

# **AARC Clinical Practice Guideline**

## **Assessing Response to Bronchodilator Therapy at Point of Care**

### **ARBD 1.0 PROCEDURE:**

Assessing response in adults and older children\* to aerosolized bronchodilator therapy at the point of care. Although subjective responses and changes in mucociliary activity are important bronchodilator therapy effects, this guideline emphasizes the airway smooth muscle response that is primarily quantified through measurement of pulmonary function. It does not address initial diagnostic or ongoing (longitudinal) laboratory evaluation. A future Guideline will address assessment during mechanical ventilation.

\*For assessing responses in infants and toddlers, see AARC CPG **Infant/Toddler PFT**.(1)

### **ARBD 2.0 DESCRIPTION:**

**2.1** Assessment of airflow (ie, forced expiratory maneuvers and other clinical indicators) is important to determine the presence or absence of an immediate response (ie, at time of expected onset of effect), proper dose, frequency of administration, and overall response to long-term therapy). It is essential that the clinician have complete knowledge of the main effects, mode of action, time course, side effects, and dosage constraints of any medications administered.

**2.2** This guideline addresses

**2.2.1** subjective and objective measures of response;

**2.2.2** frequency of monitoring;

**2.2.3** expected or desirable outcomes.

### **ARBD 3.0 SETTINGS:**

**3.1** Critical care

**3.2** Acute care

**3.3** Extended care or skilled care facility

**3.4** Outpatient clinic

**3.5** Home

### **3.6 Pulmonary rehabilitation program**

#### **ARBD 4.0 INDICATIONS:**

Assessment of airflow and other clinical indicators are indicated when the need exists

**4.1** to confirm the appropriateness of therapy;(2-4)

**4.2** to individualize the patient's medication dose per treatment and/or frequency of administration;(2-7)

**4.3** to help determine patient status during acute and long-term pharmacologic therapy;(2,8-10)

**4.4** to determine a need for change in therapy (dose, frequency, or type of medication).(2,11)

#### **ARBD 5.0 CONTRAINDICATIONS:**

When patients present in acute, severe distress, some assessment maneuvers may be contraindicated or should be postponed until therapy (eg, bronchodilator treatment) and supportive measures (eg, oxygen therapy) have been instituted.

#### **ARBD 6.0 HAZARDS/COMPLICATIONS:**

Hazards and complications include

**6.1** those associated with deep inhalation and forced exhalation

**6.1.1** bronchoconstriction(12,13)

**6.1.2** airway collapse(14)

**6.1.3** paroxysmal coughing with or without syncope;(15,16)

**6.2** inherent hazards or complications of specific assessment procedures (ie, arterial puncture, esophageal balloons, forced exhalations).(16,17)

#### **ARBD 7.0 LIMITATIONS OF PROCEDURE OR DEVICE:**

**7.1** Conventional spirometry:

**7.1.1** cost and accessibility

**7.1.2** the patient's inability to perform forced vital capacity.

**7.2** Peak-flow measurement

**7.2.1** Patient's inability to perform peak-flow maneuver or forced expiration.

**7.2.2** The accuracy and reproducibility of peak-flow meters may vary among models and among units of the same model.(2,18-22)

**7.2.2.1** For consistency and reproducibility of results the same device (unit) should be used for a given patient.(2,21)

**7.2.2.2** If peak-flow meter is changed, the patient's range should be

re-established because of variability among units and models.

**7.2.2.3** Peak flow measurement primarily reflects changes in upper airway conductance and may be of limited use in evaluation of changes in peripheral airway conductance.(23,24)

**7.2.2.4** Evaluation of peak flow performance is subjective,(25) and, therefore, acceptability criteria are lacking. Because the maneuver is effort and volume dependent, the patient must be encouraged to perform as vigorously as clinically feasible (Three trials are desirable, with the best reported). Nose clips are not necessary, and the standing position is preferred.

**7.3** The results of subjective evaluation may be difficult to interpret consistently. A validated dyspnea rating scale may be useful.(26-30)

**7.3.1** Breath sound interpretation(31-34)

**7.3.2** Symptoms (eg, dyspnea)(27-29)

**7.4** The presence of an artificial airway increases resistance and, thus, increases work of breathing in the spontaneously breathing patient and may limit inspiratory and expiratory flows.(35,36)

**7.5** Techniques for monitoring response to bronchodilator in intubated, mechanically ventilated patients are different (eg, the flow-volume curve generated through an intubated airway may be difficult to interpret).(37-40) Accuracy and reproducibility of results may be affected by the mental and physical condition of the patient.(41) The measurement technology and, therefore, the results may vary from ventilator to ventilator.(40) Bronchodilator administration and assessment of response in the MV patient will be further addressed in a separate guideline.

## **ARBD 8.0 ASSESSMENT OF NEED**

**8.1** Response to therapy should be evaluated in all patients receiving bronchodilator therapy. (However, patient's in severe distress may need immediate treatment that precludes establishing a quantitative baseline).

**8.2** Assessment of response must be made with due regard for the patient's history, clinical presentation, and results of physical exam.

## **ARBD 9.0 ASSESSMENT OF OUTCOME**

Assessment of outcome answers the question How did assessment of the effect of bronchodilator therapy impact on patient management?

**9.1** Action based on results of assessment

**9.1.1** Increase or decrease in dose and/or frequency

**9.1.2** Change medications

**9.1.3** Add medications

**9.1.4** Continue regimen

### **9.1.5** Discontinue therapy

**9.2** To guide patient management, baseline condition and changes from baseline must be determined

#### **9.2.1** Prior to therapy:

**9.2.1.1** establish respiratory and cardiovascular baseline values;

**9.2.1.2** establish presence of clinical indicators and need for therapy;

**9.2.1.3** identify presence of contraindications.

#### **9.2.2** During therapy, identify:

**9.2.2.1** adverse responses to medication;

**9.2.2.2** any clinical change from baseline.

#### **9.2.3** Following therapy, identify:

**9.2.3.1** adverse responses;

**9.2.3.2** therapeutic responses (time course for peak varies with different medications);

**9.2.3.3** lack of therapeutic response.

#### **9.2.4** For trend analysis, identify:

**9.2.4.1** change in patient baseline;

**9.2.4.2** need to modify dose;

**9.2.4.3** need to change therapy;

**9.2.4.4** need to discontinue therapy;

**9.2.4.5** direction of change in bronchial responsiveness.

#### **9.3** Documentation:

##### **9.3.1** Patient response to medication

**9.3.1.1** Medication type, dose, and time received

**9.3.1.2** Responses measured: vital signs, breath sounds, lung function (eg, PEFr, FEV<sub>1</sub>, FEV<sub>1</sub>/.FVC), dyspnea score(26-29)

**9.3.1.3** Relate observations to time of medication administration and expected time of onset and peak response.

##### **9.3.2** Patient's progress

**9.3.3** Ability to self-assess and to recognize the need for more aggressive therapy and when and how to communicate with health professional.

**9.3.4** Record of symptoms and concurrent PEFr measurements should be kept for or by the patient at home.(2,42,43)

### **ARBD 10.0 RESOURCES:**

#### **10.1** Equipment and other aids

**10.1.1** Instruments to measure expiratory flows: the choice of devices is based on cost, availability, and portability. When a portable laboratory spirometer that meets ATS standards(16,44) is available it should be used because results yield more information than is available from peak-flow measurement alone.

**10.1.1.1** Conventional spirometry with forced expiratory maneuvers is the standard for **diagnostic** measurement of bronchodilator

response.(2,16,44)

**10.1.1.2** Peak flow measurement can be used for pre- and post-treatment measurement and for daily and trend monitoring.(2,8,45,46)

**10.1.2** Stethoscope

**10.1.3** Pulse oximeter

**10.1.4** Structured interview form for complete history; validated dyspnea indices.(2)

**10.1.5** Materials for patient and family education and diary(2,42,43)

**10.2** Resources--Personnel:

**10.2.1** Level II personnel--licensed or credentialed respiratory care practitioners (eg, RRT,(47) RPFT,(48) CPFT,(49) CRTT(50)) or persons with equivalent knowledge, training, and ability, who have documented that knowledge and demonstrated the necessary skills:

**10.2.1.1** to perform initial assessments and care for the unstable patient;

**10.2.1.2** to assess patient condition and response to therapy;

**10.2.1.3** to identify the indications for and effects of specific medication and equipment;

**10.2.1.4** to instruct patients in proper breathing patterns and coughing techniques;

**10.2.1.5** to modify therapy and appropriately care for the patient in response to adverse reactions;

**10.2.1.6** to modify dose, frequency, or delivery method or to change medication according to the patient's response, within the constraints of the protocol or the physician's direction;

**10.2.1.7** to use proper technique for administration of aerosols;

**10.2.1.8** to perform, interpret, and document conventional spirometry, peak expiratory flowrate, and ventilatory mechanics and to perform and document auscultation, inspection and assessment of vital signs, and

**10.2.1.9** to teach proper use of symptom diary and peak-flow meter;

**10.2.1.10** to develop, teach, and assess self-care plan for patient and family care giver;

**10.2.1.11** to properly use equipment, administer treatment, and make assessment in compliance with Universal Precautions and other infection-control procedures.(51,52)

**10.2.2** Level I personnel--licensed or credentialed respiratory care practitioners (eg, RRT,(47) RPFT,(48) CPFT,(49) CRTT(50)) or persons with equivalent knowledge, training, and ability, who have documented that knowledge and demonstrated the necessary skills:

**10.2.2.1** to observe, measure, monitor, and document response variables established with the patient's care plan (eg, use of diary and peak flow meter);

- 10.2.2.2** to use proper technique for administration of medication;
- 10.2.2.3** to properly use and clean equipment;
- 10.2.2.4** to instruct patients in proper breathing patterns and coughing techniques;
- 10.2.2.5** to modify therapy and patient care (within the constraints of the protocol or physician's directions) in response to changes in monitored variables, severity of symptoms, or adverse reactions and to communicate any modifications to Level-II provider or physician;
- 10.2.2.6** to properly use equipment, administer treatment, and make assessment in compliance with Universal Precautions and other infection-control procedures.(51,52)
- 10.2.3** Patient or family/caregiver providing maintenance therapy must know and demonstrate ability:
  - 10.2.3.1** to monitor or measure response to bronchodilator in accordance with the patient's care plan (use of symptom diary and peak-flow meter);(2,42,43)
  - 10.2.3.2** to use proper technique for administration of medication and correct use of devices (eg, MDI, spacer, peak-flow meter, small volume nebulizer);(2,7,43)
  - 10.2.3.3** to properly use and clean equipment;
  - 10.2.3.4** to modify doses and frequency as prescribed and instructed in response to adverse reactions or increase in severity of symptoms and to appropriately communicate with physician regarding severity of symptoms.

#### **ARBD 11.0 MONITORING:**

Monitoring seeks to establish baseline function and reveal the presence or absence of a desirable response to bronchodilator or other airway medication and to identify changes in airway reactivity in response to allergens, exercise, infection, or other causes. Desirable responses are:

- 11.1** From observation of the patient
  - 11.1.1** General appearance is improved.
  - 11.1.2** Use of accessory muscles is decreased.
  - 11.1.3** Sputum expectoration is increased.
- 11.2** From auscultation
  - Breath sounds may be improved, with a decrease in wheezing(2-5) or adventitious breath sounds **and** the volume of air moved **is** increased. (Decreased wheezing, eg, the 'silent' chest coupled with decreased volume of air moved can be an indication of a worsening condition rather than improvement.)
- 11.3** Vital signs are more nearly normal.(53-55)
- 11.4** Patient reports improvement(18,29,30)(eg, less

dyspneic(56,57))

**11.5** From pulmonary function measurement: It is important to note that although correlation is generally high between values obtained by conventional spirometry and measurement of PEF, agreement may be poor for individual patients.(24,34,58)

**11.5.1** FEV<sub>1</sub>, FVC,(2,7,58-61) and/or FEF<sub>25-75%</sub>(2,58,60) are improved.

**Note:** The ATS standards for a positive bronchodilator response in adults is "12% increase, calculated from the prebronchodilator response values,**and** a 200-mL increase in either FVC or FEV<sub>1</sub>."(62) Dynamic compression of the airways during forced maneuvers may mask bronchodilator response in some patients, and for these patients the additional measurement of airway resistance and calculation of specific conductance may provide more diagnostic evidence.

**11.5.2** PEF(2,7,58,60,63) is increased.

**Note:** National Asthma Education and Prevention (NAEPP) Guidelines(2) provide detailed directions for use of the PEF in the asthmatic population.

**11.6** SaO<sub>2</sub> (or SpO<sub>2</sub>),(2) and/or arterial blood gas values are improved (Effects of underlying chronic respiratory, metabolic, or other condition should be considered.)

**11.7** Exercise performance is improved as reflected by a more normal PEF during exercise or immediately following(63) or an increase in distance achieved during the 6-minute walking test(59)

**11.8** Ventilator variables are improved.(38-40,64)

**11.8.1** Lower PIP (during volume ventilation)

**11.8.2** Lower plateau pressure, increased static lung compliance.

**11.8.3** Decreased inspiratory and expiratory resistance

**11.8.4** Increased expiratory flow, improved flow-volume loop

**11.8.5** Decreased auto-PEEP

## **ARBD 12.0 FREQUENCY**

**12.1** Acute unstable patient:

**12.1.1** Whenever possible, perform a full assessment and obtain a pretreatment baseline.

**12.1.2** Perform arterial blood gas analysis on admission if patient is in severe distress.(2)

**12.1.3** Assess and document all appropriate variables before and after each treatment, (breath sounds, vital signs, side effects during therapy, PEF or FEV<sub>1</sub>).(2)

**12.1.4** The frequency with which physical exam, PEF, and/or FEV<sub>1</sub> are repeated should be based on the acuteness and severity of the patient's condition.

**12.1.5** SpO<sub>2</sub> should be monitored continuously, if possible.(2)

**12.1.6** Assessment should continue at each level of medication dose to optimal response for patient(5) (eg, asthmatic patient achieves 70-90% of predicted or "personal best" or is symptom free(2))

**12.2** Stable patient:(43,65)

**12.2.1** In the hospital setting, the PEF should be measured initially before and after each bronchodilator administration--to establish baseline function and to determine relative changes in function. Thereafter, twice daily determinations may be adequate.

**12.2.2** In the home, use the PEF 3-4 times a day (on rising, noon, 4-7 pm, and at bedtime)(2,66) to establish baseline function and to determine relative changes in function.

**12.2.2.1** For the stable COPD patient at home, twice a day measurements may be adequate.

**12.2.2.2** Asthmatic patients in the home will need to adjust the frequency of peak flow measurement according to their level of severity, with the development of symptoms, or with any deviation from baseline. Twice daily measurements (about 7 am and 7 pm) are recommended for routine monitoring--(variability between these two measurements is a measure of severity.(2))

**12.2.3** The pre- and postbronchodilator PEFs, medication dosage, date and time, and the dyspnea score should be documented.

**12.2.4** The patient should be periodically re-evaluated for response to therapy.

## **ARBD 13.0 INFECTION CONTROL:**

**13.1** Universal Precautions(47) and precautions related to the spread of tuberculosis as published by the Centers for Disease Control(48) should be followed.

**13.2** All equipment and supplies should be appropriately disposed of or subjected to high-level disinfection between patients.(67)

### ***Aerosol Therapy Focus Group***

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