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Tracheostomy tube manometry: evaluation of speaking valves, capping and need for downsizing

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Introduction:

Readiness to speak is a major problem for many tracheostomized patients. Evaluation for tracheostomy tube capping or speaking valve is often subjective.

Objectives:

We first wanted to assess whether there were differences among speaking valves. We developed a care pathway for tracheostomy tube evaluation and management including manometry, which we wanted to evaluate.

Methods:

Three different speaking valves were assessed using manometry and measuring dyspnea in 21 patients. Subsequently, 100 consecutive patients referred for tracheostomy tube evaluation in a long-term acute-care rehabilitation hospital were studied using our care pathway with manometry before and after tracheostomy tube changes.

Results:

Inspiratory pressures differed among the speaking valves. Borg scale was higher among patients with high expiratory pressures. Of the 100 patients, following our care pathway, speech (speaking valve or capping) was recommended for 78 patients with their initial tube, and for 93 patients within 2 days of their initial evaluation. Tracheostomy tube downsizing was recommended in 94 patients. Downsizing led to significant reductions in airway pressures. Capping was initially recommended for 12 patients and for 71 following downsizing. Women had higher pressures than men for the same size tubes.

Conclusion:

Tracheostomy tube manometry is very helpful in objectively guiding recommendations for speaking valve use, capping, and changing tracheostomy tubes. Speech is an early recommendation for most patients.

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Measurement of end-expiratory pressure as an indicator of airway patentcy above tracheostomy in children

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Abstract:

The tracheostomy speaking valve is a one-way valve that closes during exhalation. It causes redirection of exhaled gas into the larynx, mouth and nasal cavity, thus enabling children with long-term tracheostomies to speak. Whether a child can tolerate the valve depends mainly on the patency of the upper airway around and above the tracheostomy tube. To measure end-expiratory pressure (EEP) at the tracheostomy tube when the speaking valve is being put in place may be a useful noninvasive tool to assess the patency of the exhalation pathway. The authors, therefore, measured EEP when the patients were first put on the speaking valves and tried to follow-up the patients thereafter. Twenty-two tracheostomized children (aged 3.2 months to 1 7years, male/female 16/6) were recruited for the present study and EEP was measured. It was found that 13 children having the EEP in the range of 2-6 cmH2O could breathe normally through the valves and later could use the valves without any problems, whereas 9 children with EEP in the range of 10-40 cmH2O demonstrated breathing difficulties and the valves had to be taken off immediately. Bronchoscopy revealed upper airway narrowing in all of those children with unsuccessful valve placements. It was concluded that EEP was exceedingly high in children with upper airway narrowing. The measurement of EEP via speaking valves can, thus, be used as an objective indicator to evaluate the patency of upper airway proximal to the tracheostomy tube.

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Selection of pediatric patients for use of the Passy-Muir valve for speech production

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Abstract:

A potential side effect of tracheotomy in the pediatric population is poor speech development. It has been well documented that children with tracheotomies have delays in expressive and receptive language out of proportion to the child's degree of intellectual functioning. While numerous methods of augmentative devices have been proposed, none are ideal for the child with a tracheotomy. Of the choices available, the Passy-Muir valve is best suited for use in the pediatric population. We present a method of selection of patients for Passy-Muir valve placement currently in use at Blythedale Children's Hospital. The criteria employed include measurement of trans-tracheal pressures. This has not previously been presented in the literature, but has been found to be of significant value in determining who will benefit most from Passy-Muir valve placement.

Success Predictors for Passy-Muir Speaking Valve Use In a Pediatric Population: A Method Evaluation

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Introduction:

After discussing the anatomy and flow dynamics of pediatric tracheas with two pediatric critical care physicians, it was hypothesized that an audibly measured leak of 15 centimeters of water pressure (cmH20) or less and/or an electronically measured leak of 50% or greater should predict successful use of the Passy-Muir valve. This size gas leak should support sufficient gas passage around the tube without producing excessive PEEP. The Passy-Muir Speaking Valve is a one way valve intended for use with tracheostomized patients of all age groups to improve speech. Speech pathologists have incorporated use of the valve in their treatment plans for patients with swallowing discoordination. A method to predict successful use of the speaking valve was needed to prevent patient fear, distress and trauma, and future non-compliance.

Method:

Six non-mechanically ventilated tracheostomized patients between six months and five years of age were studied. Sample size was limited by our institution's total number of tracheostomized children who were not mechanically ventilated. The gas leak around each patient's tracheostomy tube was evaluated audibly with a flow-inflating resuscitation bag with an in-line pressure manometer. Electronic evaluation of the tube leak was performed in accordance with the Bear Neonatal Volume Monitor User Manual and results were reported as a percentage (expired tidal volume/inspired tidal volume=% leak). Audible evaluation with the resuscitation bag was achieved by placing a stethoscope over each patient's trachea while gradually tightening the resuscitation bag valve to achieve increasingly higher airway pressures. The pressure at which the leak was heard was recorded in cmH20. Patients with audibly measured leaks of 15 cmH20 or less and/or an electronically measured leak of 50% or greater were hypothesized to have a high probability of success with the Passy-Muir Valve. This hypothesis was tested via institution of the valve.

Results/Experience:

Successful outcomes were predicted in all six cases when the patients' measured parameters positively correlated with the defined criteria for predicting success or failure. Other monitoring systems, such as end-tidal CO2 and Sp02 were initially used to evaluate patient response. Monitoring Sp02 was abandoned, because patients often failed acutely before a desaturation could be measured. These patients were often agitated and unmeasurable using oximetry. End-tidal C02 was only minimally acceptable and was used secondarily as a confirmation of

success. Select patients with established language skills were tested with a speech pathologist present. These patients needed reassurance and coaching to attempt verbalization. The session was disrupted when the end-tidal monitor was placed in the patient's mouth.

Conclusion:

Identification of potential success with leak measurements is a valuable tool when instituting the Passy-Muir Valve. Potential for patient distress and harm is greatly reduced and patient trust is protected. Although this study reflects only non-mechanically ventilated patients, mechanically ventilated patients could be studied in a similar fashion. A substantial leak is necessary for use of the Passy-Muir Valve with a ventilator, because all exhalation occurs around the tube through the patient's natural airway. Passy-Muir, Inc. recommends the tracheal tube only occupy one third of the tracheal lumen when used with a mechanical ventilator. A non-invasive assessment of tube size would enable the practitioner to be confident in use of the Passy-Muir Valve in both ventilated and non-ventilated patient populations.

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Passy-Muir Speaking Valve Use in a Children's Hospital: An Interdisciplinary Approach

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Abstract:

At The Children's Hospital of Philadelphia (CHOP) we treat many children requiring tracheostomy tube placement. With potential for a tracheostomy tube to be in place for an extended period of time, these children may be at risk for long-term disruption to normal speech development. As such, speaking valves that restore more normal phonation are often key tools in the effort to restore speech and promote more typical language development in this population. However, successful use of speaking valves is frequently more challenging with infant and pediatric patients than with adult patients. The purpose of this article is to review background information related to speaking valves, the indications for one way valve use, criteria for candidacy, and the benefits of using speaking valves in the pediatric population. This review will emphasize the importance of interdisciplinary collaboration from the perspectives of speech-language pathology and respiratory therapy. Along with the background information, we will present current practices and a cases tudy to illustrate a safe and systematic approach to speaking valve implementation based upon our experiences.

Assessment of Expiratory Tracheal Pressure with Use of a Speaking Valve

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Abstract:

Speaking valves (SV) are commonly used to promote exhalation through the upper airway for patients with tracheostomy. We have been concerned that patients occasionally experience expiratory resistance when the SV is placed. Therefore, we assessed the utility of measuring expiratory tracheal pressure as an objective indicator of expiratory resistance when a SV is placed.