Hyperinflation Therapy and the Tools to Accomplish It!!

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HYPERINFLATION THERAPY
Challenges in Post Acute Care

- Deconditioning
- Malnutrition
- Hydration
- Atelectasis
- Hypoventilation
- Aspiration
- Secretion Retention
- Mucus Plugging
- Sleep Disorders
- Infection
Chronic Diseases with Acute Respiratory Complications

- Neuromuscular Disease
  - CP, ALS, MD, SCI, Guillanne Barre, Spinal Muscular Atrophy (SMA)
- Primary Ciliary Dyskinesia
- Muscoskeletal Disease
- (CVA)
- Cardiac Dysfunctions
- Renal Disease
- COPD
- GI Problems
- Swallow Dysfunctions

- Hypoventilation, atelectasis, secretions
- Pneumonia, atelectasis
- CHF
- Pneumonia, atelectasis
- Aspiration Pneumonia
Clinical Pathway for Hypoventilation

- The PFT usually shows reduced lung functions: VC & TLC
- Reduced respiratory muscles function. Reduced Peak Flows
  Results in the reduced ability to generate intrathoracic pressures
Airway obstruction is often the most common problem for neuromuscular impaired patients.

Ventilatory insufficiency or complete ventilatory failure

Additional complications often result from an impaired cough. This often leads to respiratory infections.

When ventilatory failure is imminent, ventilatory assistance is required.
Clinical Pathway for Hypoventilation

- Non Invasive ventilation is the preferred initial intervention (CPAP, BiPAP, Opti-Flow)
- Intubation followed by a tracheotomy is the common invasive ventilation choice.
- Nocturnal ventilation followed by increased ventilatory support.
- Full time ventilatory assistance
Clinical Pathway for Neuromuscular Disease

- Tracheotomy
- Invasive Ventilation
- Neuro muscular Disease
- Normal Respiratory Function
- Dysphasia with Aspiration
- Increased Hospitalization
- Non-Invasive Ventilation
Airway maintenance is one of the most important components of the management of neuromuscular-impaired patients. It significantly increases the success of extubation and the outcomes in non-invasively ventilated patients.
Assistive Techniques and Equipment

- Patients with airway obstructions or impairment require intervention to assist in the elimination of mucus from the airway. Airways cleared of mucus improve ventilation and reduce the negative effects of the obstructed airway. 1

1 (Foster, 2002; Prior, Schofield, Boivin, P., & A., 1999; Suárez et al., 2002)
Secretion Mobilization

• The normal process for clearing secretions in a healthy person without need of any assistance is the model that is used in the therapy for airway clearance.
  
  • LOOSENING THE SECRETIONS
  • MOBILIZING THE SECRETIONS
  • COUGHING UP THE SECRETION
  • EXpectorating THEM

• Airway clearance therapy is evidenced-based techniques that duplicate these actions allowing a caregiver to assist in maintaining a clear airway.
Techniques to Loosen of Secretions

- Hydration
- Mobility
- Systemic or Inhaled Mucolytics
- The Vest or Smart Vest
- Chest physical therapy (mechanical or manual)
- Intrapulmonic Percussing Ventilation
- Flutter or Acappella
- PEP Therapy
- Neb to reduce bronchospasm or reactive airway complications
Techniques to "Loosen Mucus"
Keep Secretions Moving

- Postural Drainage Therapy
- Improve Ciliary Function
- Huff Cough Technique
- In-Exsufflator
- Intrapulmonic Percussing Ventilator
- Deep Breathing Exercises
- Keep secretions thin
- PEP Therapy
Keep Secretions Moving
Coughing Up Secretions

Create Peak Cough Flow > 165 lpm

Assisted Cough Techniques

Cough Assist Devices

Maximize Diaphragmatic Function
Expectorating Secretions

- Improve Glossal Pharyngeal Tone
- Intact Cough Reflex
- Tonsillar Suction
- Deep Tracheal Suction
- Tracheostomy
Anatomy of a Cough

• The successful elimination of mucus will depend on the degree of effectiveness of a natural cough.11

A cough has three phases
1. The inspiratory phase
2. Compression phase
3. The explosive exhalation phase
Therapy According to Clinical Symptoms

• Scheduling routine treatments should be avoided
  – The patient’s specific clearance needs determine the treatment times and intensity.
• Generally, the morning requires a very aggressive treatment and the evening requires a moderate treatment for sleep.
• As with all therapies for airway clearance of neuromuscular patients, if secretions increase, then the therapy must be increased. A nonproductive session may be experienced regardless of the quality of the effort.
• If the vital signs are good and the patient is stable, it is best to leave the patient for a short time (maybe ½ hour) and then reattempt. This is common and most likely to occur in the morning.
• Respiratory therapists, nurses and all healthcare workers should begin the training of the family immediately. They can begin to synchronize with the patients needs so that when they provide care at home they will be competent and comfortable. 3 There is an AARC clinical practice guideline available for providing patient and caregiver training and should be utilized if needed.

3 (AARC PC, 1996; Topin et al., 2002)
Beware of Fatigue

• Rest is essential to the recovery of a patient. This is a basic universal concept required to strengthen the patient to be able to give the best effort and be able to physically and mentally tolerate the therapy.
**CPAP & BiPAP**

- Continuous Positive Airway Pressure (CPAP) one pressure administered by mask or nasal prongs to support airways, relieve obstruction (OSA) and improve oxygenation.

- Dual Positive Airway Pressure (BiPAP) Two levels of pressure to keep airways open and assist with ventilation. A pressure kick with each spontaneous breath. Utilized with hypoventilation syndrome, morbid obesity, severe COPD, neuromuscular disorders.
Non - Invasive Nasal Ventilatory Assistance
The FDA approved ventilators for 5kg patients has made things simpler and safer for smaller neuromuscular NIV patients.

New FDA approved infant interface are replacing the old custom setups. Neuromuscular NIV is becoming easier, safer and more consistent.
Non Invasive Monitoring with Non Invasive Intervention
Mouthpiece Ventilation: the alternative for the more functional and independent individual
Tracheotomy Tube

- Utilized to enhance secretion clearance.
- Can be cuffed or uncuffed.
- Utilizes plug or inner cannula. Plug to speak, inner cannula to occlude fenestration.
Tracheostomies

• An artificial airway usually performed 10-14 days after an individual has been intubated for ventilation, secretion removal and/or airway protection.

• Trachs come in many sizes and features: (cuffed, uncuffed, extra long, with & without inner cannulas, suction ports, different outside & inside diameters, etc.)
Suctioning Appliances

- Upper Airway suction with tonsillar, “Yankauer”, “Little Sucker” and syringe suction.

- Lower Airway Suction with catheters and bronchoscope assistance.
Speaking Valves

- Improve Communication
- Enhance Glottic Function
- Improve Swallow Function
- Improve Secretion Mobilization
- Improve Anatomical PEEP
PEP Therapy

- Positive Expiratory Pressure Therapy
- Used to expand alveoli, improve oxygenation and enhance secretion mobilization
- Can be utilized to for medication delivery
Acapella or Flutter Therapy

• A type of PEP therapy with a percussing quality.

• Used to mobilize secretions and recruit alveoli.

• Can be used in combination with medicated aerosols
In-Exsuffllator or Coughhalator

• A 2 phase machine used to hyperinflate the lung and assist with a patient's cough effort.
• Administered with a mask, mouthpiece or through a trach
• Used in conjunction with Quad Coughing
Each session of airway clearance consists of several sets of multiple cycles of insufflation-exsufflation.

- Sets of 3, for basic maintenance, may be increased to 5 for aggressive secretion expulsion.
- Three cycles, per set, are consecutively applied without removing the mask for suctioning for routine maintenance, and increased to 5 when you need to be more aggressive.
- Insufflations and exsufflations are usually at the same pressure and duration. Abdominal thrusts are applied during the exsufflation phase of each cycle.

(JR Bach, 2002; J. Bach, 2004; JR. Bach, 2004; Sancho et al., 2004)
Technique

• The optimal pressures set for mechanical assistance is at about +40 cm H2O to -40 cm H2O pressures. ³
  – In one study using a standard lung model for 10 full cycles, flow pressures were measured. The findings showed the pressures of +/- 40 cmH2O to be the best setting to generate exhalation flows of greater than 2.71 l/sec. A normal cough has flow ranges of 6 to 20 l/sec. ⁴

³ (Sancho, Servera, Diaz, & Marin, 2004) (Hanayama et al., 1997) (Winck et al., 2004).
⁴ (Gomez-Merino & Bach, 2002; Gómez-Merino et al., 2002; Sancho et al., 2004).
Quad Coughing

• An abdominal thrust that is coordinated with a patient's cough effort.
• Assist abdominal muscles to make exhalation more forceful.
• Can be done in chair or low Fowler's position.
Cough Technique

• Proper cough technique
  1. Hyperinflate
  2. Compressive
  3. Explosive Exhalation

• Huff Cough
  1. Open glottis

• Machine gun
Breathing Techniques

- Proper breathing technique
- Pursed Lip Breathing
- Diaphragmatic Breathing
- Stacking breaths
Inspiratory Muscle Trainer

• Used to strengthen the intercostals and abdominal muscles
• Resistance when a patient inhales
• Used for progressively longer periods of time
Opti Flo

- High flow oxygen at a specific FiO2
- Need 50 PSI O2 source
- 1 cm CPAP with every 10 lpm flow
- Heated system due to high flow of gas
**Incentive Spirometry**

- A device that measures inspiratory capacity. Good gauge of progress or deterioration
- Used to encourage slow, deep breaths
- Breath hold after taking deep breath
Intrapulmonary Percussing Ventilation (IPV)

• Positive Pressure Treatment that uses percussive airwaves to loosen and mobilize secretions.

• Medication is delivered with this treatment

• Used to recruit alveoli
Chest PT & Postural Drainage

- Percussion or Vibration over specific lung segments
- Positioning to drain designated lobes of the lung
- Cough afterward to promote mucus clearance
Oscillating Vest

- Use of an external vest or wrap that oscillates the chest and helps to loosen secretions and improve aeration to the distal airways.
- Improves mucus clearance and atelectasis.
Diagnostic Studies

• Pulse Oximetry
• End Tidal Carbon Dioxide Monitor (ETCO2)
• Sleep Scan
• Pulmonary Function Test (PFT)
• NIF & Vc
Respiratory Complications due to Spinal Chord Injury

- Atelectasis
- Aspiration
- Pulmonary Emboli

- Hypoventilation due to compromised respiratory muscles & mucus plugging
- Decreased tidal volumes will increase the incidence of aspiration
- Decreased mobilization will increase the incidence of PE
Treatment of Spinal Chord Respiratory Complications

- In-exsufflator to treat atelectasis and improve secretion mobilization
- IPV: for lung recruitment and secretion mobilization
- Mobility: position changes help to mobilize mucus and change areas of ventilation in the lung
- IMT: strengthen respiratory muscles
- Anticoagulation Therapy for DVT’s
Respiratory Care Protocol Overview

**Physician orders "Respiratory Consult"**

RCP reviews patient’s chart and perform physical assessment

**Determine Therapy Care Plan**

### Indications

**Aerosolized Medication**
- Reduced Peak Flow
- Bronchospasm
- Respiratory H(x)
- Home Therapy
- Retained Secretions

**Bronchial Hygiene**
- Productive Cough
- Rhonchi
- Difficulty clearing secretions

**Hyperinflation**
- Atelectasis
- Bed rest or Inactivity
- Vc < 60% of predicted

**Oxygen**
- SpO2<93%, PAO2<60
- Clinical signs of Hypoxia:
  - Tachypnea
  - Tachycardia
  - Cyanosis
  - Confusion
  - Diaphoresis
  - Anxiety

**Tracheotomy Wean**
- Intact cough & gag reflex
- PCF > 160 LPM
- Pass Swallow Study
- Alert and Cooperative
- Reduced Secretions

### Therapy

**Aerosol T(x) with Medication**
- Coughhalator
- Flutter Valve
- PEP Therapy
- IPPB
- Cough & Deep Breath
- CPT & PD
- Suction
- Relaxation Exercises

**IPPB with Medication**
- PEP Therapy
- IPV
- Coughhalator
- Cough & Deep Breath
- IPPB
- Thermoduodenal trial

**IPV with Medication**
- Incentive Spirometry
- Inspir Muscle Trainer
- Coughhalator
- Cough & Deep Breath
- CPAP
- Reman Plugged 48hrs

**MDI with spacer &Medication**
- PEP Therapy
- Coughhalator
- Cough & Deep Breath
- CPAP
- Trach Plugging
- ThermoVent Trial
- Downsize Tracheostomy