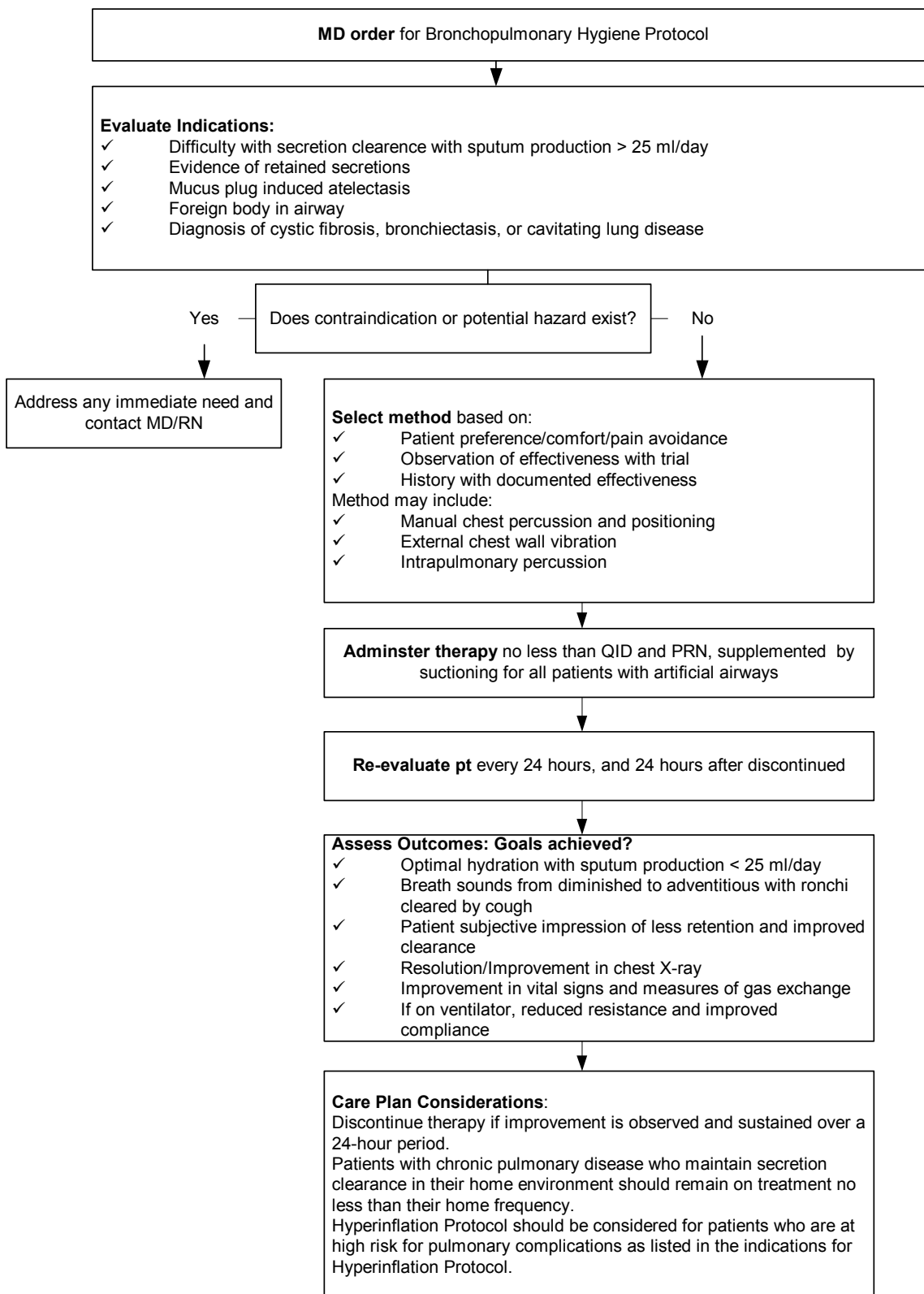


BRONCHOPULMONARY HYGIENE PROTOCOL



5/5/03 (Jan Phillips-Clar, Rick Ford, Judy Tietsort, Jay Peters, David Vines)

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AARC Clinical Practice Guideline

Postural Drainage Therapy

PDT 1.0 PROCEDURE:

Postural drainage therapy (PDT) is a component of bronchial hygiene therapy. It consists of postural drainage, positioning, and turning and is sometimes accompanied by chest percussion and/or vibration. Cough or airway clearance techniques are essential components of therapy when postural drainage is intended to mobilize secretions.(1-6) Postural drainage therapy is often used in conjunction with aerosol administration and other respiratory care procedures.

This procedure has been commonly referred to as(7-12)

chest physiotherapy,
chest physical therapy,
postural drainage and percussion, and
percussion and vibration.

PDT 2.0 DESCRIPTION/DEFINITION:

Postural drainage therapy is designed to improve the mobilization of bronchial secretions(2,4,5,8-10,13-18) and the matching of ventilation and perfusion,(19-23) and to normalize functional residual capacity (FRC)(17,24-30) based on the effects of gravity and external manipulation of the thorax. This includes turning, postural drainage, percussion, vibration, and cough.

2.1 Turning

Turning is the rotation of the body around the longitudinal axis to promote unilateral or bilateral lung expansion(19,22) and improve arterial oxygenation.(19-21,31) Regular turning can be to either side or the prone position,(32) with the bed at any degree of inclination (as indicated and tolerated). Patients may turn themselves or they may be turned by the caregiver or by a special bed or device.(21,22,33-35)

2.2 Postural Drainage

Postural drainage is the drainage of secretions, by the effect of gravity, from one or more lung segments to the central airways (where they can be removed by cough or mechanical aspiration).(2,4,5,11,13,15-18,26,29,36,37) Each position consists of placing the target lung segment(s) superior to the carina. Positions should generally be held for 3 to 15 minutes (longer in special situations).(4,6,13,16,18,20,29,38-40) Standard positions are modified as the patient's condition and tolerance warrant.

2.3 External Manipulation of the Thorax

2.3.1 Percussion

Percussion is also referred to as cupping, clapping, and tapotement. The purpose of percussion is to intermittently apply kinetic energy to the chest wall and lung. This is accomplished by rhythmically striking the thorax with cupped hand or mechanical device directly over the lung segment(s) being drained. No convincing evidence demonstrates the superiority of one method over the other.(4,18,41-44)

2.3.2 Vibration

Vibration involves the application of a fine tremorous action (manually performed by pressing in the direction that the ribs and soft tissue of the chest move during expiration) over the draining area. No conclusive evidence supports the efficacy of vibration, the superiority of either manual or mechanical methods, or an optimum frequency.(2,4,13,27,28,30,36,38,39,45-47)

PDT 3.0 SETTING:

Although PDT can be used with neonates, infants, childrens, and adults, this Guideline applies primarily to older children and adults. PDT can be performed in a wide variety of settings.

3.1 Critical care

3.2 In-patient acute care

3.3 Extended care and skilled nursing facility care

3.4 Home care

3.5 Outpatient/ambulatory care

3.6 Pulmonary diagnostic (bronchoscopy) laboratory

PDT 4.0 INDICATIONS:

4.1 Turning

4.1.1 inability or reluctance of patient to change body position. (eg, mechanical ventilation, neuromuscular disease, drug-induced paralysis)

4.1.2 poor oxygenation associated with position(20,22,48-50) (eg, unilateral lung disease)

4.1.3 potential for or presence of atelectasis(24,26,30)

4.1.4 presence of artificial airway

4.2 Postural Drainage

4.2.1 evidence or suggestion of difficulty with secretion clearance

4.2.1.1 difficulty clearing secretions with expectorated sputum production greater than 25-30 mL/day (adult)(3,7,9,11,12,27,38,40, 46,51-53)

4.2.1.2 evidence or suggestion of re-retained secretions in the presence of an artificial airway

4.2.2 presence of atelectasis caused by or suspected of being caused by mucus plugging(24,26,29,30,54)

4.2.3 diagnosis of diseases such as cystic fibrosis,(1,5,6,13-15,18,36,55) bronchiectasis,(4,5,14) or cavitating lung disease

4.2.4 presence of foreign body in airway(56-58)

4.3 External Manipulation of the Thorax

4.3.1 sputum volume or consistency suggesting a need for additional manipulation (eg, percussion and/or vibration) to assist movement of secretions by gravity, in a patient receiving postural drainage

PDT 5.0 CONTRAINDICATIONS:

The decision to use postural drainage therapy requires assessment of potential benefits versus potential risks. Therapy should be provided for no longer than necessary to obtain the desired therapeutic results.

Listed contraindications are relative unless marked as absolute (A).

5.1 Positioning

5.1.1 All positions are contraindicated for

5.1.1.1 intracranial pressure (ICP) > 20 mm Hg(59,60)

5.1.1.2 head and neck injury until stabilized (A)

5.1.1.3 active hemorrhage with hemodynamic instability (A)

5.1.1.4 recent spinal surgery (eg, laminectomy) or acute spinal injury

- 5.1.1.5 acute spinal injury or active hemoptysis
- 5.1.1.6 empyema
- 5.1.1.7 bronchopleural fistula
- 5.1.1.8 pulmonary edema associated with congestive heart failure
- 5.1.1.9 large pleural effusions
- 5.1.1.10 pulmonary embolism
- 5.1.1.11 aged, confused, or anxious patients who do not tolerate position changes
- 5.1.1.12 rib fracture, with or without flail chest
- 5.1.1.13 surgical wound or healing tissue
- 5.1.2 Trendelenburg position is contraindicated for
 - 5.1.2.1 intracranial pressure (ICP) > 20 mm Hg(59,60)
 - 5.1.2.2 patients in whom increased intracranial pressure is to be avoided (eg, neurosurgery, aneurysms, eye surgery)
 - 5.1.2.3 uncontrolled hypertension
 - 5.1.2.4 distended abdomen
 - 5.1.2.5 esophageal surgery
 - 5.1.2.6 recent gross hemoptysis related to recent lung carcinoma treated surgically or with radiation therapy(59)
 - 5.1.2.7 uncontrolled airway at risk for aspiration (tube feeding or recent meal)
- 5.1.3 Reverse Trendelenburg is contraindicated in the presence of hypotension or vasoactive medication
- 5.2 External Manipulation of the Thorax
In addition to contraindications previously listed
 - 5.2.1 subcutaneous emphysema
 - 5.2.2 recent epidural spinal infusion or spinal anesthesia
 - 5.2.3 recent skin grafts, or flaps, on the thorax
 - 5.2.4 burns, open wounds, and skin infections of the thorax
 - 5.2.5 recently placed transvenous pacemaker or subcutaneous pacemaker (particularly if mechanical devices are to be used)
 - 5.2.6 suspected pulmonary tuberculosis
 - 5.2.7 lung contusion
 - 5.2.8 bronchospasm
 - 5.2.9 osteomyelitis of the ribs
 - 5.2.10 osteoporosis
 - 5.2.11 coagulopathy
 - 5.2.12 complaint of chest-wall pain

PDT 6.0 HAZARDS/COMPLICATIONS:

6.1 Hypoxemia

Action To Be Taken/Possible Intervention: Administer higher oxygen concentrations during procedure if potential for or observed hypoxemia exists. If patient becomes hypoxemic during treatment, administer 100% oxygen, stop therapy immediately, return patient to original resting position, and consult physician. Ensure adequate ventilation. Hypoxemia during postural drainage may be avoided in unilateral lung disease by placing the involved lung up-permost with patient on his or her side.(20,22,48-50)

6.2 Increased Intracranial Pressure

Action To Be Taken/Possible Intervention: Stop therapy, return patient to original resting position, and consult physician.

6.3 Acute Hypotension during Procedure

Action To Be Taken/Possible Intervention: Stop therapy, return patient to original resting position, and consult physician.

6.4 Pulmonary Hemorrhage

Action To Be Taken/Possible Intervention: Stop therapy, return patient to original resting position, call physician immediately. Administer oxygen and maintain an airway until physician responds.

6.5 Pain or Injury to Muscles, Ribs, or Spine

Action To Be Taken/Possible Intervention: Stop therapy that appears directly associated with pain or problem, exercise care in moving patient, and consult physician.

6.6 Vomiting and Aspiration

Action To Be Taken/Possible Intervention: Stop therapy, clear airway and suction as needed, administer oxygen, maintain airway, return patient to previous resting position, and contact physician immediately.

6.7 Bronchospasm

Action To Be Taken/Possible Intervention: Stop therapy, return patient to previous resting position, administer or increase oxygen delivery while contacting physician. Administer physician-ordered bronchodilators.

6.8 Dysrhythmias

Action To Be Taken/Possible Intervention: Stop therapy, return patient to previous resting position, administer or increase oxygen delivery while contacting physician.

PDT 7.0 LIMITATIONS OF METHOD:

7.1 Presumed effectiveness of PDT and its application may be based more on tradition and anecdotal report than on scientific evidence. The procedure has been used excessively and in patients in whom it is not indicated.(11,40,61-63)

7.2 Airway clearance may be less than optimal in patients with ineffective cough.

7.3 Optimal positioning is difficult in critically ill patients.

PDT 8.0 ASSESSMENT OF NEED:

The following should be assessed *together* to establish a need for postural drainage therapy

8.1 excessive sputum production

8.2 effectiveness of cough

8.3 history of pulmonary problems treated successfully with PDT (eg, bronchiectasis, cystic fibrosis, lung abscess)

8.4 decreased breath sounds or crackles or rhonchi suggesting secretions in the airway

8.5 change in vital signs

8.6 Abnormal chest x-ray consistent with atelectasis, mucus plugging, or infiltrates

8.7 deterioration in arterial blood gas values or oxygen saturation

PDT 9.0 ASSESSMENT OF OUTCOME:

These represent individual criteria that indicate a positive response to therapy (and support continuation of therapy). Not all criteria are required to justify continuation of therapy (eg, a ventilated patient may not have sputum production > 30 mL/day, but have improvement in breath sounds, chest x-ray, or increased compliance or decreased resistance).

9.1 Change in sputum production

If sputum production in an optimally hydrated patient is less than 25 mL/day with PDT the procedure is not justified.(3,5,7,9,11,12,38,40,46,51-53) Some patients have productive coughs with sputum production from 15 to 30 mL/day (occasionally as high as 70 or 100 mL/day) without postural drainage. If postural drainage does not increase sputum in a patient who produces > 30 mL/day of sputum without postural drainage, the continuation of the therapy is not indicated. Because sputum production is affected by systemic hydration, apparently ineffective PDT probably should be continued for at least 24 hours after optimal hydration has been judged to be present.

9.2 Change in breath sounds of lung fields being drained

With effective therapy, breath sounds may 'worsen' following the therapy as secretions move into the larger airways and increase rhonchi. An increase in adventitious breath sounds can be a marked improvement over absent or diminished breath sounds. Note any effect that coughing may have on breath sounds. One of the favorable effects of coughing is clearing of adventitious breath sounds.

9.3 Patient subjective response to therapy

The caregiver should ask 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 decisions to modify or stop therapy. Easier clearance of 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, or an increase in irregularity of pulse, or fall or dramatic increase in blood pressure are indications for stopping therapy.

9.5 Change in chest x-ray

Resolution or improvement of atelectasis may be slow or dramatic.

9.6 Change in arterial blood gas values or oxygen saturation

Oxygenation should improve as atelectasis resolves.

9.7 Change in ventilator variables

Resolution of atelectasis and plugging reduces resistance and increases compliance.

PDT 10.0 RESOURCES:

10.1 Equipment

10.1.1 bed or table that can be adjusted for a range of positions from Trendelenburg to Reverse Trendelenburg position

10.1.2 pillows for supporting patient

10.1.3 light towel for covering area of chest during percussion

10.1.4 tissues and/or basin for collecting expectorated sputum

10.1.5 suction equipment for patients unable to clear secretion

10.1.6 gloves, goggles, gown, and mask as indicated for caregiver protection

10.1.7 optional: hand-held and mechanical percussor or vibrator

10.1.8 oxygen delivery device

10.1.9 recent chest x-ray, if available

10.1.10 stethoscope for auscultation

10.2 Personnel

A spectrum of education and skill levels is required for personnel who administer postural drainage therapy. Different clinical situations warrant the degree of training necessary to provide optimal respiratory care.

10.2.1. The **Level I** care provider who provides routine maintenance therapy to the stable patient should possess the following skills and knowledge

10.2.1.1 proper technique for administration of PDT

10.2.1.2 proper use of equipment

10.2.1.3 breathing patterns and cough techniques

10.2.1.4 technique modification in re-sponse to adverse reactions

10.2.1.5 position or frequency modification in response to severity of symptoms

10.2.1.6 ability to assess patient condition and patient response to therapy including physical exam (auscultation and vital signs) and tests of expiratory flow or ventilator mechanics

10.2.1.7 ability to recognize and respond to adverse reactions to and complications of procedure

10.2.1.8 understanding of and compliance with Universal Precautions

10.2.2 For initial assessments and care of the unstable patient, the **Level II** care provider should possess

10.2.2.1 knowledge of proper use and limitations of equipment

10.2.2.2 ability to assess patient condition and patient response to therapy

10.2.2.3 ability to perform physical exam auscultation and vital signs

10.2.2.4 knowledge of effects of gravity and body position on ventilation, perfusion, and sputum mobilization

10.2.2.5 knowledge of procedures, indications, contraindications, and hazards for turning

10.2.2.6 knowledge of standard drainage positions, techniques for percussion and vibration, segmental and airway anatomy

10.2.2.7 ability to teach diaphragmatic breathing, relaxation, huff cough, forced expiration technique (FET), suctioning

10.2.2.8 ability to monitor effects and patient response to changes in position and other postural drainage therapy techniques

10.2.2.9 understanding of and ability to comply with Universal Precautions and infection control issues related to cleaning and maintaining equipment

10.2.2.10 ability to instruct patient/family/caregiver in goals of therapy and proper technique for administration of PDT and associated therapies

10.2.2.11 knowledge of proper use of equipment, including suction if re-quired

10.2.2.12 ability to prepare, measure, and mix medications if required

10.2.2.13 ability to clean equipment

10.2.2.14 knowledge of breathing patterns and cough techniques

10.2.2.15 ability to modify techniques in response to adverse reactions

10.2.2.16 ability to modify dosage or frequency in response to severity of symptoms

10.2.3 The subject providing self administration of postural drainage should possess knowledge and skills related to

10.2.3.1 proper technique for administration

- 10.2.3.2 proper use of equipment
- 10.2.3.3 breathing patterns and cough techniques
- 10.2.3.4 technique modification in re-sponse to adverse reactions
- 10.2.3.5 position or frequency modification in response to severity of symptoms

PDT 11.0 MONITORING:

The following should be chosen as appropriate for monitoring a patient's response to postural drainage therapy, before, during, and after therapy.

- 11.1 Subjective response--pain, discomfort, dyspnea, response to therapy
- 11.2 Pulse rate, dysrhythmia, and EKG if available
- 11.3 Breathing pattern and rate, symmetrical chest expansion, synchronous thoracoabdominal movement, flail chest
- 11.4 Sputum production (quantity, color, consistency, odor) and cough effectiveness
- 11.5 Mental function
- 11.6 Skin color
- 11.7 Breath sounds
- 11.8 blood pressure
- 11.9 oxygen saturation by pulse oximetry (if hypoxemia is suspected)
- 11.10 intracranial pressure (ICP)

PDT 12.0 FREQUENCY:

The frequencies suggested are recommendations from group experience and apply to patients in whom the therapy is *indicated*. Careful assessment and prudent clinical judgment must be exercised by the caregiver.

- 12.1 Turning
Ventilated and critically ill patients: as necessary with goal of once each hour or every other hour as tolerated, around the clock. Less acute patients should be turned every 2 hours as tolerated.
- 12.2 Postural Drainage Therapy
 - 12.2.1 In critical care patients, including those on mechanical ventilation, PDT should be performed from every 4 to every 6 hours as indicated. PDT order should be re-evaluated at least every 48 hours based on assessments from individual treatments.
 - 12.2.2 In spontaneously breathing patients, frequency should be determined by assessing patient response to therapy.
 - 12.2.3 Acute care patient orders should be re-evaluated based on patient response to therapy at least every 72 hours or with change of patient status.
 - 12.2.4 Domiciliary patients should be re-evaluated every 3 months and with change of status.

PDT 13.0 INFECTION CONTROL:

- 13.1 Implement Universal Precautions.(64)
- 13.2 Observe all infection control guidelines posted for patient.
- 13.3 Disinfect all equipment used between patients.

Bronchial Hygiene Guidelines Committee:

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