

# An Introduction to Airway Clearance Techniques

*Airway clearance techniques (ACT)* are widely accepted treatments to help people with cystic fibrosis (CF) stay healthy and breathe with less difficulty. ACT help loosen the thick, sticky mucus in the lungs that is removed by coughing or huffing. Unclogging the airways is important to reducing the severity of lung infections and may help reduce deterioration in lung function.

There are many techniques and most are easy to perform. For the infant and toddler ACT can be performed by parents, therapists, nurses, friends, or siblings. For the older child and adult, the techniques can be performed independently by the person with CF.

ACT is often used in conjunction with other types of treatments, such as inhaled bronchodilators and antibiotics. For maximum effectiveness, bronchodilators should be taken **before** or with ACT to open the airways, and inhaled antibiotics should be taken **after** ACT to treat the opened airways. Your doctor at your Cystic Fibrosis Foundation care center will recommend an individualized routine for ACT and other treatments. Each year, your routine should be reviewed by a therapist or nurse at your center, and updated if necessary.

## **BECOMING FAMILIAR WITH YOUR LUNGS**

Learning more about the respiratory system and its relationship to internal organs can help you to understand why ACT is effective. The goal of ACT is to move mucus from the small

airways into the larger (more central) airways so that it may be coughed or huffed out.

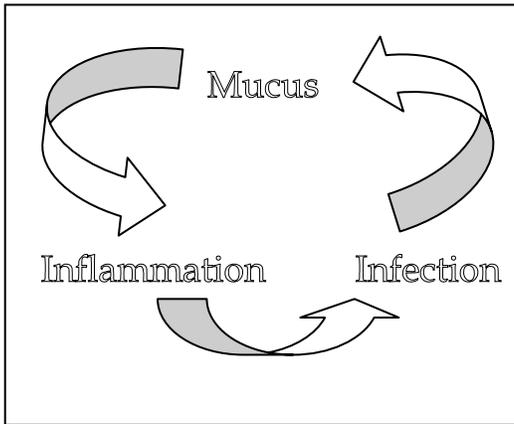
## **THE LUNGS**

The right lung is composed of three lobes: the upper, middle and lower lobes. The left lung is made up of only two lobes: the upper lobe and the lower lobe.

The lobes are divided into smaller divisions called segments. Each segment of the lung contains a network of air tubes (**bronchi**), air sacs (alveoli) and blood vessels (arteries, veins, and capillaries). The air sacs allow for the exchange of oxygen and carbon dioxide between the blood and air. It is these segments which are being cleared during ACT.

## **MUCUS**

Our bodies are constantly making mucus. Changes in mucus because of CF make it harder to get rid of. Scientists have shown that people with CF have more inflammation in their airways. This inflammation makes more mucus, and makes it thicker. This cycle goes on even without infection. The mucus may coat the bronchi and makes it harder for air to move in and out of the lungs. Eventually it can completely plug up some of the bronchi. Inflammation and mucus can hurt the lungs and gradually decrease lung function.



The increased amount of mucus, thickness of the mucus, and difficulty with clearing the mucus, makes it ideal for infections to occur. The infections speed up the injury done to the lungs. Although antibiotics are used to treat the infection, and a person feels better, over years and years, the damage done builds up. This is why, even if a person is well, your CF care provider may recommend that you do routine airway clearance, and why it is very important, when someone gets sick, that they increase the number of times they are doing ACTs.

### HOW DOES MUCUS MOVE?

Mucus moves by the following 3 ways:

- We all have tiny microscopic hairs, called cilia, lining our air tubes. These hairs beat and move like grass waving back and forth in the wind. Some mucus can be carried on top of these hairs. As the amount and thickness of mucus increases, this method has a hard time keeping up.
- As mucus builds up and lines the walls of our bronchi, we use ACT to speed up the flow of air through our bronchi. As the air rushes over the mucus on the side of the air tubes, it pulls that mucus towards our central airways. This is like a strong wind across the ocean making a crest on waves, or wind across a dry plain pulling dust in

direction the wind is going. The faster we can make the air flow, the better it is at pulling the mucus along with it.

- Another way that we can improve mucus movement is by getting more air behind the mucus. If the mucus is really thick, the air can push the mucus from behind into larger airways. Even if the mucus is not thick, the more air we get behind it, the more air can flow over it, pulling the mucus along. In fact, if we can't get air behind the mucus, it will be very, very hard to move the mucus at all.

### AIRWAY CLEARANCE TECHNIQUES

**Coughing** is our most basic type of airway clearance technique. Mostly it is a reflex mechanism. It generates a lot of speed and flow of air and can be very helpful in clearing secretions. Sometimes, though, even if we cough a lot, we cannot get mucus up and out. Sometimes, coughing a lot can actually make someone feel more short of breath, and worse, not better.

**Huffing** is a modified cough. It also involves taking a breath in, and exhaling it actively. It is very similar to what we do when we "huff" onto a mirror or window to steam it up. Although it is not as forceful as a cough, huffs can sometimes be more effective and less tiring.

**Postural Drainage (PD)** is one specific type of chest physical therapy (CPT or chest PT) that may be prescribed for people with CF. It is called postural drainage because the person lies in various positions (postures) that help to drain the mucus from the lungs.

In postural drainage, the child lies or sits in a position that allows a particular portion of the lung to drain towards the throat or largest airway (the trachea). With the aid of gravity, the mucus moves from the small airways into

larger airways where it can be coughed up more easily. At the same time, that region of the chest is usually **percussed** (clapped) and vibrated to help dislodge the mucus from the walls of the airway and to make it move. This is then repeated in different positions to drain different parts of the lung.

**Oscillating Positive Expiratory Pressure** (Oscillating PEP) is an airway clearance technique where the CF person repeatedly blows all the way out through a special device several times in a row. Types of Oscillating PEP include the Flutter™, the Acapella™, the Cornet™, and Intrapulmonary Percussive Ventilation (IPV). Breathing with these devices generate a very rapid vibrating effect all the way down through the large to the small airways. This vibration helps the mucus to move by making it less thick, dislodging it, and stimulating its movement towards the large airways. After blowing through the device several times, the person actively coughs or huffs. This cycle is repeated several more times.

**High Frequency Chest Wall Oscillation** is also known as the Vest or Oscillator. A special inflatable vest is attached to a machine that vibrates it at a high frequency. The vest vibrates the chest helping to loosen the mucus and make it thinner. Approximately every five minutes the CF person stops the vibration and then coughs or huffs; since the mucus has been thinned and loosened it is easier to clear out.

**Positive Expiratory Pressure (PEP)** Therapy allows air to get into the lungs and behind the mucus by going through extra (collateral) airways. PEP also helps to hold open airways and prevents them from collapsing or squeezing shut, which they can sometimes do. A PEP system consists of a mask or mouthpiece connected to a resistor prescribed by your physician or therapist. The CF person

breathes in normally and breathes out with a little more force against the resistance.

**Active Cycle of Breathing (ACBT)** involves a set of different breathing techniques, and can easily be varied to each individual with CF. It helps get air behind mucus, decreases spasm of the airway, and helps to maximize clearance of secretions. It consists of:

Breathing control – normal, gentle breathing, using the lower chest with relaxation of the upper chest and shoulders

Thoracic expansion exercises – deep breaths emphasizing breathing in. Some individuals will use a three-second breath-hold to help the air to get behind the mucus. This may be combined with chest clapping or shaking, followed by breathing control.

Forced expiration technique – several huffs of different lengths (taught by the therapist) and combined with breathing control.

**Autogenic Drainage (AD)** means “self-drainage” and uses various airflows to help move mucus. Its aim is to reach the highest possible airflow in different parts of the lung. This helps to clear secretions from small to large airways. It consists of three phases:

- Unsticking the mucus
- Collecting the mucus
- Evacuating the mucus

The CF person inhales to different levels and then adjusts how they breathe out to help maximize the airflow and mobilize the mucus. Autogenic Drainage initially requires concentration and practice. It is usually recommended for people over 8 or 9 years old.

## CONCLUSION

This introduction is only a brief overview of many of the ACTs in use at this time. There can be variations in ACTs based upon your disease, your center, or even your country! Your care provider will be happy to show you

each technique to see which one works best for you.