AARC Clinical Practice Guideline

Intermittent Positive Pressure Breathing

IPPB 1.0 PROCEDURE:
Intermittent positive pressure breathing

IPPB 2.0 DESCRIPTION/DEFINITION:
IPPB is a technique used to provide short-term or intermittent mechanical ventilation for the purpose of augmenting lung expansion, delivering aerosol medication, or assisting ventilation(1)

2.1 IPPB is not a therapy of first choice for aerosol delivery or lung expansion in spontaneously breathing patients when other less expensive and less invasive therapies can reliably meet clinical objectives.(2-8)

2.2 IPPB can include volume-, pressure-, time-limited, or flow-cycled ventilation.

2.3 IPPB may be applied to intubated as well as nonintubated patients.

IPPB 3.0 SETTINGS:
IPPB can be administered in settings that include hospital, clinic, extended care facility, and home.

IPPB 4.0 INDICATIONS:

4.1 The need to improve lung expansion

4.1.1 The presence of clinically important pulmonary atelectasis when other forms of therapy have been unsuccessful (incentive spirometry, chest physiotherapy, deep breathing exercises, positive airway pressure) or the patient cannot cooperate(9-14)

4.1.2 Inability to clear secretions adequately because of pathology that severely limits the ability to ventilate or cough effectively and failure to respond to other modes of treatment(13)

4.2 The need for short-term ventilatory support for patients for are hypoventilated as an alternative to tracheal intubation and continuous ventilatory support(12-21)

4.3 The need to deliver aerosol medication (We are not addressing aerosol delivery for patients on long-term mechanical ventilation)(4)

4.3.1 Although some authors oppose the use of IPPB in the treatment of severe bronchospasm (acute asthma, unstable or status asthmaticus, exacerbated COPD),(6,22-24) we recommend a careful, closely supervised trial of IPPB when treatment using other techniques (metered dose inhaler [MDI] or nebulizer) has been unsuccessful(1,25-33)

4.3.2 IPPB may be used to deliver aerosol medications to patients with fatigue as a result of ventilatory muscle weakness (eg, failure to wean from mechanical ventilation, neuromuscular disease, kyphoscoliosis) or chronic conditions in which intermittent ventilatory support is indicated (eg, ventilatory support for home care patients and the more recent use of nasal IPPV for respiratory insufficiency).(1,15-21)
**IPPB 5.0 CONTRAINDICATIONS:**

Although no absolute contraindications to the use of IPPB therapy (except the oft-cited tension pneumothorax) have been reported, the patient with any of the following should be carefully evaluated before a decision is made to initiate IPPB therapy.

- **5.1** Intracranial pressure (ICP) > 15 mm Hg
- **5.2** Hemodynamic instability
- **5.3** Recent facial, oral, or skull surgery
- **5.4** Tracheoesophageal fistula
- **5.5** Recent esophageal surgery
- **5.6** Active hemoptysis
- **5.7** Nausea
- **5.8** Air swallowing
- **5.9** Active untreated tuberculosis
- **5.10** Radiographic evidence of bleb
- **5.11** Singulation (hiccups)

**IPPB 6.0 HAZARDS/COMPLICATIONS:**

- **6.1** Increased airway resistance
- **6.2** Barotrauma, pneumothorax
- **6.3** Nosocomial infection
- **6.4** Hypocarbia
- **6.5** Hemoptysis
- **6.6** Hyperoxia when oxygen is the gas source
- **6.7** Gastric distention
- **6.8** Impaction of secretions (associated with inadequately humidified gas mixture)
- **6.9** Psychological dependence
- **6.10** Impedance of venous return
- **6.11** Exacerbation of hypoxemia
- **6.12** Hypoventilation
- **6.13** Increased mismatch of ventilation and perfusion
- **6.14** Air trapping, auto-PEEP, overdistended alveoli

**IPPB 7.0 LIMITATIONS OF PROCEDURE OR DEVICE:**

- **7.1** All of the mechanical effects of IPPB are short-lived--lasting < or = an hour after treatment
- **7.2** Based on the available literature, MDI or compressor-driven nebulizers should be considered the devices of choice for aerosol therapy to COPD and stable asthma patients.
- **7.3** Only a very small percentage of the aerosol output deposits in the airway.
MDI(38,39)

7.4 Efficacy of device for ventilation and aerosol delivery is technique dependent (eg, coordination, breathing pattern, selection of appropriate inspiratory flow, peak pressure, inspiratory hold).(40,51)

7.5 Efficacy is dependent on the design of the device (eg, flow, volume, and pressure capability as well as aerosol output and particle size).(40,42,52-54)

7.6 IPPB is equipment- and labor-intensive as a method of delivery of aerosol.(40,42,55-59)

7.7 Limited portability and lack of convenience may affect patient compliance.

IPPB 8.0 ASSESSMENT OF NEED:

8.1 Presence of atelectasis

8.2 Reduced pulmonary function as evidenced by reductions in timed volumes, and vital capacity (eg, FEV1 < 65% predicted, FVC < 70% predicted, MVV < 50% predicted, or VC < 10 mL/kg) precluding an effective cough

8.3 Neuromuscular disorders or kyphoscoliosis with associated decreases in lung volumes and capacities

8.4 Fatigue or muscle weakness with impending respiratory failure

8.5 Presence of acute severe bronchospasm or exacerbated COPD that fails to respond to other therapy

8.5.1 Regardless of the type of delivery device used (MDI with spacer or small volume, large-volume, or ultrasonic nebulizer), it is important to recognize that the dose of the drug needs to be titrated to give the maximum benefit.(37,39)

8.5.2 Based on proven therapeutic efficacy, variety of medications, and cost-effectiveness, the MDI with accessory device should be the first method to consider for administration of aerosol.(42,55-59,61,62)

8.6 With demonstrated effectiveness, the patient's preference for a positive pressure device should be honored.

IPPB 9.0 ASSESSMENT OF OUTCOME:

9.1 Tidal volume during IPPB greater than during spontaneous breathing (by at least 25%)

9.2 FEV1 or peak flow increase

9.3 Cough more effective with treatment

9.4 Secretion clearance enhanced as a consequence of deep breathing and coughing

9.5 Chest x-ray improved

9.6 Breath sounds improved

9.7 Favorable patient subjective response

IPPB 10.0 RESOURCES:

10.1 Equipment

10.1.1 IPPB device or pressure-support; volume-, pressure-, or time-limited ventilator or manual resuscitation device
10.1.2 Connecting tubing
10.1.3 Nebulizer (small-volume, large-volume, or ultrasonic) and medication or normal saline, or MDI with accessory adapter, or humidifier
10.1.4 Mouthpiece, flange (lip seal), nose clip, mask, or endotracheal tube adapter
10.1.5 Tissues and emesis basin or container for collecting or disposing of expectorated sputum
10.1.6 Gloves, goggles, gown, and mask as indicated
10.1.7 Hand-held spirometer or other volume-measuring device
10.1.8 Oral and/or endotracheal suction equipment

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

10.2.1 Level I caregiver may be the provider of service after Level II personnel have established need for a specific device by patient assessment, and the first administration has been completed. Level I personnel must demonstrate

10.2.1.1 ability to prepare, measure, and mix medication;
10.2.1.2 proper technique for administration of medication;
10.2.1.3 proper use of equipment, including adjustment of machine settings to meet patient demands;
10.2.1.4 effective cleaning of equipment;
10.2.1.5 proper disposal of wastes;
10.2.1.6 ability to encourage effective breathing patterns and coughing techniques;
10.2.1.7 ability to modify technique (after communication with physician) in response to recognized complications and adverse reactions or change in severity of symptoms as determined by observation and vital-signs determination;
10.2.1.8 ability to implement Universal Precautions and proper infection control.

10.2.2 Level II Personnel must demonstrate all Level I skills and

10.2.2.1 ability to perform physical exam--auscultation, inspection, percussion, and vital signs;
10.2.2.2 ability to assess patient condition and patient response to therapy;
10.2.2.3 ability to perform peak expiratory flowrate, spirometry, and ventilatory mechanics measurement;
10.2.2.4 proper use and knowledge of limitations of IPPB equipment and aerosol device and ability to fit mask and/or identify best application device for particular patient;
10.2.2.5 ability to recognize and respond to therapeutic changes, adverse response, and complications of aerosol medications;
10.2.2.6 ability to modify dosage of medication and/or frequency of administration as prescribed in response to severity of symptoms;
10.2.2.7 ability to negotiate care plan and modifications with physician and healthcare
team;
10.2.2.8 understanding of effects of increased pressure on ventilation, perfusion, and sputum mobilization;
10.2.2.9 ability to modify technique in response to adverse reactions;
10.2.2.10 ability to instruct patient/family/caregiver in goals of therapy and
10.2.2.10.1 proper technique for administration,
10.2.2.10.2 proper use of equipment,
10.2.2.10.3 cleaning of equipment,
10.2.2.10.4 breathing patterns and cough techniques,
10.2.2.10.5 recognition of communications and technique modification in response to adverse reactions,
10.2.2.10.6 frequency modification in response to severity of symptoms;
10.2.2.11 understanding and compliance with Universal Precautions and infection control issues related to cleaning and maintaining equipment and handling of secretions and hazardous waste.

10.2.3 Level III--Self-administration of IPPB. Patients who are to self-administer IPPB should demonstrate to the supervising clinician
10.2.3.1 proper technique for administration;
10.2.3.2 proper use of equipment;
10.2.3.3 proper cleaning of equipment;
10.2.3.4 ability to measure and mix medications;
10.2.3.5 breathing patterns and cough techniques;
10.2.3.6 technique modification in response to adverse reactions, duration or frequency modification in response to severity of symptoms.

**IPPB 11.0 MONITORING:**
Items from the following list should be chosen as appropriate for the specific patient.

11.1 Performance of machine trigger sensitivity, peak pressure, flow setting, FIO2 inspiratory time, expiratory time, plateau pressure, PEEP
11.2 Respiratory rate and volume
11.3 Peak flow or FEVI/FVC
11.4 Pulse rate and rhythm from EKG if available
11.5 Patient subjective response to therapy--pain, discomfort, dyspnea
11.6 Sputum production--quantity, color, consistency, and odor
11.7 Mental function
11.8 Skin color
11.9 Breath sounds
11.10 Blood pressure
11.11 Arterial hemoglobin saturation by pulse oximetry (if hypoxemia is suspected)
11.12 Intracranial pressure (ICP) in patients for whom ICP is of critical importance
11.13 Chest radiograph

**IPPB 12.0 FREQUENCY:**

12.1 Critical care--q 1 h-q 6 h, for IPPB as tolerated. IPPB order should be re-evaluated at least every 24 hours based on assessments during individual treatments.

12.2 Acute/domiciliary care--

12.2.1 Common strategies for IPPB vary from *qid* to *bid*. Frequency should be determined by assessing patient response to therapy.

12.2.2 For acute care patients, order should be re-evaluated based on patient response to therapy at least every 72 hours or with any change of patient status.

12.2.3 Domiciliary patients should be reevaluated periodically and with any change of status.

**IPPB 13.0 INFECTION CONTROL:**

13.1 Caregivers should implement Universal Precautions(63) and appropriate guidelines for prevention of tuberculosis transmission.(64)

13.2 Caregivers should observe all infection control guidelines posted for patient.

13.3 All reusable equipment should be disinfected between patients.

13.4 Nebulizers should be changed or subjected to high-level disinfection

13.4.1 at conclusion of dose administration (for single treatment), or

13.4.2 every 24 hours with continuous administration, or more often when visibly soiled.

13.5 Nebulizers should not be rinsed with tap water between treatments,(65,66) but may be rinsed with sterile water or sterile saline and allowed to air dry.

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ADDITIONAL BIBLIOGRAPHY


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