Introduction

When the spinal cord is damaged, the respiratory muscles below the level of the injury become paralysed. Therefore people with a spinal cord injury (SCI) above T12 have reduced respiratory function. They are therefore at increased risk of developing respiratory complications due to the reduced or absent capacity to cough and the lack of ability to breathe deeply.

Anatomy of the respiratory system
There are four main muscle groups that assist in breathing:

1. The Diaphragm (C₃ – C₅)
   This is the large flat muscle that connects to the bottom of the ribs and sits between the lungs and the abdominal contents. When you breathe in, the diaphragm moves, sucking air in and causing the lungs to expand. As you breathe out, the diaphragm relaxes and moves up causing the air to be pushed back out.

2. The Accessory Muscles (C₁ – C₈)
   Including Scalenes and Sternocleidomastoids.
   Situated around the neck and attach to the collarbone and the 1st and 2nd ribs.

3. The Intercostal Muscles (T₁ – T₁₂)
   These are thin muscles situated between each rib. These muscles assist to move the ribs in and out when breathing.

4. Abdominal Muscles (T₆ – T₁₂)
   These hold the abdominal contents in to prevent them falling down and forward when the body is upright. When these muscles are not working, the diaphragm rests in a relatively lower and more flattened position. When the diaphragm is in this low and flat position, it is less effective. This explains why people with SCI can feel short of breath, especially when they sit up. Wearing an abdominal binder can assist, as it helps replace some of the action of the abdominals. This is also why, when acutely unwell, it is often easier to breathe lying flat.

The other major function of the abdominal muscles is to contract strongly and rapidly during coughing. This causes the air to be moved out of the lungs very fast, and moves secretions from the lungs. It is not possible to have an effective cough (or sneeze) without abdominals.

Vital capacity

Vital capacity (VC) is a measure of your lung capacity. It is measured by breathing out through a device called a spirometer.

In the general population the VC is approximately 4.8 litres for males, and 3.1 litres for females.

Initially following a cervical or high thoracic SCI, the VC can be reduced to approximately 25% of the expected normal value. Over time this may increase to approximately 58% of the average normal value for a person with tetraplegia, and approximately 73% of the normal value for a person with paraplegia.

After a SCI it is easier to breathe when lying on your back, as your VC will be higher in this position. It will reduce slightly if lying on your side, and will reduce further when sitting up in the wheelchair. This is one reason the abdominal binder is worn when first getting up, as it helps the diaphragm to work better. A person with a SCI that is having difficulty breathing and/or clearing secretions when upright, may find this easier when lying down.
Ongoing chest care

All SCI patients need to take extra care of their chest and ability to breathe, especially if they smoke or have a cold or the flu. After SCI you may be more prone to getting chest infections, which could develop into more serious conditions such as pneumonia, requiring hospitalization. To limit the chance of getting serious chest problems it is important to:

- Avoid smoking
- Do regular cardiovascular exercise to promote deep breathing
- Do deep breathing exercises
- Consider an annual flu shot
- Quad cough as soon as there are any secretions in the nose and/or chest
- Ensure there is someone who is confident in helping with quad coughing if necessary
- In the event of a cold that is not resolving, it may be necessary to visit the GP for treatment to prevent further complications.

Signs of a chest infection include:

- Increased chest secretions and/or change in colour (i.e. yellow or green)
- Increased difficulty clearing secretions
- Difficulty breathing
- Breathing faster than normal
- Increased spasm
- Generally feeling unwell
- Increased temperature

If you continue to have difficulty breathing, seek urgent medical assistance.

If hospitalization is required it may be necessary to educate the staff, that for people with SCI, breathing is easier lying down. It may also be necessary to instruct staff in hospital, how to perform effective quad coughs (refer to instruction sheet on how to quad cough).