

Health Professional Info

Manually Assisted Cough (MAC)

What is MAC?

MAC is a manual technique to improve cough effectiveness. The caregiver's forceful arm replaces the individual's weak abdominal and intercostal muscles.

MAC follows an augmented breath using lung volume recruitment (LVR) techniques or a deep spontaneous breath (the latter for those with lower spinal cord injury).

The acronym "MAC" may be used to refer to "Mechanically Assisted Cough" which includes mechanical insufflation-exsufflation and/or manually assisted cough. MAC in this documentation refers to manually assisted cough only.

Who benefits from MAC?

Individuals with weak inspiratory and expiratory muscles unable to achieve an effective peak cough flow (PCF) (>270 L/min), with or without LVR, usually benefit from routine use of MAC. Weak inspiratory and expiratory muscles are associated with neuromuscular diseases (e.g. amyotrophic lateral sclerosis, muscular dystrophy, post-polio syndrome), spinal cord injury or muscular skeletal conditions (e.g. kyphoscoliosis). The individual must be alert, cooperative, and able to communicate.

Why would you perform MAC?

The main reason why MAC is used is to achieve an effective cough, which subsequently helps to prevent respiratory infections. Individuals with neuromuscular diseases, spinal cord injury or muscular skeletal conditions may not be able to produce an adequate inspiratory volume and/or use their expiratory muscle to cough effectively.

MAC is recommended either used alone or in combination with LVR to increase PCFs to > 270 L/min. PCF is easily measured with a peak flow meter.

Four stages are involved for an effective cough:

1. Achievement of a maximal and adequate inspiratory lung volume;
2. Closing of the glottis (vocal cords) to increase the intrathoracic pressure;
3. Contraction of the abdominal and intercostal muscles; and
4. Opening of the glottis to forcefully expel air.

During a normal cough, subglottic pressure may rise to 200 cmH₂O and PCFs may be well above 350 L/min.

In individuals with weak inspiratory and expiratory muscles, maximal insufflation capacity (MIC) is reached with LVR. Combined with MAC, the caregiver's arms replace the individual's abdominal and intercostal muscles and usually results in an improved cough.

When do you perform MAC?

MAC is recommended once or twice a day and as often as required to clear secretions. It is best to perform MAC before meals and at bedtime to minimize the risk of refluxed gastric contents.

Where would you perform MAC?

MAC is possible in any clinical or home setting with an alert and cooperative individual.

How should you perform MAC?

Several MAC techniques are possible; the most commonly applied MAC techniques include:

1. Caregiver-assisted abdominal thrust;
2. Caregiver-assisted lateral costal compression; and
3. Individual self-assisted cough.

For all techniques, the following should be considered when positioning the individual prior to MAC:

- + If the individual is in a wheelchair, lock it against a wall to prevent tipping;
- + The individual is best seated or lying supine with head slightly elevated (30 degrees);
- + When seated, the individual's buttocks should be as far back in the chair as possible;
- + The back and head must be fully supported with the individual in a straight posture; and
- + A rolled towel or pillow placed horizontally just below the individual's shoulder blades may be necessary to ensure a straight posture.

1) Caregiver-Assisted Abdominal Thrust

- a) The caregiver landmarks the naval by placing index fingers on the individual's hipbone then slide their thumbs towards the naval.
- b) The caregiver places the heel of one hand, one inch above the naval with the other hand on top of the first hand with fingers interlocked and pulled away from the body. The elbows remain straight and prevent fingers from touching the ribs and xiphoid.
- c) The individual takes a deep spontaneous or augmented breath with lung volume recruitment.
- d) Breath is held.
- e) At the command of "cough", the individual coughs and the caregiver simultaneously initiates a single thrust applied inward and upward through the abdomen.
- f) The caregiver must shift their body weight forward while maintaining straight arms.
- g) If the thrust is not forceful enough, secretions may not be mobilized.
- h) Individual secretions are expelled and wiped with tissue, or removed with a suction tip.

Contraindications to Abdominal Thrust

- + Abdominal aneurysm
- + Acute bleeding ulcer
- + Pregnancy
- + Recent abdominal surgery

Cautions for Abdominal Thrust

- + Vena cava filters; may be dislodged with the thrust
- + Insertion of new abdominal feeding tube < 48 hrs

2) Caregiver-Assisted Lateral Costal Compression

Consider caregiver-assisted lateral costal compression if contraindication(s) for abdominal thrust is/are present. This method is also more effective in obese individuals.

- The caregiver locates the lower third of the ribs and places hands on either side with fingers pointing to the back.
- The individual takes a deep spontaneous or augmented breath with LVR.
- Breath is held.
- At the command of "cough"; the individual coughs and the caregiver simultaneously squeezes the ribs up and in.
- Individual secretions are expelled and wiped with tissue, or removed with a suction tip.

Contraindications to Lateral Costal Compression

- + Osteoporosis of the ribs
- + Rib pathology such as fractures, bruising, metastasis

Cautions for Lateral Costal Compression

- + May be less effective in kyphoscoliosis.

3) Individual Self-Assisted Cough

The individual self-assisted cough is typically performed in a wheelchair and the use of a seat belt is recommended. Effective self-assisted cough is usually successful for individuals with strong arms and good balance.

- To initiate the self-assist cough technique the individual wraps both arms across the abdomen below the lower border of the rib cage.
- The individual takes a deep spontaneous breath.
- Breath is held.
- The individual coughs forcefully and throws their torso forward over arms while hugging the abdomen.

Glossary

LVR	Lung Volume Recruitment
MAC	Manually Assisted Cough
MIC	Maximum Insufflation Capacity
PCF	Peak Cough Flow