits of Passy-Muir® Valve for the preterm and sick newborn may not be considered by NICU staff due to lack of information



## Spreading the Word in NICU

- Partner with RT
- SLP and RT complete Passy-Muir® Valve competency
- Information and Education for the team
  - Normal infant swallowing physiology
  - Alterations in anatomy and physiology due to trach
  - [www.passy-muir.com](http://www.passy-muir.com) -> click "Videos"
  - Benefits of Passy-Muir Valve
  - What to expect once we start
- Start slowly, facilitate learning from each baby, share the successes



## Indications for Tracheostomy in the NICU

- Requires prolonged ventilatory support
  - Neuromuscular
  - Vent dependency
- Chronic obstruction within the airway:
  - Choanal Atresia
  - Subglottic stenosis
  - Tracheomalacia, laryngomalacia, bronchomalacia
  - Vocal cord paralysis
- Chronic aspiration
- Pulmonary toileting due to inability to clear secretions



Carron et al, 2000

## Diagnoses Associated with Tracheostomy in the NICU

- Severe CNS problems
  - Arnold Chiari, Werdnig - Hoffman, Congenital Hypoventilation Syndrome
- Craniofacial problems:
  - Pierre Robin Sequence, Treacher Collins, Beckwith - Wiedemann, CHARGE Syndrome
- Chronic Lung Disease, BPD



## Need for NICU Care: Impact

- Clinically,
  - Adverse consequences of NICU environment
  - Prolonged NPO
  - Prolonged and/or emergent intubation
  - Extended mechanical ventilation
  - Respiratory co-morbidities with preterm
  - EER (extra esophageal reflux) common
  - Altered oral-pharyngeal sensory process experiences
  - Swallowing problems unrelated to trach



### Implications of Trach in NICU for Swallowing

- Loss of (or inability to experience) the senses of taste and smell
- Reduced or latent airway closure
- Altered subglottic pressure
- Decreased laryngeal and pharyngeal sensation
- Increased secretions: “wet trach” with mild intermittent accumulation of clear tracheal secretions to be expected
- Altered awareness/management of secretions
- Altered cough



### Implications of Trach in NICU for Swallowing: Research

- No Randomized Controlled Trials/research on neonates
- Available research only with older infants and toddlers
  - Swallowing disorders in 91% (33/36) of infants with trachs (Rosin & Peek, 1999)
  - In toddlers: Delay in swallow initiation and penetration, delayed closure of laryngeal vestibule (Abraham & Wolf, 2000)
  - 75% (60/80) infants and toddlers (0-3 years) with dysphagia: 81% oral phase, 60.9% pharyngeal phase, 79.7% esophageal (Norman et al, 2007)
  - Decreased secretion control (Abraham, 2009)

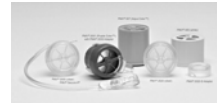
### Observed Benefits of the Passy-Muir® Valve in the NICU Population

- Infant able to communicate via cry/sounds
- Infant able to taste and smell
- Infant able to generate subglottic pressure for cough, cry, swallowing, phonation
- Reduces potential for further vocal cord dysfunction by restoring airflow over vocal cords
- Restores laryngeal/pharyngeal sensation by restoring airflow through upper airway



### Observed Benefits of the Passy-Muir® Valve in the NICU Population

- Improved secretion management: observed
  - Similar to Abraham (2009) 24/49 children wearing Passy-Muir Valve during waking hours normalized secretion management within 2 weeks due to improved sensation of secretions
- Reducing time to decannulation: observed
  - Restoration of physiologic PEEP
  - More normal breathing pattern with less excessive WOB and more use of expiratory muscles



### Passy-Muir® Valve Initial Assessment: Standard Operating Procedure

- Contraindications
  - Medical instability
  - Cannot tolerate cuff deflation
  - Inability to manage secretions
  - Airway obstruction
  - Respiratory impairment that renders lung elasticity poor and may result in air trapping
  - Unable to maintain quiet alert state



### Passy-Muir® Valve Initial Assessment: Standard Operating Procedure

- Procedure for Placement
  - Verification of trach size, type, etc.
  - Monitor vital signs, including O<sub>2</sub> saturations, throughout assessment
  - Suctioning will be performed by trained personnel
  - Cuff deflation if cuffed trach
  - Suction
  - Assess airway patency
  - Assess tolerance of procedure
  - Attach the Passy Muir Valve using a ¼ turn to right



### Baby Abel



### Baby Abel: Trial Two Application of Passy Muir® Valve

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### Ventilator Application of Passy Muir® Valve

- Before Placing Valve in-line with ventilator
  - Discussion with Respiratory Therapist regarding any changes that need to be made to the ventilator (each ventilator requires different changes)
- Placement of Passy Muir Valve in-line
  - We utilize the Passy Muir Valve 007 (Aqua)
  - Attach the Passy Muir Valve to adapter to appropriately fit the tubing
  - Place the Passy Muir Valve as close to the trach hub as possible

### VFSS: Neonatal Swallowing Physiology

Remember: need to be aware of unique components of neonatal swallowing physiology

- **Larynx already elevated** and forward at rest due to postural and structural differences
- **No epiglottic displacement**
- **Strong posterior propulsion of tongue** provides anterior hyoid motion to impact UES
- Swallow is **highly pressure driven**: valves apply pressure to direct food through oral-pharyngeal cavities



**VFSS:**  
**Neonatal Swallowing Physiology**


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- **Driving force on bolus** comes from tongue generating strong posterior propulsion
- **Pressures and their interaction critical to avoid bolus misdirection:** inability to build up adequate pressure to propel the bolus due to an open trach can distort the interrelationship of pressures
- **Cough** not reliable in the *typical* newborn: sensors not developed

**VFSS: Impact of Passy- Muir® Valve in NICU**

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- Co-morbidities unrelated to trach must be considered
- No published research with NICU infants
- Observational data
- Hypothesis:
  - **improved sensation**
  - **normalized pressure changes** within the aerodigestive system (restored subglottic positive pressure + negative esophageal pressure)
  - **vocal cord closure** = more driving force on bolus
  - **expiratory flow s/p swallow** sweeps the pharynx



**VFSS with Baby  
with Passy- Muir® Valve**

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**VFSS with Baby  
without Passy- Muir® Valve**

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