

Swallow Function: Passy-Muir® Valve Use for Evaluation & Rehabilitation

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David A. Muir

- 23 year-old ventilator dependent quadriplegic due to Muscular Dystrophy
- Developed PMV with help of his father
- David passed away in August 1990

Course Outline

- Physiology of Swallow
- Aspiration Risks
- Tracheostomy Tubes and Swallow
- The Passy-Muir® Valves
- Benefits of the Passy-Muir Valves
- Troubleshooting and Treatment Planning

Physiology of Swallow

- The Aerodigestive Tract Is a Shared System
 - Respiratory system shares a common functional space with the digestive tract and the vocal tract.
 - The trachea is a dynamic structure
 - We never fully exhale (i.e. physiological PEEP)
 - The Upper-Aerodigestive Tract Is a Valving System
 - Beginning at the lips and ending at the UES, the valves are always permitting or preventing airflow, food, or liquids to go from one direction to another.
- Consensus
 - High incidence of disordered swallowing following intubation, tracheostomy, and mechanical ventilation
- Oral Preparatory and Oral Stage Swallowing
 - Readiness to accept the bolus, including level of alertness.
 - Positioning, dentition, and medications.
 - Valving system: lip closure, lingual propulsion, velopharyngeal closure.
- Pharyngeal Stage of Swallowing
 - Hyo-laryngeal anterior motion provides some airway protection and opens UES sphincter
 - Bolus pressure widens opening of UES
 - Closure of the laryngeal valving system.
- Respiratory Pause
 - In healthy adults there is a respiratory "pause" during the swallow, with swallowing occurring most often in mid-expiration

- There is evidence that swallows occurring at lower lung volumes such as exhalation to inhalation transition are more likely to result in aspiration
- Esophageal Phase of Swallowing
 - Readiness to accept the bolus, including level of alertness.
 - Positioning, dentition, and medications.
 - Valving system: lip closure, lingual propulsion, velopharyngeal closure.
 - Reflexive phase transports the bolus via peristaltic wave.

Aspiration Risks

- Effects of Tracheostomy on Normal Swallowing Function
 - Tracheostomy is often preceded by endotracheal tube intubation. (oral or nasal)
- Well Documented Complications Associated with Endotracheal Tubes
 - Mucosal injury
 - Blunting of glottic reflexes
 - Allows free passage (aspiration) of oral-pharyngeal secretions into the upper airway with a heightened risk for Ventilator Associated Pneumonia (VAP)
- Aspiration Pneumonia Is an Opportunistic Infection
 - Something must be aspirated.
 - Aspirate must contain a respiratory pathogen.
 - Must be able to overwhelm patient's normal defense/immune system.
- Additional Identified Risk Factors Predisposing Patients to Aspiration Include:
 - Witnessed aspiration secondary to emesis or reflux.
 - Supine position and coma.
 - Enteral nutrition and presence of a nasogastric tube.
 - Multiple intubations or self-extubation.
- Aspiration
 - Incidence of aspiration in patients with tracheostomy is estimated to be in the range of 50-83% (includes "silent aspiration")
 - Is this a causal relationship?
 - Other factors cited to contribute: intubation and underlying critical illness
- Additional Identified Risk Factors Predisposing Patients to Aspiration Include:
 - COPD, age > 60 years, and acute respiratory distress syndrome
 - Prior exposure to antibiotics which predispose the patient to colonization of the upper aerodigestive tract.
 - Infection control lapses, including hand washing and non-sterile tracheal suctioning
- Ventilator Associated Pneumonia (VAP)
 - Defined as nosocomial (hospital acquired) pneumonia occurring in patients after 48 hours of mechanical ventilation via endotracheal tube or tracheostomy tube

- Oral-pharyngeal secretions colonized with bacteria bypass the cuff on the ET tube or tracheostomy tube and pass into the lower respiratory tract.
- Factors Related to Dysphagia Which May Influence Cost of Care for Tracheostomized Patients:
 - Pulmonary complications from aspiration, use of antibiotics, reduced weaning, and prolonged ICU/hospital stay.
 - Late onset aspiration due to undiagnosed laryngeal injury or impairment.
 - Depression and reduced patient participation in care, reduced quality of life and impaired communication and loss of control over decision making.

Tracheostomy Tubes and Swallow

- Early Tracheostomy (7-10 days) May:
 - Reduce incidence of VAP and further injury to the larynx caused by the ET tube.
 - Improve patient comfort including possibility for oral communication and oral diet and requirement for less sedation
 - Improve oral hygiene
 - Improve secretion management (pulmonary toilet)
- Indications for Tracheostomy
 - Upper airway obstruction
 - Pulmonary toilet
 - Mechanical ventilation
- A Tracheostomy Alters Physiological Function of Upper AeroDigestive Tract
 - Aphonia
 - Reduced ability to expectorate secretions
 - Reduced sense of taste and smell
 - Reduced physiological PEEP
 - Reduced ability to expectorate secretions
- Tracheostomy Effect on Swallowing:
 - Scar tissue formation from the tracheotomy procedure may affix the trachea to overlying tissues and the larynx may not move freely
 - If the tube is too large for the patient's trachea, patient may feel discomfort and may compensate with reduced laryngeal excursion
 - "Many physicians conceive of a tracheostomy as a solution to long term aspiration, but in reality, it may increase the problem rather than solve it." Nash, 1998
- The Cuff on the Tracheostomy Tube Is Indicated During Mechanical Ventilation
 - The cuff is designed to create a "closed" system, so the volume of air delivered to the lungs is not lost due to an upper airway leak.
 - The cuff may reduce the impact of aspiration, but cannot prevent aspiration, it sits below the level of the true vocal folds.

- Aspiration of Liquid or Food Around the Tracheostomy Tube Cuff Has Been Well Documented
 - The tracheal lumen is not static during respiration.
 - Aspiration around the tracheal cuff may be due to the leak caused by tracheal dilation during inspiration, and/or due to secretions which pool above the cuff.
 - The cuff may create a reservoir for pooled or stagnate secretions to colonize and eventually enter the lower respiratory tract.
- Cuff Mismanagement Has Been Associated with:
 - Damage to the tracheal mucosa
 - Tracheal stenosis
 - Granulation formation
 - Tracheal erosion
 - Tracheoesophageal fistula
 - Tracheal dilation
- Mismanagement of Cuff Pressures
 - Distention caused by the cuffed tracheostomy tube against the esophagus may cause liquids to overflow the UES and fall into the trachea.
 - Refluxed tube feedings or gastric contents may also enter the airway via the same mechanism
- Tracheostomy Tube Effect on Swallowing
 - Impaired oral-pharyngeal pressure
 - Impaired hyolaryngeal elevation/excursion
 - Impaired glottic closure
 - Reduced subglottic pressures and reduced sensation..
 - Muscle disuse atrophy
- Effect of Mechanical Ventilation on Swallowing:
 - Ventilator modes with a pre-set breath may push air at a time the patient is trying to maintain airway closure for a swallow.
 - If the cuff is deflated, without a Passy-Muir® valve, a translaryngeal leak may occur on inspiration and expiration.
- Evaluation and Rehabilitation of Swallowing in the Tracheostomized Patient
 - "All tracheostomy patients should be referred for speech therapy prior to surgical placement of the tracheostomy or soon thereafter." Respiratory Care, April 2005.
- Passy-Muir® Valve and Swallowing
 - Placing the Passy-Muir valve before your swallowing assessment may enhance your patient's swallowing performance
- Benefits of a Passy-Muir® Valve Include:
 - Re-connects the upper and lower airway and normalizes the aerodigestive tract and prevents disuse atrophy.

The Passy-Muir® Valves

- Passy-Muir® Valves
 - The biased-closed position, “no-leak” design of the Passy-Muir valve was invented by David Muir.
 - Since the early 1990’s numerous independent research studies have further described it’s benefits, including improved swallowing function.
- Improved Swallowing and the Passy-Muir® Valve
 - The valve is “biased closed”—closes at the end of inspiration.
 - Remains completely closed during exhalation.
 - Patient does not exhale against the valve diaphragm to close.
 - Secretions are not exhaled into the valve.
- Criteria for use of the Passy-Muir® Valve
 - Cognitive status- awake and responsive and able to follow simple instructions
 - Medically stable (individually decided)
 - Able to tolerate cuff deflation
 - non-negotiable
- Improved Swallowing and the Passy-Muir® Valve Bedside Exam:
 - Chart review, to include: indication for tracheostomy, size of tube, and goals for de-cannulation.
 - A full bedside swallow exam (BSE).
 - Diagnostic use of the Passy-Muir valve may help in assessment of airway patency, laryngeal sensitivity and function.

Benefits of the Passy-Muir® Valve

- Improved Swallowing and the Passy-Muir® Valve Trial and Placement:
 - If indicated, suction patient pre- and post slow cuff deflation, and provide oral suction.
 - May use digital occlusion to assess for upper airway patency.
 - Assess vocal quality, throat clear, cough, response to secretions.
 - Bolus test swallow
- Passy-Muir® Valve Trial and Placement Additional Assessment Tools:
 - Monitor and record baseline vital signs.
 - Pulse oximetry
 - Blue dye testing
 - Cervical auscultation
- Improved Swallowing and the Passy-Muir® Valve
 - Once in place, the Passy-Muir valve allows you to further assess the patient with instrumental assessment (VFSS or FEES)
- Improved Airflow and the Passy- Muir® Valve:
 - Patient will still inspire through the tracheostomy, but exhale through the glottis and upper airway.
- Improved Swallowing and the Passy-Muir® Valve Functions Restored: Peep
 - Facilitates end-expiratory pressure (PEEP)which increases alveolar surface area

- Physiologic PEEP is instrumental in gas exchange across blood/gas barrier
- Improved Swallowing and the Passy-Muir® Valve Functions Restored: Sensitivity
 - Improved Laryngeal and Pharyngeal Sensitivity
 - Improved Glottic Function: Ability to cough and expectorate and react to material threatening entrance to the airway.
- Improved Swallowing and the Passy-Muir® Valve Functions Restored:
 - Restoration of Subglottic Pressure: Improved duration of vocal fold closure during swallow.
 - “No-Leak” design: mimics a closed pharyngeal system, allowing improved reciprocity between respiration and swallowing.
 - “Early placement of the Passy-Muir valve may provide “physical therapy” to the upper airway, helping to reduce effect of muscle atrophy, and improve pharyngeal and laryngeal swallowing function.” Burkhead, 2007
- Early Placement of the Passy-Muir® Valve
 - Allow patients to communicate orally and actively participate in healthcare decision making

Swallowing and Passy-Muir® Troubleshooting and Treatment Planning

- Cuff Up or Down?
 - Our pulmonologist directs the nurses to feed the patient with the cuff up.
 - A clinician asks:
 - Q: How do we educate them about the risks/benefits to cuff deflation?
 - Review the role of the cuff during mechanical ventilation.
 - Request a trial of cuff deflation and Passy-Muir® valve use to restore more normal physiology.
 - Perform an instrumental exam, and document findings under both conditions.
- Swallowing Treatment Short Term Goals:
 - Patient will tolerate cuff deflation and Passy-Muir® valve placement during supervised trials with speech pathology (30 min), twice daily.
 - Patient will have functional voice, laryngeal responses (cough, throat clear) when using Passy-Muir valve, 75%
 - Patient will expectorate pulmonary secretions when using the Passy-Muir valve with reduced need for tracheal suctioning, 80%
 - Patient will participate in bedside bolus trials, demonstrating prompt and efficient swallow, and without signs/symptoms of aspiration, 80%
- Work of Breathing
 - Our pulmonologist will not let us use the Passy-Muir® valve with our patients during weaning from mechanical ventilation, stating that: “the valve will increase the work of breathing”
 - A clinician asks:
 - Q: How do I convince him otherwise?

- Work of breathing is multifactoral.
- Patients may actually benefit from “exercising” the respiratory and upper airway musculature.
- Careful monitoring of the patient by respiratory and speech.
- Swallowing Treatment Short Term Goals:
 - Patient will tolerate cuff deflation and Passy-Muir® valve placement during t-piece trials, 30 minutes, bid, with maintenance of baseline vital signs, 80%
 - Patient will participate in respiratory support exercises (diaphragmatic breathing), 10-15 min. while using the Passy-Muir valve .
 - Patient will participate in bedside swallow exam while using Passy-Muir valve .
 - Patient will tolerate ice chip trials, while wearing the Passy-Muir valve , and without signs/symptoms of aspiration, 80%.
- Dysphonia–Dysphagia Despite Passy-Muir® Valve Use
 - I have placed the Passy-Muir valve on my patient, and she tolerates it well, but she only has whispered voice, and we still document aspiration of thin liquids on a VFSS.
 - A clinician asks:
 - Q: Should I continue to use the Passy-Muir valve?
 - What do you observe?
 - s/s of dysphonia and reduced airway protection.
 - What do you request?
 - Intubation history.
 - ENT consult .
 - What do you do?
 - Vocal function/laryngeal strengthening exercises.
- Swallowing Treatment Short Term Goals:
 - Patient will tolerate Passy-Muir® valve placement 30-90 minutes daily with no decline in baseline vital signs, 80%.
 - Patient will utilize Passy-Muir valve and participate in vocal function exercise to increase vocal fold adduction for voice as measured by audible phonation attempts, 45%.
 - Patient will utilize Passy-Muir valve while participating in laryngeal strengthening exercises for improved airway protection during swallowing, 90%.
 - Patient will utilize Passy-Muir valve to maximize benefit of employing compensatory swallowing strategies, with reduced episodes of aspiration for liquid trials, 80%
- Educate and Document
 - If you didn't document it, you didn't do it.
 - Utilize the instructions and labels that come packaged with the Passy-Muir® valve.
 - Develop multidisciplinary policies and procedures for best outcomes.

Educational Opportunities

WEBINARS or SELF STUDY COURSES

Application of Passy-Muir® Swallowing and Speaking Valves

Interdisciplinary Tracheostomy Team: Where Do I Start?

Ventilator Basics for the Non-RT

Ventilator Application of the Passy-Muir Valve

Pediatric Tracheostomy and Use of the Passy-Muir Valve

Pediatric Ventilator Application of Passy-Muir Valve

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