

## Basic techniques of pulmonary physical therapy (II)

2011/04/24

### Techniques for airway clearance

- Forced expiration
- Postural drainage and body position
- Percussion and vibration

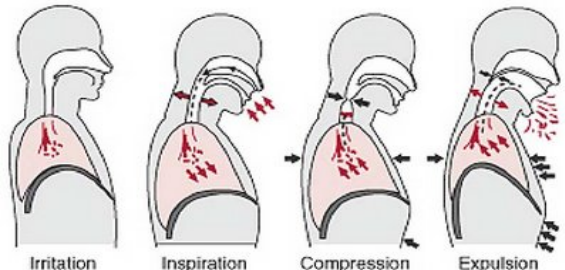
### Forced expiration

- Enhance mucus transport with high airflow velocities
  - Interaction (two-phase gas-liquid interaction)
  - Energy transfer between the air stream and mucus layer
- To the central airways

### Forced expiration

- High expiratory flow rate + dynamic airway compression
  - Huffing
    - Deep inspiration followed by a forced expiration without glottis closure
  - Coughing
    - Deep inspiration followed by a forced expiration with glottis closure

### Cough/ Huff



Irritation    Inspiration    Compression    Expulsion

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### Positioning and instruction to improve cough effectiveness (I)

- Position the patients for success, especially in regard to trunk alignment
- Maximize inspiratory phase through verbal cues, positioning, and active arm movement
- Improve hold stage through verbal cues and positioning

## Positioning and instruction to improve cough effectiveness (II)

- Maximize intrathoracic and intraabdominal pressures with muscle contractions, physical assist, or trunk movements
- Instruct the patient in appropriate timing and trunk movements for expulsion
- Make the procedure physically active on the patient's part

## Assisted cough

### Assisted cough techniques

1. Costophrenic assist
2. Heimlich-type or abdominal thrust assist
3. Anterior chest compression assist
4. Counter-rotation assist

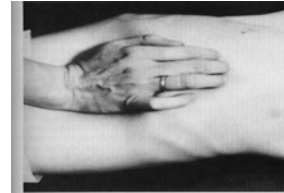


FIGURE 22-3 Hand position for Heimlich-type assist or abdominal thrust.

## Assisted cough



FIGURE 22-4 Assisted cough techniques in supine position, variation of the anterior chest compression assist.



FIGURE 22-5 Assisted cough techniques in supine position, variation of the anterior chest compression assist.



FIGURE 22-2 Assisted cough techniques in supine position, costophrenic assist.

## Assisted cough



FIGURE 22-9 Tetraplegic-self-assisted cough in long-sitting, maximizing the inspiration phase.



FIGURE 22-10 Tetraplegic-self-assisted cough in long-sitting, maximizing the expiration, or coughing, phase.

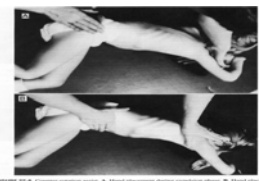


FIGURE 22-8 Contracted expiration assist. A, Hand placement during expiration phase. B, Hand placement during inspiration phase.

## Self-assisted cough

### Self-assisted techniques

1. Prone on elbows head flexion self-assisted cough
2. Long-sitting self-assisted cough
3. Short-sitting self-assisted cough
4. Standing self-assisted coughs



FIGURE 22-7 Head flexion assistive cough in prone on elbows; extension and inspiratory phase.



FIGURE 22-8 Head flexion assistive cough in prone on elbows; flexion and coughing phase.

## Self-assisted cough



FIGURE 22-11 Paraplegic-self-assisted cough in long-sitting; inspiration.



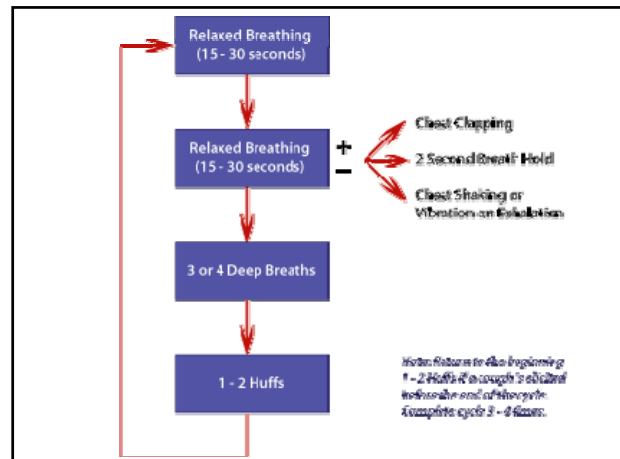
FIGURE 22-12 Paraplegic-self-assisted cough in long-sitting; expiration.



FIGURE 22-13 Assisted cough in short-sitting. A, Hand position for patient with good hand function. B, Hand position for patient with only wrist function.

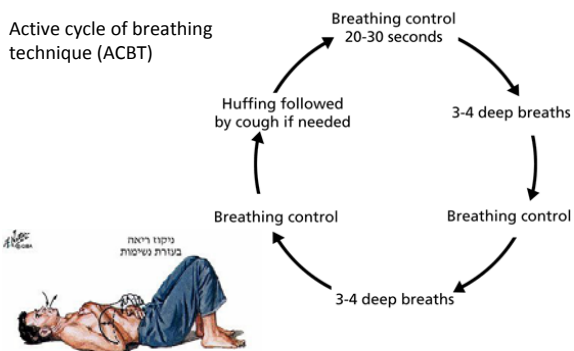
## Forced expiration

- Active cycle of breathing technique (ACBT)
  - Breathing control
    - 5~10 seconds
  - Thoracic expansion
  - Forced expiratory technique (FET)



## Forced expiration

Active cycle of breathing technique (ACBT)



## Caution!

- **NOT** in Airway instability patients (pulmonary emphysema) → airway collapse and impair mucus transport
- Excessive attempts to achieve the highest flow rates are not necessary
- Repetitive strain on the mucus by repeated huffing or coughing reduces viscosity

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## Postural drainage and body position

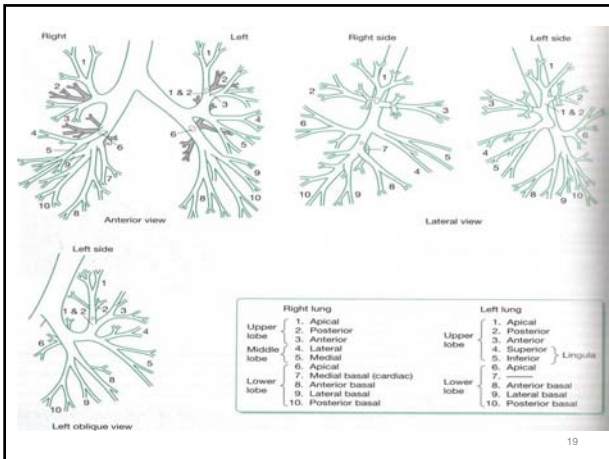
- promote mucus transport to the central way
  - Gravitational forces
  - Major bronchi are positioned in a more vertical position
- Improve oxygenation
  - Unilateral lung disease
    - Lateral decubitus position (unaffected side down)

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## Postural drainage

- Passive technique in which the patient is placed in positions that allow gravity to assist with the drainage of secretion from bronchopulmonary tree
- Gravity-assisted positioning
  - Assist clearance of bronchial secretions
    - Gravity assisting
    - Based on anatomy of the bronchial tree

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## Postural drainage

- Determine the lobe of lung
- Prepare the patient
- Maintain for 5 to 10 min. or longer
  - Care for pressure relief!
  - Monitor the patient!
- Encourage patient to cough or take deep breathing
- Secretion may be mobilized immediately or one hour later

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## Postural drainage



FIGURE 20-1 Postural drainage position for the right upper lobe—posterior segment (anterior view)—patient positioned three quarters prone.

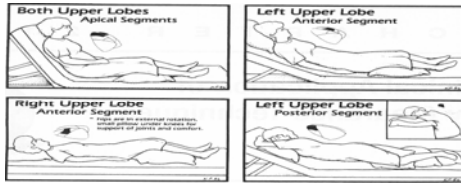


FIGURE 21-1 Upper lobes.

## Postural drainage

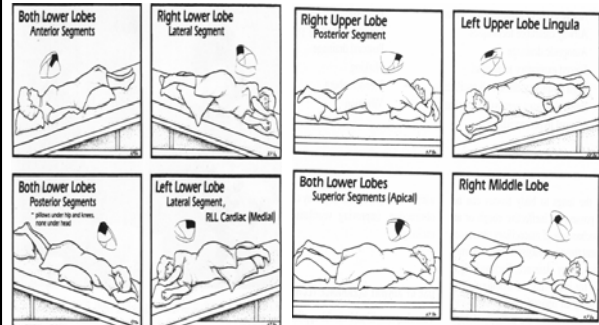


FIGURE 21-3 Lower lobes.

FIGURE 21-2 Upper, middle, and lower lobes.

## Contraindications of postural drainage

- 全部姿勢擺位
  - 絕對禁忌症：
    - 頭和頸部嚴重損傷而未穩定。
    - 急性出血而且血液動力學不穩定。
  - 相對禁忌症：
    - 顱內壓 (ICP) > 20 mmHg。
    - 近期脊髓手術(例如：椎板切除術)或急性脊髓損傷。
    - 活動性咳血。
    - 膿胸。
    - 支氣管肋膜瘻管。
    - 鬱血性心衰竭合併肺水腫 (心因性肺水腫)。
    - 大量肋膜積水。
    - 肺栓塞。
    - 意識混亂或焦慮無法忍受的病人。
    - 肋骨骨折合併或未合併連枷胸。
    - 外傷傷口或癒合組織。

## Contraindications of postural drainage

- 垂頭仰臥式(Trendelenburg position)姿勢擺位的相對禁忌症
  - 顱內壓(ICP) > 20 mmHg。
  - 避免顱內壓增加的病人 (例如：神經外科、動脈瘤、眼睛手術)。
  - 未受控制的高血壓。
  - 腹脹。
  - 食道手術。
  - 近期因肺癌接受外科手術或放射治療造成的大量咳血。
  - 呼吸道有吸入危險的情況 (剛灌食或用餐後)。

## Percussion and vibration

- Percussion
  - A rhythmic force is applied with cupped hands to the patient's thorax over the involved lung segment
- Vibration
  - A co contraction of the upper extremities of a caregiver to produce a vibratory force that is transmitted to the thorax over involved lung segment

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## Percussion

- Placing patient
  - Conjunction with postural drainage
- Place a *thin* towel or hospital gown over patient's skin
- Adjust the level of the bed
- Percussion
  - Maintain cupped position, while wrists, arms and shoulders relaxed



FIGURE 21-4 Chest percussion.

## Percussion

- Hollow sounds not slapping sounds
- 100 to 480 times per minute
- Equal force of bilateral hands
- Start with nondominant hand
- Avoid bony process, like the spinous processes of vertebral, spine of scapulae, and the clavicle
- Floating rib
- Not perform over breast area

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## Percussion

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## Vibration/shaking

- Often in postural drainage positions following percussion over that area
- Place your hands over the lobe of the lung to be treated
- Instruct patient to take a deep breath

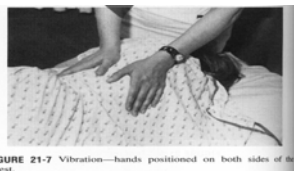


FIGURE 21-7 Vibration—hands positioned on both sides of the chest.



FIGURE 21-8 Vibration—hand placement one on top of the other.

## Vibration/shaking

- Shaking
  - At the peak of inspiration, apply a slow, rhythmic bouncing pressure to chest wall until end of expiration (approximately 2 times per second)
- Vibration
  - Gentle but steady co-contraction of the upper extremities is performed (12~20 Hz)

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## Contraindications of percussion/ vibration

- 皮下氣腫。
- 近期接受硬膜脊髓注射或脊髓下麻醉。
- 剛接受胸腔和皮膚移植及補皮。
- 胸腔有燒傷、開放性傷口和皮膚感染。
- 近期接受經靜脈心律調節器或皮下心律調節器放置（特別是機器有被使用）。
- 疑似肺結核。
- 肺挫傷（胸膜異常未處理，例如：血胸、氣胸、膿胸未插引流管）。
- 支氣管痙攣。
- 肋骨骨髓炎。
- 骨質疏鬆。
- 凝血異常（血小板 < 50000 不可做扣擊，血小板 < 20000 不可做震顫）。
- 有胸壁疼痛現象（肋骨骨折、挫傷、傷口插引流管）。

