LUNG EXPANSION THERAPY
INTRODUCTION

• Pulmonary complications are the most common serious problems seen in patients who have undergone thoracic or abdominal surgery

• They include
  • atelactasis
  • pneumonia
  • acute resp failure
ATELACTASIS

• Absence of gas from a part or whole of lung due to failure of expansion or resorption of the gas from the alveoli

• TYPES
  • Resorption atelactasis
  • Passive atelactasis
  • Lobar atelactasis
CLINICAL SIGNS OF ATELACTASIS

- Increased resp rate
- Fine late insp crackles over affected region
- Bronchial type breath sounds
- Tachycardia
LUNG EXPANSION THERAPY

• Includes a variety of respiratory care modalities to prevent or correct atelactasis

  TYPES

• Incentive spirometry
• Intermittent positive pressure breathing
• Continuous positive airway pressure
• Positive expiratory pressure
INDICATIONS

• Post operative patients especially after thoracic & upper abdominal surgery

• Neuromuscular disorders
MECHANISM

• Increase in transpulmonary pressure

\[ P(L) = P(\text{alv}) - P(\text{pl}) \]

• Can be done by either by
  • Decreasing the pleural pressure by spontaneous deep inspiration
  • Or increasing alveolar pressure by application of positive pressure
INCENTIVE SPIROMETRY (IS)

• Designed to mimic natural sighing by encouraging patients to take deep slow breaths

• Sustained Maximal Inspiration is a slow, deep inhalation from the FRC upto the total lung capacity followed by 5 to 10 sec breath hold
INDICATIONS

• Presence of conditions predisposing to development of atelactasis
• Atelactasis
• Presence of restrictive lung defects associated with quadriplegia &/or dysfunctional diaphragm
CONTRAINDICATIONS

• Uncooperative patient
• Unable to take deep breaths effectively i.e. VC<10 ml/kg
• Cannot be instructed or supervised
EQUIPMENT

• Volume oriented: measure volume achieved during SMI
• Flow oriented: measure degree of inspiratory flow
• Successful implementation involves
  • Planning
  • Implementation
  • Follow up
• PLANNING : Preop PFT for baseline

• IMPLEMENTATION : Effective patient education for correct technique

• Started initially at 5-10 SMI maneuvers/hour
MONITORING

- Frequency of sessions
- No of breaths/session
- Volume/flow goals
- Breath hold maintained
- Vital signs/breath sounds
- New & increasing inspiratory volume each day
POTENTIAL OUTCOMES

Absence/improvement in phy signs
- Decreased resp rate
- Normal pulse rate
- Resolution of abnormal breath sounds
- Normal/improved chest x-ray
- Increased PaO2 & decreased Pa CO2
- Increased Sp O2
- Increased VC &peak exp flows
- Increased FVC
HAZARDS & COMPLICATIONS

• Ineffective unless correctly performed
• Hyperventilation
• Increased bronchospasm
• Fatigue
• Discomfort
• Inappropriate for major collapse
INTERMITTENT POSITIVE PRESSURE BREATHING (IPPB)

- Application of positive pressure to a spontaneously breathing patient as an intermittent or short term therapeutic modality.
- Positive pressure at the airway opening creates the needed pressure gradient to cause gas flow into the lung.
- Positive pressure is transmitted from the alveoli to the pleural space during the insp phase of an IPPB treatment causing Ppl to rise during inspiration.
INDICATIONS

- Pulmonary atelactasis unresponsive to IS or uncooperative patient
- As a short term non invasive ventilatory support for hypercapnic patients
CONTRAINDICATIONS

• Tension pneumothorax
• ICP >15 mm Hg
• Hemodynamic instability
• Active hemoptysis
• Tracheo oesophageal fistula
• Recent esophageal surgery
• Active untreated TB
• Radiographic evidence of blebs
• Recent facial/oral surgery
ADMINISTERING IPPB

• PLANNING : To correctly assess the need for IPPB
• BASELINE ASSESSMENT
• General assessment : vital signs, patient appearance & sensorium, breathing pattern
• Respiratory system exam
IMPLEMENTATION

• Proper infection control measures
• Equipment preparation including calibration & checking for leaks in system
• Patient education
APPLICATION

• Device should be properly fitted over patient face
• A sensitivity or trigger level of 1 to 2 cm H2O is adequate for most patients
• Initial system pressure is set between 10 cm to 15 cm H2O
• Goal is to establish a breathing pattern of 6 breaths/min with I/E ratio of 1:3 to 1:4
MONITORING

• MACHINE PERFORMANCE
  • sensitivity
  • peak pressure
  • flow setting
  • Fi O2
  • I/E ratio
PATIENT RESPONSE

- Resp rate & expired volume
- Peak flow
- Pulse rate & rhythm
- Mental function
- Skin color
- Breath sounds
- Blood pressure
- Chest x ray
- SpO2
- Subjective response
POTENTIAL OUTCOMES

- Improved VC
- Increased FEV1
- Enhanced secretion clearance
- Improved chest x ray
- Improved oxygenation
- Favorable subjective response
- Improved breath sounds
HAZARDS & COMPLICATIONS

- Pulmonary barotrauma
- Nosocomial infection
- Respiratory alkalosis
- Gastric distension
- Impaired venous return
- Increased airway resistance
- Dependence
POSITIVE AIRWAY PRESSURE THERAPY (PAP)

- PEP both create exp positive pressure
- EPAP only
- CPAP: maintains positive airway pressure throughout resp cycle
MECHANISM

- Exact mech unknown
- Recruitment of collapsed alveoli
- Decreased work of breathing
- Improved distribution of ventilation through collateral channels
- Improved secretion removal
CONTRAINDICATIONS

• Hemodynamically unstable patient

• Facial trauma

• Pneumothorax

• Increased ICP
HAZARDS & COMPLICATIONS

• Hypoventilation
• System leaks
• Pain & irritation
• Barotrauma
• Gastric insufflation & aspiration of gastric contents
SELECTING AN APPROACH

- Patient meets criteria
  - YES
- Patient alert
  - YES
- VC>15 ml/kg
  - YES
- Excessive secretions
  - YES
  - PEP & B dilators
  - NO
- Goal oriented IS
All the best...