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AARC Clinical Practice Guideline

Use of Positive Airway Pressure Adjuncts to Bronchial Hygiene Therapy

PAP 1.0 PROCEDURE:

Positive airway pressure (PAP) adjuncts are used to mobilize secretions and treat atelectasis and include continuous positive airway pressure (CPAP), positive expiratory pressure (PEP), and expiratory positive airway pressure (EPAP).

Cough or other airway clearance techniques are essential components of PAP therapy when the therapy is intended to mobilize secretions.(1-3)

PAP 2.0 DEFINITION/DESCRIPTION:

During CPAP therapy, the patient breathes from a pressurized circuit against a threshold resistor (water-column, weighted, or spring loaded) that maintains consistent preset airway pressures from 5 to 20 cm H2O during both inspiration and expiration.(4-13) (By strict definition, CPAP is any level of above-atmospheric pressure.) CPAP requires a gas flow to the airway during inspiration that is sufficient to maintain the desired positive airway pressure.

During PEP therapy, the patient exhales against a fixed-orifice resistor, generating pressures during expiration that usually range from 10 to 20 cm H2O.(14-24) PEP does not require a pressurized external gas source.

During EPAP therapy the patient exhales against a threshold resistor, generating preset pressures of 10 to 20 cm H2O.25-27 EPAP does not require a pressurized external gas source.

EPAP utilizing threshold resistors does not produce the same mechanical or physiologic effects that PEP does when a fixed orifice resistor is used.(28) Further study is necessary to determine how these differences affect clinical outcome.

PAP 3.0 SETTINGS:

3.1 Critical care
3.2 Acute care inpatient
3.3 Extended-care and transitional-care facilities
3.4 Home care
3.5 Outpatient

PAP 4.0 INDICATIONS:

4.1 To reduce air trapping in asthma and COPD(16,29-31)
4.2 To aid in mobilization of retained secretions (in cystic fibrosis and chronic bronchitis)(14,15,17-24,32,33)
4.3 To prevent or reverse atelectasis(6-13,34-36)
4.4 To optimize delivery of bronchodilators in patients receiving bronchial hygiene therapy(37,38)

PAP 5.0 CONTRAINDICATIONS:

Although no absolute contraindications to the use of PEP, CPAP, or EPAP mask therapy have been reported,4,39 the following should be carefully evaluated before a decision is made to initiate PAP mask therapy.
5.1 Patients unable to tolerate the increased work of breathing (acute asthma, COPD)
5.2 Intracranial pressure (ICP) > 20 mm Hg
5.3 Hemodynamic instability(4)
5.4 Recent facial, oral, or skull surgery or trauma4
5.5 Acute sinusitis(39)
5.6 Epistaxis
5.7 Esophageal surgery
5.8 Active hemoptysis(39)
5.9 Nausea
5.10 Known or suspected tympanic membrane rupture or other middle ear pathology
5.11 Untreated pneumothorax

PAP 6.0 HAZARDS/COMPLICATIONS:

6.1 Increased work of breathing(4) that may lead to hypoventilation and hypercarbia
6.2 Increased intracranial pressure
6.3 Cardiovascular compromise
6.3.1 myocardial ischemia
6.3.2 decreased venous return(4)
6.4 Air swallowing,(4) with increased likelihood of vomiting and aspiration

6.5 Claustrophobia(4)
6.6 Skin break down and discomfort from mask(4)
6.7 Pulmonary barotrauma(4)

PAP 7.0 LIMITATIONS OF METHOD:

7.1 PAP therapies for bronchial hygiene require spontaneously breathing patients.
7.2 CPAP is an equipment-intensive procedure requiring an external positive pressure gas source or compressor and considerable training of personnel for proper setup and maintenance. These factors make CPAP more expensive and less portable than other PAP alternatives.

PAP 8.0 ASSESSMENT OF NEED:

The following should be assessed together to establish a need for PAP therapy:
8.1 Sputum retention not responsive to spontaneous or directed coughing
8.2 History of pulmonary problems treated successfully with postural drainage therapy
8.3 Decreased breath sounds or adventitious sounds suggesting secretions in the airway
8.4 Change in vital signs-increase in breathing frequency, tachycardia
8.5 Abnormal chest radiograph consistent with atelectasis, mucus plugging, or infiltrates
8.6 Deterioration in arterial blood gas values or oxygen saturation

PAP 9.0 ASSESSMENT OF OUTCOME:

9.1 *Change in sputum production*--if PEP does not increase sputum production in a patient who produces > 30 mL/day of sputum without PEP, the continued use of PEP may not be indicated.
9.2 *Change in breath sounds*--with effective therapy, breath sounds may clear or the movement of secretions into the larger airways may cause an increase in adventitious breath sounds. The increase in adventitious breath sounds is often a marked improvement over no (or diminished) breath sounds. Note any effect that coughing may have had on the breath sounds.
9.3 *Patient subjective response to therapy*--the caregiver should ask the patient how he or she feels before, during, and after therapy. Feelings of pain, discomfort, shortness of breath, dizziness, and nausea should be considered in modifying and stopping therapy. Improved ease of clearing secretions and increased volume of secretions during and after treatments support continuation.
9.4 *Change in vital signs*--moderate changes in respiratory rate and/or pulse rate are expected. Bradycardia, tachycardia, increasingly

irregular pulse, or a drop or dramatic increase in blood pressure are indications for stopping therapy.
9.5 *Change in chest radiograph*--resolution or improvement of atelectasis and localized infiltrates may be slow or dramatic.
9.6 *Change in arterial blood gas values or oxygen saturation*--normal oxygenation should return as atelectasis resolves.
PAP 10.0 RESOURCES:

10.1 Equipment:
10.1.1 *PEP*--Fixed orifice resistor capable of developing 10 to 20 cm H2O pressure during passive expiration, with one-way valves allowing unobstructed inspira-tion.(39,41,42)
10.1.2 *CPAP*--Threshold resistor capable of developing 5 to 20 cm H2O pressure, with a source of gas flow sufficient to maintain the desired level of pressure during inspiration, at desired FIO2 (requiring flowrater or blender, reservoir bag on inspiratory line, or an adjustable demand valve)
10.1.3 *EPAP*--Threshold resistor capable of developing pressures of 10 to 20 cm H2O, with a one-way valve that allows gas at ambient pressure to enter airway on inspiration and directs exhaled gas through the threshold resistor(28)
10.1.4 Transparent mask or mouthpiece(12,39)
10.1.5 Manometer for initial adjustments of resistor size and/or gas flow(39)
10.1.6 Tissues and emesis basin or container for collecting or disposing of expectorated sputum
10.1.7 Gloves, goggles, gown, and mask
10.2 Personnel: A spectrum of education and skill levels is required for personnel who administer PEP, CPAP, or EPAP therapy. Different clinical situations warrant the degree of training necessary to provide optimal respiratory care:
10.2.1 Level-I personnel are responsible for ongoing assessment and care of unstable patients. Their demonstrated skills and knowledge should include
10.2.1.1 proper use and limitations of equipment;
10.2.1.2 ability to assess patient condition and response to therapy;
10.2.1.3 performance of physical examination (auscultation and vital signs);
10.2.1.4 understanding of effects of increased expiratory pressure on ventilation, perfusion, and sputum mobilization;
10.2.1.5 understanding of procedures, indications, and contraindications, and hazards for PEP, CPAP, and EPAP;
10.2.1.6 ability to demonstrate dia-phragmatic breathing and relaxation, and to direct coughing;

10.2.1.7 ability to monitor effects of and subject response to changes in expiratory airway pressure;
10.2.1.8 understanding of and compliance with Universal Precautions and infection control standards related to cleaning equipment, maintaining equipment, and handling of secretions.
10.2.2 Level-II personnel should possess all Level-I skills and knowledge plus
10.2.2.1 ability to perform initial assessment of patient, initiate therapy and assess patient response and tailor therapy to patient needs.
10.2.2.2 ability to negotiate care plan and modifications with physician and health care team
10.2.2.3 ability to instruct patient, family, or caregiver in goals of therapy and
10.2.2.3.1 proper technique for administration,
10.2.2.3.2 proper use of equipment,
10.2.2.3.3 cleaning of equipment,
10.2.2.3.4 breathing patterns and cough techniques,
10.2.2.3.5 modification of technique in response to adverse reactions,
10.2.2.3.6 modification of duration or frequency in response to severity of symptoms.
10.2.3 Level III: Self-administration of PEP, EPAP, or CPAP--the patient who is to self-administer treatment should demonstrate
10.2.3.1 proper technique for adminis-tration,
10.2.3.2 proper use of equipment,
10.2.3.3 appropriate breathing patterns and cough techniques,
10.2.3.4 ability to modify technique in response to adverse reactions,
10.2.3.5 ability to modify duration or frequency in response to severity of symptoms.

PAP 11.0 MONITORING:

Items from the following list should be chosen as is appropriate for monitoring a specific patient's response to PAP.
11.1 Patient subjective response--pain, discomfort, dyspnea, response to therapy
11.2 Pulse rate and cardiac rhythm (if EKG is available)
11.3 Breathing pattern and rate, symmetrical lateral costal expansion, synchronous thoraco-abdominal movement
11.4 Sputum production (quantity, color, consistency, and odor)
11.5 Mental function
11.6 Skin color
11.7 Breath sounds
11.8 Blood pressure
11.9 Pulse oximetry (if hypoxemia with procedure has been previously

demonstrated or is suspected); blood gas analysis (if indicated)
11.10 Intracranial pressure (ICP) in patients for whom ICP is of critical importance.

PAP 12.0 FREQUENCY:

12.1 *Critical Care*--from once per hour(43) to once every 6 hours, for intermittent PAP as tolerated. PAP order should be re-evaluated at least every 24 hours based on assessment made during and following each treatment.
12.2 *Acute/Domiciliary Care*
12.2.1 Common strategies for PAP vary from twice to four times daily, with frequency determined by assessment of patient response to therapy.
12.2.2 PAP orders for acute care patients should be reevaluated at least every 72 hours based on patient response to therapy or with any change of patient status.
12.2.3 Domiciliary patients should be reevaluated periodically and with any change of status.

PAP 13.0 INFECTION CONTROL ISSUES:

13.1 Observe Universal Precautions as appropriate.(44)
13.2 Follow guidelines for prevention of transmission of tuberculosis in health care settings.(45)
13.3 Observe all infection control guidelines posted for specific patient.
13.4 Disinfect any reusable equipment (according to manufacturer's recommendations) between patients.

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