

# AIRWAY CLEARANCE AND MANAGEMENT IN NEONATE

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# Learning Objectives

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- Explain Indications for airway clearance techniques in neonates
- Describe the types of airways clearance techniques
- Illustrate the equipment used and techniques.
- Review the hazards and how to address them.
- Evaluate response to therapy.
- Examine artificial airways in neonates.
- Furnish Add'l Resources

# Traditional Airway Clearance Techniques

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- Postural drainage
- Percussion
- Postural drainage and percussion
- Vibration of the chest wall
- Suctioning
- Mechanical Insufflation/Exsufflation
- Adjunctive medications

# Airway Clearance Therapy (ACT)

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- Cough
- Forced expiration technique (FET)
- Coughing and FET
- Positive expiratory pressure (PEP) therapy
- Cough assist
- Autogenic drainage (AD)
- PEP + AD

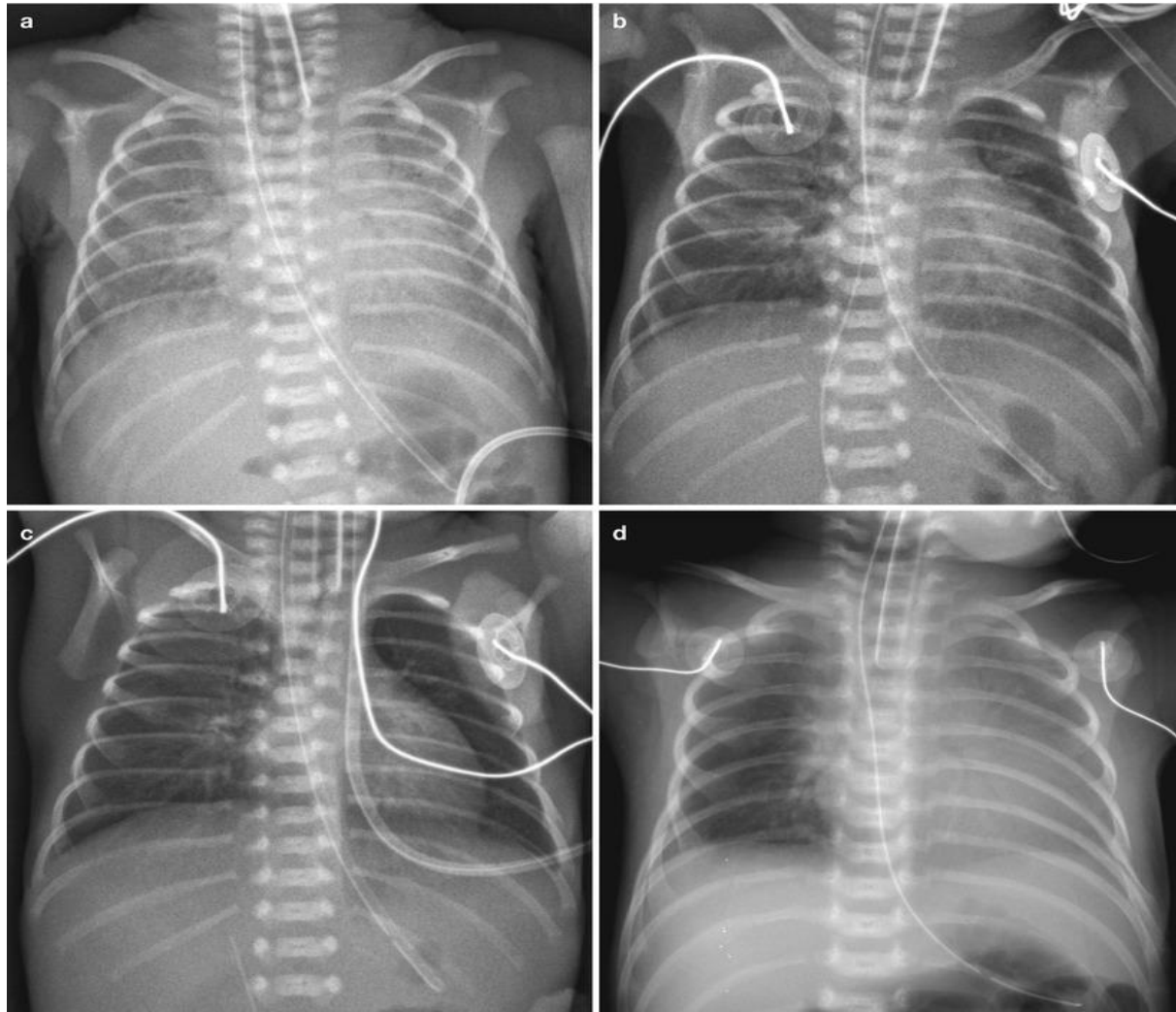
# Selection of Patients for ACT

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- Conditions in which airway clearance therapy may not be beneficial
- Conditions in which airway clearance therapy may be beneficial
  - Bronchiolitis
  - Acute lobar atelectasis
  - Cystic fibrosis
  - Neuromuscular disease or injury
  - Lung abscess
  - Asthma

# CXR of Potential ACT Candidates

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# Contraindications

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- Frank hemoptysis
- Empyema
- Foreign body aspiration
- Untreated pneumothorax
- Unstable hemodynamic or overall clinical status

# Length and Frequency of Therapy

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- CF and bronchiectasis: 30 to 45 minutes
- Most ACTs, 15 to 20 minutes
- Rarely needed more than every 4 hours
- Evaluated every 48 hours and modified as appropriate.



# Therapy Modification

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- Medical or surgical procedures
- Implanted devices
- Brittle bones
- Trendelenburg
  - ▣ Gastroesophageal reflux
  - ▣ Intracranial trauma or surgery
  - ▣ Increased intracranial pressure
  - ▣ Abdominal distention
  - ▣ Cardiopulmonary failure

# Postural Drainage Positions

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- A. Posterior of Right and Left Upper lobes
- B. Apices of Right and Left Lung
- C. Anterior of Right and Left Upper lobes
- D. Superior Segments of Both lower lobes
- E. Lateral Basal Segments
- F. Posterior Segments of Both Lower lobes

# Percussion... With Postural Drainage



# Chest Wall Vibration

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# Cough Assist-Inexsufflation

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# Cough Assist-Inexsufflation-Cont.

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- 1 Second Inspiration
- 2-3 second Expiration
- Insp. Pressure Max- 20-25 cm H<sub>2</sub>O
- Expiratory Pressure Max. -20-35 cm H<sub>2</sub>O
- 5-10 cycles over 5-10 minutes
- Monitor of contraindications and adverse reactions

# Suctioning Procedure

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- Vacuum pressure
  - ▣ Neonates: 60 to 80 mm Hg
  - ▣ Children: 80 to 100 mm Hg
- Appropriate length and size of catheter
  - ▣ Diameter should not exceed  $\frac{1}{2}$  ID of artificial airway
  - ▣ Neonates 5 – 8 Fr., Pediatrics 8 – 12 Fr.
- Instillation of saline or other medication
- Nasotracheal suction
- Bulb suction
- Closed tracheal suction system

# Suction Catheter Sizes

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<b>Endotracheal/Tracheostomy Tube (inner diameter in mm)</b>	<b>Suction Catheter Size (French)</b>	<b>In-Line Suction Catheter (French)</b>
2.5	5	6
3	6	6 or 8
3.5	6	8
4	8	8
4.5	8	10
5	10	10
5.5	10	10



# To Instill Saline in an Artificial Airway or Not?

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- Saline instillation prior to suctioning remains a controversial topic
- Catheter insertion alone may dislodge thousands of bacteria into the lung
- A flush of saline increases this and potentially distributes them distally into the lung
- When necessary, the low-sodium solution may preserve the antimicrobial component of the airway mucus while still enhancing cough and secretion removal.
- 1-2 mls of half NS or 0.45% saline

# Mucolytic and Hydrating Agents

- Dornase alfa (Pulmozyme)
  - Mechanism of action
  - Place in therapy
  - Dosage, administration, and adverse events
- *N*-Acetylcysteine (Mucomyst)
  - Mechanism of action
  - Place in therapy
  - Dosage, administration, and adverse events
- Hypertonic Saline (3 or 7% saline)

# Complications of ACT

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- Hypoxemia
- Airway obstruction and respiratory arrest
- Intracranial complications
- Rib fractures and bruising
- Airway trauma
- Infection

# Evaluation of Therapy

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- Amount of secretions expectorated
- Hydration status
- Changes in sputum production
- Breath sounds
- Vital signs
- Chest x-ray
- Blood gases
- Lung mechanics

# Documentation of Therapy

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- Technique used
- Lobes treated
- Position of the patient
- Suctioning
- Pretreatment and post-treatment breath sounds
- Vital signs
- Amount and quality of the sputum

# Airway Management



# Intubation

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## □ Indications

- Lack of pulmonary function
- Deficits in oxygenation ( $\text{PaO}_2 < 60 \text{ mm Hg}$ )
- Deficits in ventilation ( $\text{PaCO}_2 > 50\text{-}60 \text{ mm Hg}$ )

## □ Equipment

- ETT
- Laryngoscope and blades
- LMA
- Suction equipment

Age of Patient	Laryngoscope	Internal Diameter of Tracheal Tube (mm)	Distance From Midtrachea to Lips or Gums (cm)	Suction Catheter (F)
		$\frac{\text{Age (years)}}{4} + 4$	<p>&lt;44 weeks gestational age: 6 + Weight (kg)</p> <p>&gt;44 weeks gestational age: 3 × TT size</p>	2 × TT size
Preterm infant	Miller 0†	2.5, 3.0 uncuffed	8	5-6
Term infant	Miller 0-1† Wis-Hipple 1 Robertshaw 0	3.0, 3.5 uncuffed	9-10	6-8
6 months		3.5, 4.0 uncuffed	10.5-12	8
1 year	Miller 1 Wis-Hipple 1½ Robertshaw 1	4.0, 4.5 uncuffed	12-13.5	8
2 years	Miller 2 Macintosh 2 Flagg 2	4.5 uncuffed 4.0 cuffed	13.5	8
4 years		5.0, 5.5 uncuffed 4.5 cuffed	15	10
6 years		5.5 uncuffed 5.0 cuffed	16.5	10
8 years	Miller 2 Macintosh 2	6.0 cuffed	18	12
10 years		6.5 cuffed	19.5	12
12 years	Macintosh 3	7.0 cuffed	21	12
Adolescent	Macintosh 3 Miller 3	7.0, 8.0 cuffed	21	12





**FIGURE 13-7** The NeoBar. A commercial adaptation of the Logan bow for stabilizing an infant endotracheal tube.

# Considerations for Extubation

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- Condition
  - ▣ Improved or reversed
- Hemodynamically stable
- Breathing spontaneously
- Able to protect airway

# Tracheotomy

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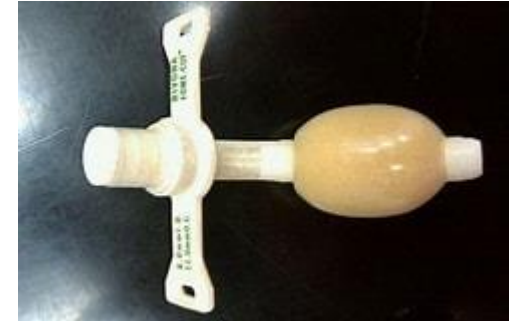
## □ Indications

- Airway obstruction
- Airway protection
- Long-term ventilation
- Pulmonary hygiene

# Tracheotomy (Cont.)

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- Tubes
  - ▣ High volume, low pressure
  - ▣ Foam cuff
  - ▣ Tight to shaft (TTS)
- Procedure and technique



# Tracheotomy (Cont.)

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## □ Complications

### □ Prevention

- Good training for caregivers

### □ Plugging of the tube

### □ Accidental dislodgment

### □ Others

- Bleeding, stomal and suprastomal granulation tissue, tracheal erosion, suprastomal tracheomalacia

### □ Speech delay and delay in phonation

- Passe Muir valve

### □ Swallowing complications

# Tracheotomy (Cont.)

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- Decannulation (indications)
  - ▣ Original condition resolved or improved
  - ▣ Natural airway adequate
  - ▣ Able to protect airway
- Procedure
  - ▣ Immediately remove the tube.
  - ▣ Downsize and cap the tube.
  - ▣ Extubate after single-stage laryngotracheal reconstruction.

# Take Home Points

- Airways clearance techniques can be beneficial to neonates and pediatric patients.
- There are many techniques which can be applied.
- Selecting the best technique(s) should be tailored to the patient and their condition.
- Most airway clearance techniques have hazards which can be addressed by the skilled clinician.
- Careful assessment is the foundation for evaluating the effectiveness of this type of therapy.
- Artificial airways should be suitable for the patient, properly maintained and removed as soon as practical and safe.

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