Clinical Insights for Assessing and Using No-Leak Speaking Valves with Trachs and Vents: Key Takeaways for Pediatric and Adult Patients

Learning Through Lecture, Case Studies, Mock Assessments, Hands-On Training, & Demonstrations

Presented in 2025

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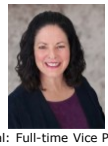
Learning Through Lecture, Case Studies, Mock Assessments, Hands-On Training, and Demonstrations

1

Disclosures

Kristin King, PhD, CCC-SLP	Gabriela Ortiz, RCP, RRT
	
Financial: Full-time Vice President of Clinical Education and Research, Passy-Muir, Inc. Non-financial: Nothing relevant to disclose	Financial: Full-time Clinical Specialist, Passy-Muir, Inc. Non-financial: Nothing relevant to disclose

Passy-Muir, Inc., is a medical device manufacturer that produces and markets PassyMuir® Tracheostomy & Ventilator Swallowing and Speaking Valves for patients with ventilator dependence and non-ventilator tracheostomy. This presentation will focus primarily on the *no-leak* PassyMuir® Valve and will include little to no information on other speaking valves.

2

Disclosure

The content of the seminar is for your general educational information only.

Information you learn cannot replace your clinical judgment or the judgment of treating physicians and other healthcare professionals working with patients. The information provided in this seminar should not be considered as medical advice.

3

Seminar Overview

Fundamentals: From Tracheostomy Tubes to Mechanical Ventilation Terminology

- 7.5 hours today and 4 hours tomorrow = 11.5 hours total
- Up to 6 recorded hours
  - 1 pre-requisite webinar hour
  - 5 post-seminar recorded webinar hours
- 17.5 total hours, if all are completed.

4

Seminar Participation

5

What is the actual color the PMV 007?

6

Assessment and Placement of the Passy-Muir Valve: Non-Vent

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Indications for Tracheostomy

- Prolonged mechanical ventilation
  - Neuromuscular
  - Ventilator dependency
- Inability to perform trans-laryngeal intubation
  - Trauma, max/fax deformity
- Airway obstruction
  - Subglottic stenosis
  - Tracheal or laryngeal malacia
  - Vocal fold paralysis
- Secretion management

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Pre-trach

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When: Timing of Tracheostomy

- Number of days intubated
- Pre-planning
- Age of child

Does time of tracheotomy procedure have an impact on outcomes?

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Post-trach

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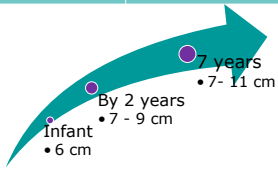
Vocal Tract Development

Vocal Tract Length (Birth)	Vocal Tract Length (Adulthood)
6-8 cm	14-18 cm
1:2 ratio	1:1 ratio



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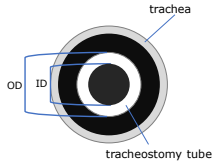
Calculating Tube Size

- ATS Consensus:
  - Allows for airflow for speech
  - Colinear with trachea
  - 2 cm beyond stoma
  - 1-2 cm above carina
  - Peds are usually up-sized, not down-sized



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Calculating Tube Size

Age or Weight	Tracheostomy Tube Size
Babies who weigh less than 1000 g	2.5 mm
Babies who weigh 1000-2500 g	3 mm
Neonates aged 0-6 months	3-3.5 mm
Infants aged 6 months to 1 year	3.5-4 mm
Infants aged 1-2 years	4-4.5 mm
Children older than 2 years	[age in years + 16] divided by 4

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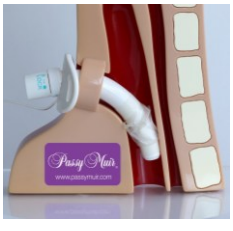
Neonate vs Pediatric vs Adult Trach Tube



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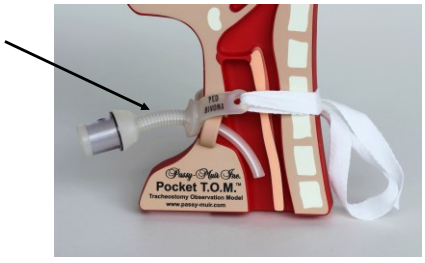
Flex-tend Trach Tube



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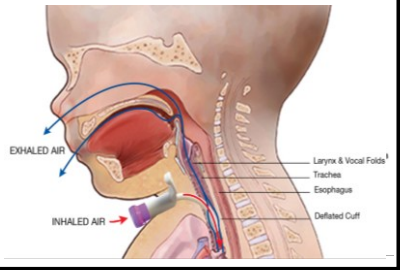
Airflow Changes with Tracheostomy

Cuffed

Cuffless (Uncuffed)

Closed System



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Implications of Tracheostomy in NICU, Pediatrics, & Adults

- Loss of sense of taste and smell
- Reduced airway closure
- Altered subglottic pressure
- Decreased sensation
- Increased accumulation of secretions
- Altered awareness and management of secretions
- Altered cough

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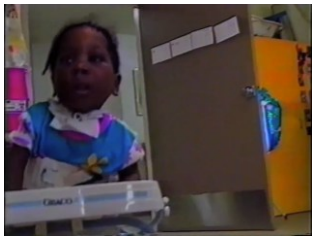
Millie



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David

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Safety Issue

"Being unable to communicate is emotionally frightening for children and can lead to an increase in sentinel events, medical errors and extended lengths of stay"

- Costello, Patak, and Pritchard (2010). Communication vulnerable patients in the pediatric ICU: Enhancing care through augmentative and alternative communication. Journal of Pediatric Rehabilitation Medicine: An Interdisciplinary Approach 3: 289–301

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JCAHO Requires Communication

Meeting JCAHO's goal is not the only reason to encourage patients to have a voice in their care:

Those who are actively involved in their care often have better outcomes.

Joint Commission International Center for Patient Safety. (2006). Patient-inclusive care: Encouraging patients to be active participants in their care. Patient Safety Link, 2(2), 1. http://www.modernmedicine.com/modern-medicine/content/jcahos-patient-safety-goals-part-1-practical-guide?page=full

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Application of the Passy Muir Valve

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Team Approach

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Open Tracheostomy Tube

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Passy-Muir Valves

- Bias-closed
- No-leak

PMV® 2001 (Purple color™)

PMV® 007 (Aqua color™)

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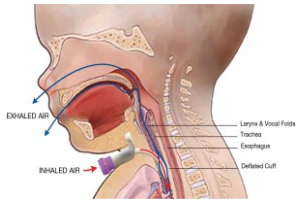
Benefits of a *Closed System*

- Restores airflow and sensation
  - Voice and communication
  - Sense of taste and smell
  - Eliminates need for finger occlusion or chin dropping



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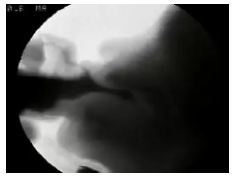
Benefits of a *Closed System*

Impacts swallowing and may reduce aspiration
- Suck-Swallow-Breathe
- Airflow
- Sensation
- Positive airway pressure



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Benefits of a *Closed System*

- Restores physiologic positive pressure
  - Improved gas exchange
  - Improved oxygen saturation levels
  - Decreased risk of atelectasis

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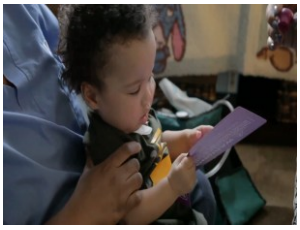
Noah – Improved Cough



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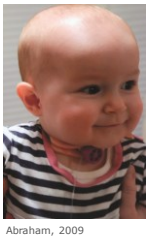
Improved Secretion Management



- Research study:
  - 24/49 children wearing PMV full time
  - Secretion management within normal limits in average of 2 weeks
  - Parent report QOL increases
  - Used valve for occasional sounds and secretion control

1. Abraham, 2009

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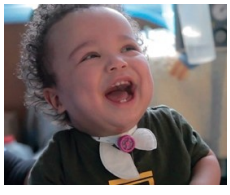
Benefits of a *Closed System*

- Improves quality of life



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Pre-Assessment Considerations

- Inpatient vs Outpatient vs Home Health
- Factors to consider:
  - Parental involvement
  - Home environment
  - Proximity to therapy
  - Socioeconomic status
  - Insurance coverage

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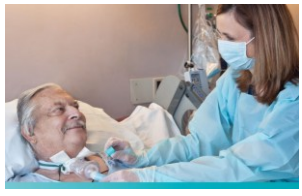
Patient Selection Guidelines

- Awake and alert
- Medically stable
- Manage complete cuff deflation
- Manageable secretions
- Patent upper airway



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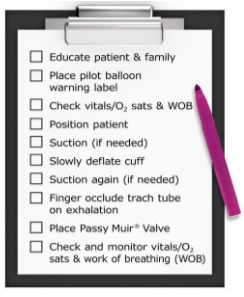
Application Checklist:



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Checklist: Educate

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Pediatrics
Facilitate Success: Play, Play, Play!

- Best in play-like environment (bubbles, singing, whistles, and more)
- Environment of trust
- Use distractions to your advantage
- Positive feedback

CHILD LIFE SPECIALIST, SIBLINGS, RECREATION THERAPISTS

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Warning Label

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Take Baseline Measurements

- Oxygenation
- Vital signs
- Breath sounds
- Color
- Work of breathing
- Patient responsiveness

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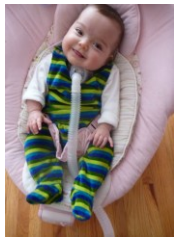
Patient Readiness: Adults and Peds

- Positioning
- State regulation
  - Clear sleep state
- Modulation
  - Robust crying
  - Periods of quiet alertness
- Attentional interaction
  - Attends to visual and auditory stimuli



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Suctioning

- Competencies
- When to suction
- How often
- Oral and tracheal
- Secretions?
  - Color
  - Smell
  - Thickness

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Assess Upper Airway Patency

- Deflate cuff
- Ask patient to inhale
- Finger occlude and speak or cough on exhalation

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Deflate Cuff

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Airway Patency for Valve Placement

Adults
- Finger Occlusion
  - Describe breathing
    - Respiratory distress?
    - Work of breathing?
- TTP?

Pediatrics
- Finger occlusion trials
  - Compliance
  - Tolerance
- TTP

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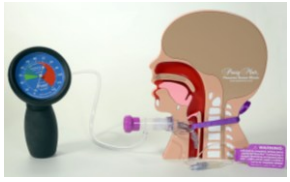
Assessment for Placement

- Transtracheal pressures measurements
  - Back pressure
  - Air trapping
  - Assessing for patent upper airway



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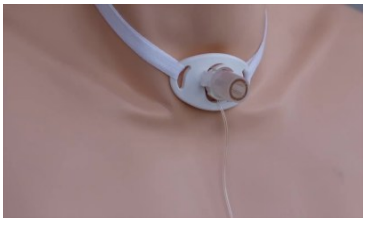
Candidate for Placement? Place PMV



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Assessment

- What to watch for:
  - Signs of Stability and Stress
    - Autonomic
      - Smooth breathing
      - Stable color
    - Motor
      - Good posture
      - Good tone

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After Placing the Valve

- Allow patient to adjust to airflow change
- Continue education and reassurance
- Establish phonation
- Continue to monitor for any changes from baseline measurements
- Remove valve if any significant changes occur

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Monitor Baseline Measurements

- Oxygenation
- Vital signs
- Breath sounds
- Color
- Work of breathing
- Patient responsiveness

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Following Placement

- Wear times vary - monitor
- Confer with medical team as needed
- Post warning labels

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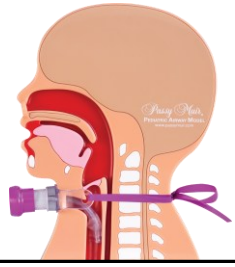
Transitioning & Troubleshooting

- Excessive coughing
- Air trapping/back pressure
- Need for retraining
- Laryngeal/pharyngeal muscle rehab
- Psychological issues



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Air Whoosh – Back Pressure

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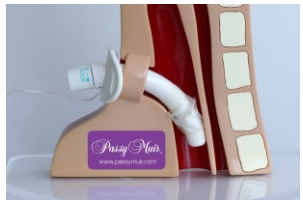
Factors Affecting Expiratory Air Flow

- Size or type of tracheostomy tube
- Presence and degree of obstruction
- Edema
- Secretions
- Incomplete cuff deflation
- Foam filled cuff
- Tube position



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Troubleshooting: Downsize or Different Brand

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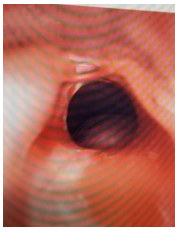
Subglottic Stenosis



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Closed Tracheostomy Tube

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Humidification With PassyMuir Valve

- Humidification is recommended
- Use with heat-moisture exchanger (HME) is ineffective
- Consider using with heated humidification
- Remove Valve for medicated aerosol treatments

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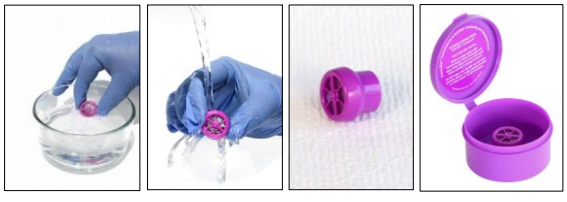
Care and Cleaning

- Average lifetime of 2 months



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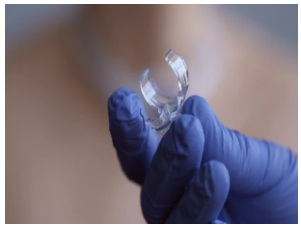
Supplemental Oxygen Adapter



PMA® 2000

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Impacts on Pressure and TTP Measurements

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Pressure: Resistance

Factor	Affected By
Length of the system	Constant; not a factor
Viscosity of air	Usually constant; humidity and altitude may alter viscosity slightly
Diameter of airways	Physical obstruction
Upper Airways	Mucous, stenosis, granulation tissue, and other factors
Lower Airways	Broncho constriction/dilation, tumors, disease, and other factors

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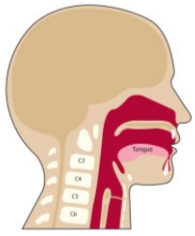
Primary Pressures Related to Airway Disorders

- Aerodigestive Tract
  - Respiratory
    - Thoracic cavity
    - Lungs
  - Digestive Tract
    - Oral
      - Intra-oral
      - Suck and swallow
    - Pharyngeal
      - Bolus transition
    - Esophagus
      - UES opening
      - Esophageal pressures
    - *Stomach*
    - *Intestines*
    - Abdominal cavity



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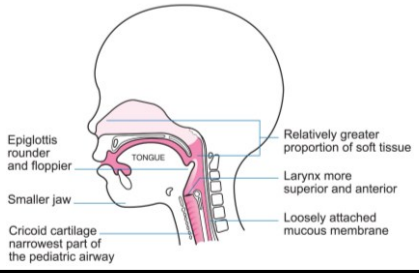
Toddler Anatomy



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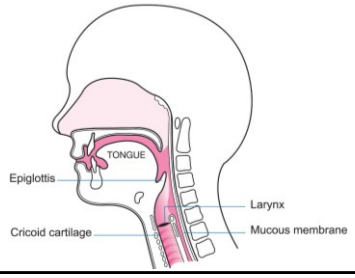
Older Child Anatomy



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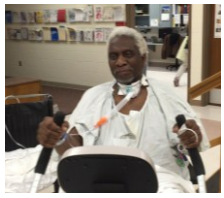
Pressurized System

- Restored or improved pressurized system:
  - Intraoral
  - Subglottic pressure
  - Respiratory – PEEP
  - Esophageal ??
  - Intrathoracic
  - Respiratory
- Leads to improved:
  - Feeding and swallowing
  - Cough and throat clear
  - Trunk support and postural control
  - Respiratory function



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Posture and Trunk Control

Primary pressure regulators

- Diaphragm
- Vocal folds/glottis (pressure regulator)
- Accessory muscles stabilize the spine and ribcage

Massery, M. (2006). Multisystem consequences of impaired breathing mechanics and/or postural control in cardiovascular and pulmonary physical therapy evidence and practice. (4th ed). In Frownfeter, D., & Dean, E., (Eds). St. Louis, MO: Elsevier Health Sciences, 695.

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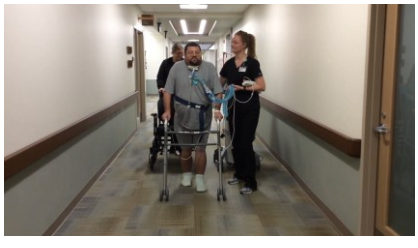
Posture and Trunk Control



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Open Tracheostomy Tube

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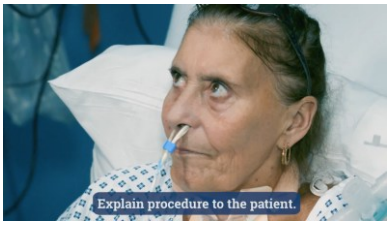
Vocalization with Cuff Deflation: Leak Speech



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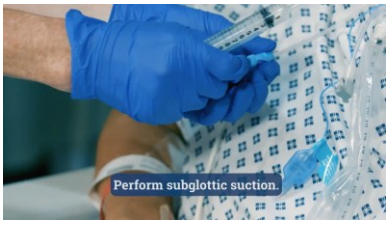
Above the Cuff Vocalization (ACV)



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Airway Patency: TTP Measurement

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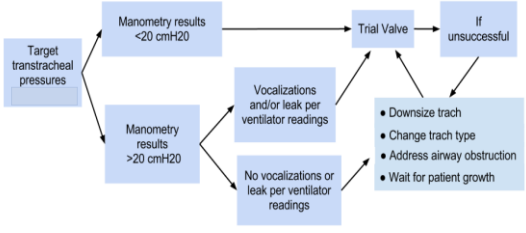
Transtracheal Pressure Manometry: Decision Tree



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Transtracheal Pressure Measurement

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Pediatric Evaluation with TTP

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Breakout Sessions:
Tracheostomy Tubes and PMVs,
Cuff Management, and
Mock Assessments

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Tracheostomy Tubes and PMVs

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Cuff Management

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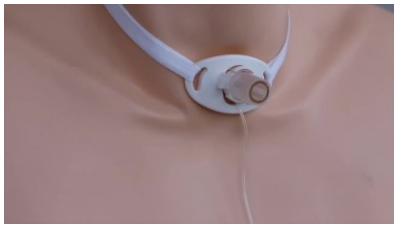
Valve On and Off



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Mock Assessments

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Mock Assessment Patient Three

- 3 yr old male s/p MVC
- SCI – C 4-5
- Right lobe pneumothorax with chest tube
- Dysautonomia

82

What additional information do you need?

83

You find out the pneumothorax is unresolved and has drainage. Could you use the PMV?

84

You find out the pneumothorax is primarily resolved and no drainage through the chest. So, you proceed with your evaluation. What would you do first?

85

How might dysautonomia impact your assessment?

86

Mock Assessment Patient One

- 16 yr old female with TBI s/p MVC
- Inpatient Rehab setting
- Self-extub x3
- Recovered pneumothorax

- Pt awake, alert, and mouthing words

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Order for Assessment of
Cognition and Speaking Valve

Which would you conduct first?

88

Patient demonstrates a patent airway and is able to use the PMV but has no voicing. What would you evaluate next?

89

Mock Assessment Patient Two

- 44 yr old male s/p MVC with TBI
- Atelectasis
- Tracheoesophageal fistula

90

What could be a cause of atelectasis? (mark all that apply)

91

PMV and Communication

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What do you notice about the patient's voice/speech?

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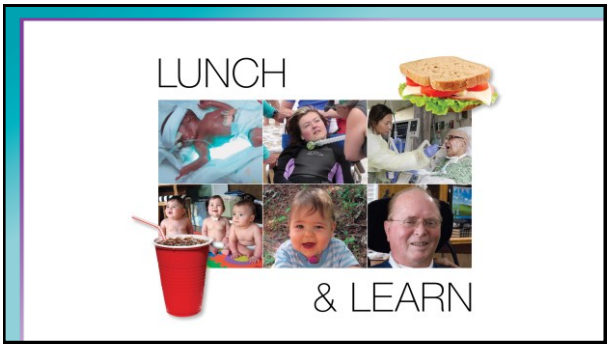

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Lunch and Learn:
Case Studies
Questions and Discussion

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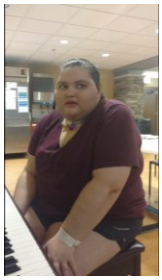

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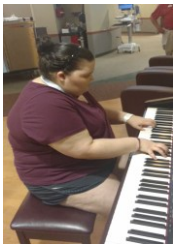

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Transtracheal Pressure
and Behavioral Considerations

6

Questions & Discussion

- Patent Upper Airway
- Behavioral Considerations
- Physiologic Considerations

7

Be back in 15 minutes

8

Treatment Considerations: Voicing, Swallowing, Mobility, and Impacts on Development

9

Advantages of a Closed System vs Open Trach

- Open trach
  - Reduced airflow
  - Reduced positive airway pressure
- Closed Respiratory System
  - Allows graded exhalation and pressure regulation
    - Feeding and Swallowing
    - Posture and balance
    - Upper extremity force/strength

10

Developmental Assessment Considerations

Preterm to 4 months
- Assess oral motor functioning & feeding
- Vocalizations (evaluate for Valve use)
- Cooing and crying

4 to 12 months
- Assess means to communicate
- Ability to vocalize
- Receptive language
- Parent-child interaction

11

Developmental Assessment Considerations

8-24 months
- Support communication systems and receptive language
- Motor coordination
- Ability to vocalize and cognition

24 months and older
- Progress in cognition
- Phonology, receptive/expressive language
- Change in communication system

Older Children
- Evaluate language, cognition, speech, and swallowing, as appropriate.
- Monitor respiratory function and valve use.

12

Adult Considerations

Young Adult
- Support communication systems
- Evaluate speech-language and cognition as needed.
- Monitor respiratory function and Valve use.

Older Adult
- Support communication systems
- Evaluate speech-language and cognition as needed.
- Monitor respiratory function and Valve use.

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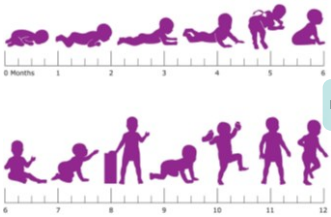
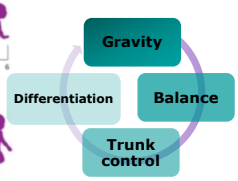
Development: Gross Motor & Oral Motor Skills





14

Speech Effects in Pediatrics

- Subglottic and intraoral pressures
  - Bias Open vs Bias Closed
- Poor breath support
- Disruption of pre-linguistic language development
- Delayed onset of babbling stage
- Expressive and receptive language delays

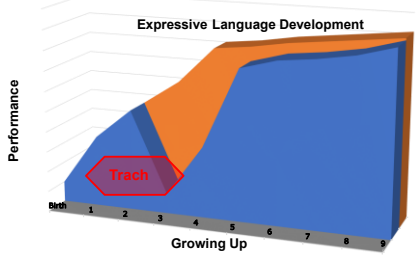
Crucial period

9 months/ 4.8 months

Hull et al. (2005); Roberts et al. (2019); Watters (2017); Zajac, D.J, Fornataro-Clerici, L., & Roop, T.A. (1999).

15

Growing Into It: Long Term Trach



DeMauro et al (2014) Developmental Outcomes of Very preterm Infants with Tracheostomies. Journal of Pediatrics. 164 (6): 1303- 10.

16

Ability to Vocalize

- To feel and hear their own vocalizations
- Need opportunities to practice speech production skills

17

Habilitate!

Early intervention:

Restores normal upper airway physiology as soon as possible

- Supports:
  - Speech and language development
  - Social interactions
  - Cognitive development

Jackson D and Albamonte S. (1994). Enhancing communication with the Passy-Muir valve. *Pediatric Nursing. 20*(2): 149-53.

18

Facilitate Success and Co-Treatments

- Increase child's comfort with exhalation and encourage vocalization with activities such as:
  - Microphone (echoes)
  - Bubbles
  - Horns or whistles
  - Talking Tom App

Valve wearing schedule

- Incorporate multidiscipline
- Optimize rehabilitation
  - Activities of daily living
  - Transfers
  - Exercise
  - Toileting

19

Speech and Language Development

Avoid delays or decrease them with use of PMV

- Cooing
- Babbling

1. Simon, B.M., Fowler, S.M., and Handler, S.D. (1983) Communication development in young children with long-term tracheostomies: Preliminary report. *International Journal of Pediatric Otorhinolaryngology, 6*: 37-60.
2. Kasion, K.W, and Stein, R.E. (1985) Chronic pediatric tracheostomy: Assessment and implications for habilitation of voice, speech and language in young children. *International Journal of Pediatric Otorhinolaryngology, 9*: 165-171.
3. Kertoy, M.K., Guest, C.M., Quart, E., and Leih-Lai, M. (1999). Speech and phonological characteristics of individual children with a history of tracheostomy. *Journal of Speech, Language and Hearing Research, 42*(3): 621-635.

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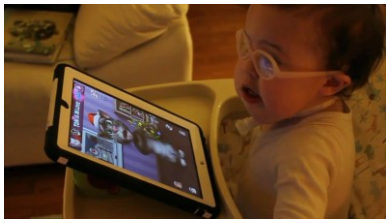
Speech and Language



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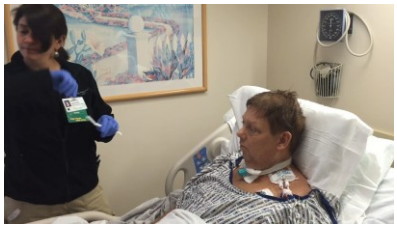
What to do with a weak voice?



22

Increase Oral Exhalation:
Retrain Upper Airway

- Techniques:
  - Imitation
  - Blowing
  - Bubbles
  - Whistles
  - Horns, kazoos
  - Pinwheels
  - Straws
  - Cotton balls

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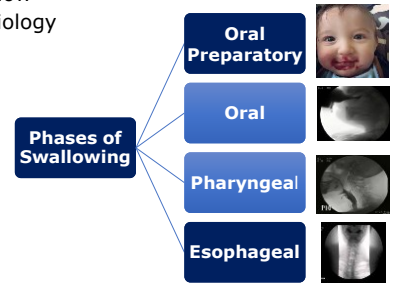
Swallow
Physiology



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Oral Preparation/Oral

Peds only:
Latch and suck (infants)

Adult and Peds:
Oral reflexes

Anterior spillage
Chewing
- Cohesive bolus
- Anterior to posterior transfer
- Residue

Pharyngeal

Laryngeal penetration
Aspiration
Decreased pharyngeal motility
Airway protection

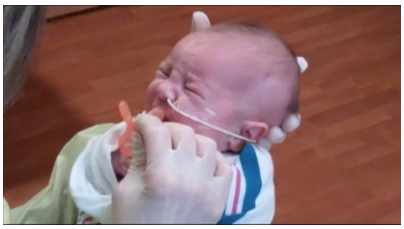
Esophageal

Motility
Reflux
Stricture
Atresia
Diverticulum

Pullens & Streppel (2021)

25

Initial Assessment and Treatment: Non-Nutritive



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Instrumental Assessment: MBS or FEES

- Timing
- Preparation
- Compensatory strategies
- Interpretation
- Family training
- Collaboration

27

28

Postural Stability Study Findings:

"…balance strategies are likely to be disadvantaged if the ability to recruit glottal structures as part of dynamic postural control is compromised. This would be clinically meaningful for patients with a tracheostomy…"

Massery, M., Hagins, M., Stafford, R., Moerchen, V., Hodges, P.W. (2013). Effect of airway control by glottal structures on postural stability. *J Appl Physiol* (1985). 115(4):483.

29

Co-therapies: Mobility and Speech

30

Mobility Considerations

31

Respiratory Muscle Strength Training (RMST)

- Inspiratory Training Improves:
  - Lung volumes
  - Vocal fold opening
- Expiratory Training Improves:
  - Cough strength
  - Suprahyoid complex activation
  - Vocal fold closure
  - Breath support

32

Functional Outcomes: What does the evidence show?

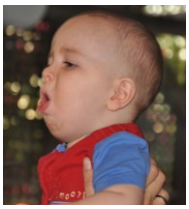
- Cough Effectiveness
  - Improve inspiratory and expiratory pressures
- Swallow Effectiveness
  - Expiratory muscle strength training is an effective intervention for impaired swallowing function in acute stroke patients with dysphagia

- Hutchenson, K.A., et al. (2017). Expiratory muscle strength training for radiation-associated aspiration after head and neck cancer: A case series. Laryngoscope, doi: 10.1002/lary.26845. [Epub ahead of print].
- Jong, H.M., Jin-Hwa, J., Young, S.W., Hwi-Young, C. and Kiltun, C. (2017). Effects of expiratory muscle strength training on swallowing function in acute stroke patients with dysphagia. Journal of Physical Therapy Science, 29(4), 609-612.

33

Not Just for Adults - Functional Outcomes: Evidence?

- Risk of re-intubation
  - Neuromuscular weakness at time of extubation in children
- Improved functions
  - IMT improved: trunk control, respiratory muscle strength, ADLs, functional exercise capacity, and QOL in children with CP



- Khemani et al., 2017; Keles et al., 2018

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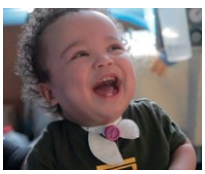
Therapy Goal Areas



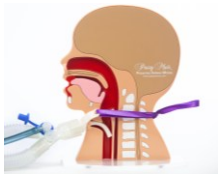
- Valve use - waking hours with SpO_2 > 90%
- Swallowing & secretion management
- Re-establish intra-oral airflow management
- Speech and language development or rehabilitation
- Voicing
- Decannulation

35

Toby Tracheapuppet™

36

Pediatric and Adult Considerations for Ventilator Management



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Can Patients Drink While Ventilated?

38

Peds vs Adults

Adults = Trucks

- Stable, durable, and built for load
- Slower to change — takes time to see effects
- Can tolerate more variability
- More reserve — but slower recovery if overwhelmed
- Handle changes in fluid, meds, and settings with more cushion

39

Peds vs Adults

Pediatrics = Sports Cars

- High performance, low margin for error
- Quick to respond to changes — both good and bad
- Require precise, fine-tuned adjustments
- Less reserve — can tire out or crash quickly
- Small changes (fluid, meds, vent settings) can have big effects

40

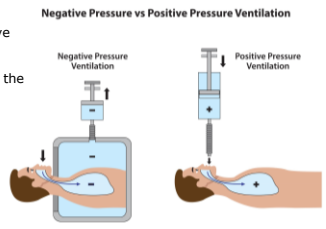
Indications for Invasive Mechanical Ventilation

- Can no longer support with NIV
- Airway protection
- Hypercapnic respiratory failure
- Hypoxemic respiratory failure
- Cardiovascular distress
- Anticipated patient decline or impending transfer

41

Positive Pressure Ventilation

- The primary approach to mechanical ventilation is positive pressure
- The flow's driving pressure is higher than the pressure inside the lungs
- The pressure is high enough to overcome resistance



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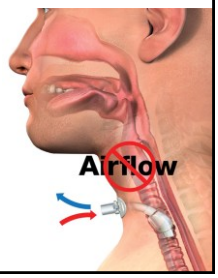
Invasive Ventilation

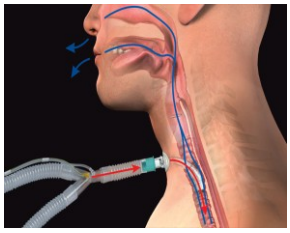
- Usually requires airway to be sealed with little to no leak present.
- Seal is achieved with a cuff at the end of the artificial airway.



43

Cuff Deflation and Mechanical Ventilation

1. Set parameters do not change when cuff is deflated.
2. Cuff deflation generates less resistance to flow.
3. Ventilatory system is no longer sealed, there is a leak.



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Lung Mechanics

- Lung Compliance
- Factors affecting C_{LUNG}
  - Pulmonary disease
  - Pulmonary edema or effusion
  - Tube position
  - Abdominal distension
- Airway Resistance
- Factors affecting R_{aw}
  - Trach tube size
  - Secretions
  - Turbulent flow
  - High flow
  - Bronchospasm

45

Why use a Passy-Muir Valve with patients who are mechanically ventilated?

- Verbal communication
- Improved lung recruitment and diaphragm involvement
- More rapid weaning from the ventilator
  - Rehabilitation tool
- Improved secretion management
  - More effective cough
  - Reduces need for suctioning
- Improves quality of life

46

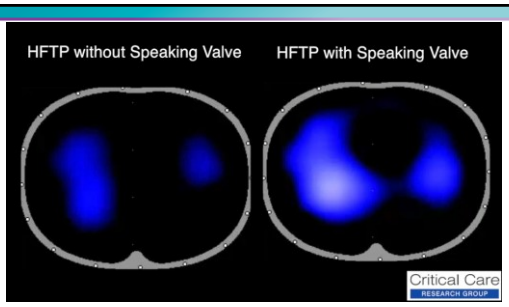
Can Patients Eat While Ventilated?

47

Communication

- Adults:
  - Understand instructions & can express needs to report discomfort
- Pediatrics:
  - Non-Verbal Cues
    - Nasal flaring
    - Grimacing
    - Smiling
  - Close monitoring

48



(Sutt et al. (2016). *Critical Care.* 20:91)

49

PMV Assessment and Placement

Set yourself and your patient up for success!

50

Step 1: Prepare for Assessment

51

Patient Selection Guidelines

- Awake and alert
- Medically stable
- Able to manage cuff deflation, if present
- Manageable secretions
- Low risk for gross aspiration
- Patent upper airway

52

Conventional vs Non-Conventional Ventilation

Conventional Ventilation	**Non-Conventional Ventilation**
• Follows a normal inhalation exhalation (normal breathing) • Closely mirrors how one breathes without support	• Does not follow normal breathing patterns • Used when lungs are damaged – air is changed to protect them

53

Conventional Modes of Ventilation

- **Control Modes**
  - Continuous Mandatory Ventilation (CMV)
    - Assist Control (A/C)
- **Spontaneous Modes**
  - PS
  - Continuous Positive Airway Pressure (CPAP)
- **Combination Mode**
  - Synchronized, Intermittent Mandatory Ventilation (SIMV)

54

Modes of Ventilation

Compatible with PMV Use:
- A/C, VC, & PC
- SIMV
- CPAP/PS
- NIV

55

Modes of Ventilation

Not recommended with PMV:
- PRVC
- APRV
- NAVA
- Other "auto" adjusted modes

56

Ventilator Terms - Settings

- Mode of ventilation
- Tidal Volume
- Pressure
- Respiratory Rate
- Inspiratory Time
- Trigger sensitivity
- FiO_2
- PEEP/CPAP

57

Measured Ventilator Parameters

- PEEP
- Exhaled Tidal Volume (Vte)
- Peak Inspiratory Pressure (PIP, Ppeak, PAP)
- Total Respiratory Rate (RR/f)
- Mean Airway Pressure (MAP)

58

Ventilator Terms – Alarm Settings

- High Pressure
- Low Pressure
- High and Low Exhaled Volumes
- High Respiratory Rate

59

Assessing Ventilator Parameters

Three parameters that give you the general state of your patient's respiratory status:

1. FiO_2
2. PEEP
3. PIP

60

Step 2: Patient Preparation and Education

61

Team Approach

- Timing and tube selection
- Introducing a speaking Valve
- When to downsize
- Plan of care
- Decannulation
- Impacts safety, length of stay, and cost

62

63

Pre-Placement, General Observations, and Other Considerations

- Have a plan and block time
  - Pick a good time of the day
  - Reduce noise and interference
- Education
  - Reassure the patient
- Address pain issues
- Position the patient

64

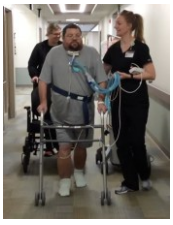
Pre-Placement, General Observations, and other Considerations

- Patient position
  - Congenital, anatomical differences, such as malformations, can affect the structure and function of the upper airway.
  - Proportionally larger heads
- Support with rolled towels or pillows

65

Why Is Body Position Important?

- Tasks requiring trunk control:
  - Breathing
  - Coughing
  - Eating
  - Talking
  - Moving
  - Reaching
  - Bowel and bladder emptying



66

Facilitate Success

- Environment of trust
  - Familiar voices
- Use distractions to your advantage
  - Soft toy
  - Pacifier
- Positive feedback
  - Time & trial

67

Video

68

Establish Baseline: Assess Vital Signs and Work of Breathing

- Oxygenation
- Vital Signs
- Breath sounds
- Color
- Work of breathing
- Patient responsiveness

69

"Must Know" for PMV Use

- $FiO_2 \leq .50$
- PEEP $\leq$ 10 cmH_2O
- PIP $\leq$ 40 cmH_2O
- VTi & VTe
- Patient stability and ability to manage secretions and tolerate cuff deflation

70

Assessing Ventilator Parameters

- FiO_2
  - Fraction of inspired Oxygen
  - Room Air 21%
  - Supplemental O_2 > 21%

71

Assessing Ventilator Parameters

- PEEP
  - Positive End-Expiratory Pressure
  - Resistance to the exhaled volume that creates a back pressure that stents the alveoli open
  - PEEP and FiO_2 work together to improve the oxygenation

72

Assessing Ventilator Parameters

- PIP (Peak Inspiratory Pressure)
  - Max amount of pressure to deliver volume.
  - Sum of the inspiratory pressure required to deliver volume plus PEEP.
  - PIP indicates the compliance of the lungs.

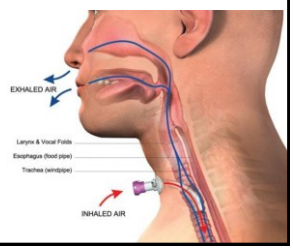
73

Step 3: Assess For Airway Patency

74

Airway Patency Assessment with Mechanical Ventilation

- Requires complete cuff deflation
- Assess the leak or airflow into the upper airway
- Use vent parameters to determine airway patency
- The type of breath matters



75

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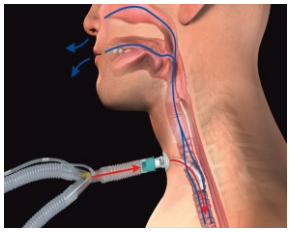

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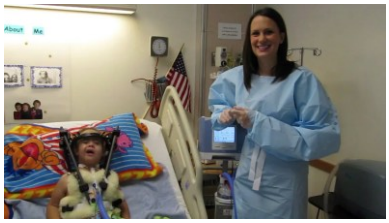
Assessing Airflow Into the Upper Airway



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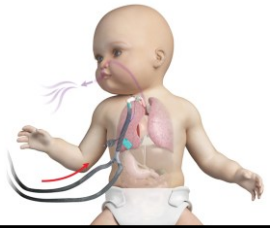
Upper Airway Assessment

- Transtracheal pressure(TTP) measurement

78

Assessment Criteria

- Note PIP
- Observe inhaled and exhaled VT
- Achieve cuff deflation slowly, if present
- Assess volume changes (measure Vte)
- Listen for tracheal BS and assess leak through the upper airway



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Vent TTP Measurement

80

TTP Measurement

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Q&A With Case Study Review and Troubleshooting: Pediatrics and Adults

82

Case Study: Samuel

Home program focused on:

- Cooing
- Babbling
- Extended utterances
- Intelligibility
- Importance of positioning

83

Case Studies: Low Level TBI

- Rehabilitation: Ranchos II-III
- Localized to generalized responses
- Stimulation

84

Responsiveness

85

Vocalization

86

Case Study: Problem?

87

Resolution

88

Case Study: Grady

- Medical History
  - Born at 23 weeks
  - Periventicular Leukomalacia (PVL); Intraventilcular Hemmorage (IVH)
  - BPD
  - Bowel perforation
- DOL 155 – trach performed
- DOL 212 – PMV
- Vent settings: CPAP/PS
  - PEEP 8
  - PS 12
  - TTP >20

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Trial 1 – 15 minutes

- No vocalizations observed
- Patient calm, appeared happy and content
- Breathing unlabored with stable respiratory rate, no signs of distress
- Color pink, SpO_2 maintained within normal range
- Tolerance: good

90

Trial 2 – 20 minutes

- Occasional cooing noted
- Patient alert, interacting with environment
- No signs of increased work of breathing
- Respiratory rate stable
- SpO_2 stable
- Tolerance: good

91

Trial 3 – 15 minutes

- Increased vocalizations (cooing)
- Patient visually engaged and responsive
- Airflow through upper airway adequate
- RR unlabored
- V/S Stable
- Tolerance: good

92

Trial 4 – 30 minutes

- Sustained vocalizations including crying and cooing
- First instance of audible crying
- Mother present, emotionally moved by hearing child's voice
- Patient demonstrated increased upper airway use
- No desaturation or signs of respiratory fatigue
- Tolerance: excellent

93

Case Study: Grady

94

What else should we consider?

- Manometry pressures (if applicable): for objective measurement of airway patency
- Secretion management: Was there increased secretion or need for suctioning?
- Upper airway patency: Was it visually assessed, or inferred from vocal quality?
- Cuff status (if trach is cuffed): e.g., cuff deflated
- Any changes in behavior or signs of fatigue post-trial

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Any questions?

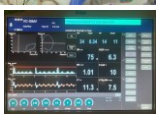
- In summary, close the system to restore functions.

96

Audience Q&A

97

Tomorrow:
Ventilator Application of the Valve



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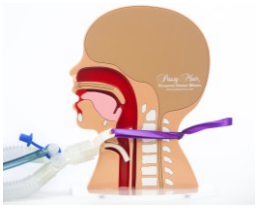
Day Two
Ventilator Application with the Valve



1

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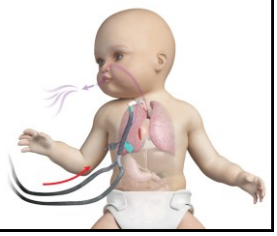


2

"Must Know" for PMV Use

- $FiO_2 \leq .50$
- PEEP $\leq$ 10 cmH_2O
- PIP $\leq$ 40 cmH_2O
- VTi & VTe
- Patient stability and ability to manage secretions and tolerate cuff deflation

3

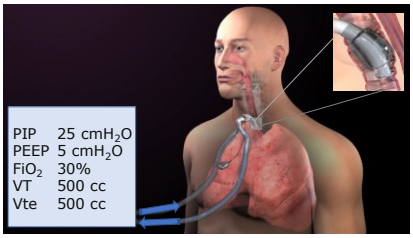
Modes of Ventilation

Compatible with PMV Use:

- A/C, VC, & PC
- SIMV
- CPAP/PS
- NIV

4

VC: Patient Assessment



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Ventilator Assessment

- Note Vent Settings:
  - Set Vt
  - PEEP
  - RR/f
  - FiO_2
- Note Vent Measurements
  - PIP
  - Exhaled VT (Vte)
  - Total RR
  - MV

6

Upper Airway Patency Assessment

- Turn Down PEEP
  - PEEP down by 5
- Then,
  - Slow cuff Deflation

7

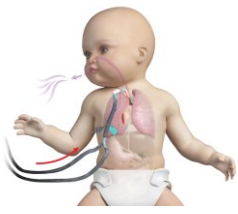
VC: Patient Assessment

PIP	25cmH_2O
PEEP	8 cmH_2O
FiO_2	30%
VT	250cc
Vte	250cc

8

PEEP

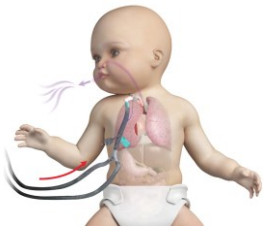
- Never turn the PEEP off
- Lower FiO_2 need
- Preserve FRC
- Prevent alveolar collapse
- Adjust by half



9

Upper Airway Patency Assessment

- Turn Down PEEP
  - PEEP down by half-Peds
- Then,
  - Slow cuff Deflation



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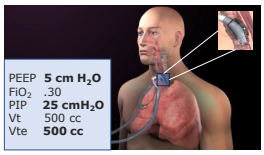
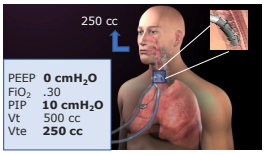
Upper Airway Patency

Cuff Inflated-Closed Circuit



Cuff Deflated-Open Circuit



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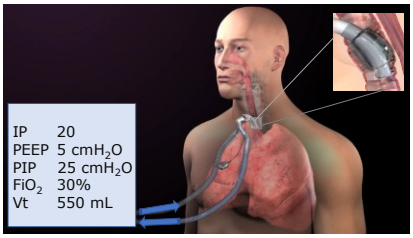
PC: Patient Assessment



12

Ventilator Assessment

- Note Vent Settings:
  - Set IP
  - PEEP
  - RR/f
  - FiO_2
- Note Vent Measurements
  - PIP
  - Exhaled VT (Vte)
  - Total RR
  - MV

13

Upper Airway Patency Assessment

- Turn Down PEEP
  - PEEP down by 5
- Then,
  - Slow cuff Deflation

14

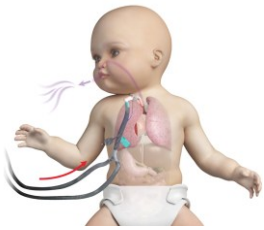
PC: Patient Assessment

IP	20 cmH_2O
PEEP	8 cmH_2O
PIP	28
FiO_2	30%
Vte	250

15

Upper Airway Patency Assessment

- Turn Down PEEP
  - PEEP down by half-Peds
- Then,
  - Slow cuff Deflation



16

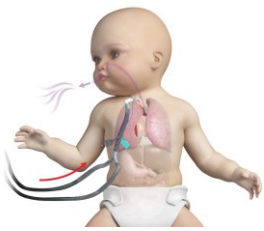
Ventilator Assessment

- Note Vent Settings:
  - Set IP
  - PEEP
  - RR/f
  - FiO_2
- Note Vent Measurements
  - PIP
  - Exhaled VT (Vte)
  - Total RR
  - MV

17

Upper Airway Patency Assessment

- Turn Down PEEP
  - PEEP down by half-Peds
- Then,
  - Slow cuff Deflation



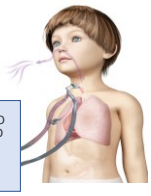
18

Upper Airway Patency

Cuff Inflated-Closed Circuit

IP	20 cmH_2O
PEEP	8 cmH_2O
PIP	28
FiO_2	30%
Vte	250

Cuff Deflated-Open Circuit



IP	20 cmH_2O
PEEP	4 cmH_2O
PIP	24
FiO_2	30%
Vte	125

19

Distress May Appear As:

- Increased RR, HR
- Anxiety and fear
- Restlessness
- Increased irritability
- Stridor
- Decreased BS during auscultation
- Decreased chest movement

20

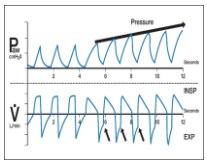
Troubleshooting

- PIP increases 2-4 cmH_2O at a time
- Increased abdominal WOB noted

What is wrong?

- Remove the Valve and hear a "rush" of air coming from the trach

What is this telling you?



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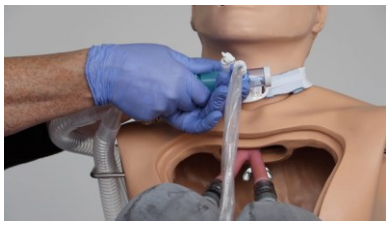
Listen for Back Pressure



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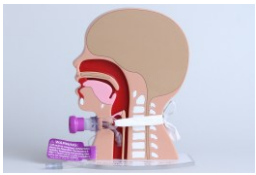
What are some factors leading to back pressure?

23

Factors Affecting Upper Airway Patency

- Tube size and type
- Stenosis, edema, tumors, tracheomalacia
- Anatomical differences
- Foam cuff is an absolute contraindication.



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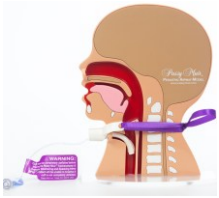
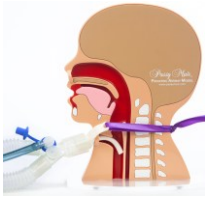
Tube Position is Important





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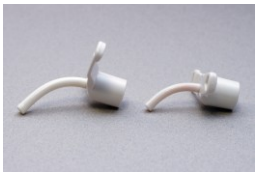
Tracheostomy Tubes and Impact on Airflow



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Step 4: Assemble the Necessary Parts & Pieces

27

Which Valves can be used for in-line placement?

28

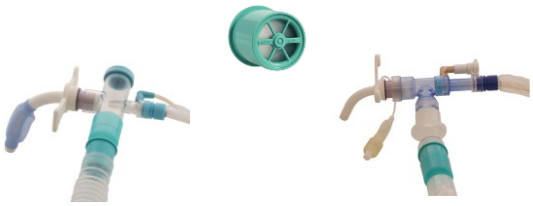
Ventilator Connections

29

In-line Placement of the PMV® 2001 (Purple color™)

30

In-line Placement of the PMV® 007 (Aqua color™)



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Apply Pilot Balloon Warning Label

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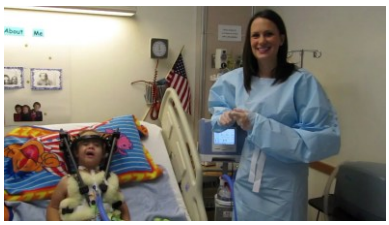
Valve Placement In-line with the Circuit



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Ventilator Adjustments

- Consider PEEP
- Evaluate Trigger Sensitivity
  - Pressure vs. Flow Trigger

34

Ventilator Adjustments

Volume Ventilation

- Increase VT in small increments to achieve pre-cuff deflation pressures (PIP)
- Compensate for leak

35

Pressure Adjustments

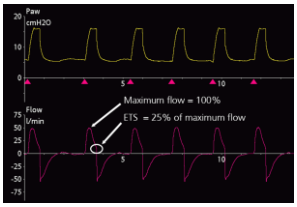
Pressure ventilation

- If necessary, increase PC in small increments to achieve audible voice and adequate ventilation
- Adjust I-Time

36

Ventilator Assessment and Adjustments

- Pressure Support
  - Exp % sensitivity
  - Inspiratory cycle off
  - Set I-time
- Pressure Control
  - Set I-time



37

Non-Invasive Ventilation(NIV)

- Approach to breath delivery is very similar to invasive ventilation.
- Difference is almost always have a leak present.

38

Alarm Settings – Safe Practice

- Low exhaled Vt and Ve alarms
- Low pressure alarm
  - Set 5 to 10 below PIP
- High pressure alarm
  - Set 5 to 10 above PIP
- High respiratory rate
  - 10 to 15 above baseline

39

Humidification

- Heat/Moisture Exchanger (HME) is ineffective
- Use with Heated Systems
- Remove PMV for medicated treatments

40

Case Study #1

- 8-month-old BPD
- Cuffless 3.5mm
- Awake and alert
- Hemodynamically stable

41

Vent Settings

- SIMV 12
- IP 18 cmH_2O
- PEEP 8 cmH_2O
- PIP 26 cmH_2O
- FiO_2 .24

42

Airway Patency Assessment

- Transtracheal pressure measurement
- Observe several breaths
- Note pressure at the end of exhalation

43

PassyMuir Valve Placement

- PEEP decreased to 4 cmH_2O
- Place PMV
- PIP 22 cmH_2O
- Good cough and begins to make sounds

Successful?

44

Video

45

Case Study #2

- Older child
- Trach 5.0, cuffed
- Awake and alert
- Hemodynamically stable

46

Vent Settings

- SIMV 10
- VT 250 cc
- PIP 28 cmH_2O
- PEEP 8 cmH_2O
- FiO_2 .24
- PS 10 cmH_2O

47

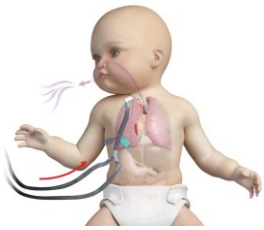
Ventilator Assessment

- Note Vent Settings:
  - Set Vt
  - PEEP
  - RR/f
  - FiO_2
- Note Vent Measurements
  - PIP
  - Exhaled Vt (Vte)
  - Total RR
  - MV

48

Upper Airway Patency Assessment

- Turn Down PEEP
  - PEEP down by half-Peds
- Then,
  - Slow cuff Deflation



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Upper Airway Patency

Cuff Inflated-Closed Circuit

PEEP **8 cm H_2O**
FiO_2 .24
PIP **28 cmH_2O**
VT 250 cc
Vte **250 cc**

Cuff Deflated-Open Circuit

PEEP **4 cmH_2O**
FiO2 .24
PIP **23 cmH_2O**
VT 250 cc
Vte **200 cc**

50

Cuff Deflation Assessment

- Poor cough
- Not making any sounds

Would you place the Valve?

51

Valve is NOT Placed In-Line

Why not?
What are your recommendations?

52

Re-assessment

Trach tube to size 4.5
- Exhaled VT 100 cc
- PIP 12 cmH_2O

Would you place the valve?

53

Ventilator Adjustments

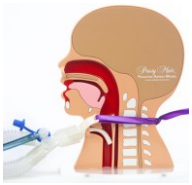
- Patient is coughing
- Patient is verbalizing but doing so on inhalation and exhalation
  - Appears to have difficulty cycling the breath
- Prolonged I-time

What would you adjust to help your patient?

54

Troubleshooting

- Time or Flow Limit PS breath



55

After Placement

- Treatment begins
  - Increase vocalizations
  - Secretion managment
  - Address feeding and swallowing

56

Review

- Assess ventilatory status
- Ensure airway patency
- Place Passy Muir Valve
- Ventilator Adjustment

57

VITO Demonstration

58

Hands-On: Parts and Pieces

59

Hands-On: Inline Vent Placement

60

Case Studies, Q&A, and Troubleshooting

61

Sebastian – Case Study

62

Charlie: 8 months old

- HRHS (dx in utero), white matter on brain, not eligible for transplant - d/c home hospice at 2.5 mos old
- Awake, alert, responsive, and active
- Cyanotic, SpO_2 83–91% on high FiO_2
- Tracheostomy present (3.0 uncuffed)
- LTV Vent settings:
  - PC = 12
  - PEEP = 4 cmH_2O
  - SIMV = 25
  - Spont. RR = 30/min, which is appropriate for age and consistent with the set SIMV rate.

63

Concerns & Considerations Before PMV Placement

- **Cyanosis and variable SpO_2 (low 80s)**:
  - poor oxygenation reserve.
- **Uncuffed tracheostomy tube (3.0)**:
  - very small infants, tube size and airway resistance can become limiting.
- **Ventilator compatibility with PMV**:
  - The LTV ventilator can support PMV if appropriate settings are adjusted
- **HRHS and not transplant-eligible**:
  - Indicates limited long-term prognosis.
  - PMV may be used for quality of life, bonding, vocalization, or feeding coordination rather than long-term weaning.

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Pre-PMV Checklist

- Before attempting PMV, assess:
  - Upper airway patency-TTP
  - observe for distress, increased WOB, drop in SpO_2
  - Team readiness (RT, speech-language pathologist, and provider) to monitor closely during initial trial.

65

Off the vent

- First Trial: Valve on the Vent
  - TTP met the guidelines
  - Outpatient clinic setting
- First Trial: Valve off the Vent
  - Outpatient clinic and at home

66

Case Study #2

67

What would you check next?

68

What modes of ventilation are compatible with the Valve?

69

Cuff is deflated without adjusting PEEP. What are your considerations?

70

What is the first step in removing the Valve?

71

Case Study #3

72

Audience Q&A

73

Thank you!

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- You will have 5 days from the time this course ends to complete the evaluation, which is required to receive credit
- Go to: https://ep.passy-muir.com
- Login or create an account
- Click on the purple box
  - Upper righthand corner
  - Labeled "Enter Meeting Code Here"
- The meeting code is:

Enter Meeting Code Here

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