

## Humidification

It is mandatory that a method of artificial humidification is utilised when a tracheostomy tube is in situ, for people requiring oxygen therapy – ‘dry’ oxygen should never be given to someone with a tracheostomy or laryngectomy. The type of humidification will be dictated by the needs of the patient.

During normal breathing, inspired air is warmed, filtered and moistened by ciliated epithelial cells in the nose and upper airways. However, these humidifying functions are bypassed by a tracheostomy tube or laryngectomy and air inspired will be cold and dry. Inadequate humidification can result in a number of physiological changes which can be serious to the patient and potentially fatal, including:

- Retention of viscous, tenacious secretions
- Impaired mucociliary transport
- Inflammatory changes and necrosis of epithelium
- Impaired cilia activity
- Destruction of cellular surface of airway causing inflammation, ulceration and bleeding)
- Reduction in lung function (e.g. atelectasis/pneumonia)
- Increased risk of bacterial infiltration.

As a result, humidification must be artificially supplemented to assist normal function and facilitate secretion removal. **Failure to adequately humidify could result in tube or stoma blockage as secretions become dry and viscous, forming a crust around the tracheostomy.**

The assessment of a patient with a tracheostomy should include management of their secretions and should identify the effectiveness and adequacy of the current humidification of that patient. Maintaining systemic hydration is also important and a dehydrated patient is at a greater risk of developing problems due to thick and dry secretions.

A tracheostomy tube can become completely blocked by thick secretions, leading to a respiratory arrest but this can be prevented by regular and effective assessment of the patient’s humidification, regular inner cannula care and suctioning. Warning signs can be identified which will allow for an appropriate change in management and this should prevent tube blockage.

Patient assessment should include:

- Frequency of suctioning and/or cleaning or inner cannula
- Tenacity of secretions
- Evidence of airflow via tracheostomy
- Respiration rate

- Use of accessory muscles
- Patient coughing (ineffective or excessive)
- Requirement for supplementary oxygen

High risk patients include those with reduced or thickened secretions and those with a longer length and/or single lumen tube. These patients should be cared for with extra vigilance in order to minimize the risk of tube blockage.

### Methods of artificial humidification

The chosen method of humidification will:

- Provide adequate humidification of chest secretions
- Help maintain body temperature
- Be convenient and cost effective
- Be physically suited to the patient

Consideration should be made relating to the potential infection risk of each device. Any chosen device should be used in accordance with the manufacturer's guidelines and staff trained and assessed as competent in its use.

#### Heated Humidification

Heated Humidification operates actively by increasing the heat and water vapour content of inspired gas. Gas can be delivered fully saturated at core temperature, depending on the system employed. A heater and water bath system is shown to the right. These systems indicated for tracheostomy patients requiring mechanical ventilation or oxygen therapy for  $\geq 96$  hours. This type of humidification is more effective than HME filters for those patients receiving artificial ventilation and should be used if the HME is not adequate.



#### Cold Humidification

Cold humidification bubbles gas through cold water, but only delivers a relative humidity of around 50% at ambient temperatures. For tracheostomy patients on high inspiratory flow rates of oxygen with tenacious secretions or patients complaining of subjective dryness, a heated device is indicated.

Note: Condensation from heated or cold humidification should be considered infectious waste and disposed of according to hospital policy using strict universal precautions. Because condensate is infectious waste, it should never be drained back into the humidifier reservoir.

### Saline Nebulisation

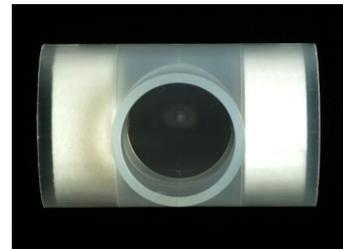
The nebuliser unit (right) converts saline into a supersaturated aerosol of liquid droplets which penetrates the lung moistening the airways. It may be indicated in tracheostomy patients who are mechanically ventilated, receiving oxygen therapy or self-ventilating on air.



Saline nebulisers help to reduce the viscosity of secretions which makes them easier to remove by suction or cough. Saline nebulising involves administration of 5 to 10mls 0.9% sterile normal saline into the nebuliser unit 2-4 hourly or as required. Nebulisers must be connected to a gas source with a flow rate of 6-8 litres/minute (or follow manufacturer's guidelines). Remember if the patient is requiring supplemental oxygen, then the gas driving the nebuliser should be oxygen and not air. Ensure nebulisation is given via the tracheostomy (not the face mask!). A nebuliser can be attached to tracheostomy mask or T-piece circuit.

### Heat Moisture Exchanger (HMEs)

HMEs consists of rolls of metal gauze or a condenser element like propylene sponge/fibre sheet/corrugated paper. These products are placed either directly onto the end of the tracheostomy tube or can be placed into a breathing circuit. They conserve heat and moisture on expiration via tube. They need to be checked regularly to ensure they are not occluded by secretions which may obstruct the airway. They require checking regularly and must be changed at least every 24 hours. Some product ranges also offer oxygen delivery inlets, suction ports. Heat moisture devices are available as small cylinder or nozzles which attach directly to tracheostomy tubes allowing for patient mobility and may have speaking valves incorporated in them.



Images: Thermovent (above)  
HMEs for anaesthetic circuits (centre)  
'Swedish nose' (right)

### Stoma filters or bibs

This group of humidification devices contains a foam layer which absorbs moisture from the patient's expired gases. They are predominantly used for

established tracheostomy patients and are often favoured by patients as they are less bulky and conspicuous and are able to completely obscure the tube from sight.

The image shows a 'Buchannon bib'. These can be used by tracheostomy or laryngectomy patients and come in a variety of styles and designs. Some can disguise the stoma completely and the patient just appears to be wearing a scarf or cravat (see images below)



### **Mucolytics**

This group of medications reduce the 'thickness' of secretions by breaking down some of the bonds that exist between the mucus. They are indicated when the patient has excessively thick secretions that are difficult to expectorate. Examples include hypertonic saline or acetylcysteine (via nebuliser), carbocysteine (via mouth) or DNA-ases such as dornase alfa (used in conditions such as cystic fibrosis)

### **Hydration**

Ensuring that the patient is adequately hydrated is essential in managing the secretion load of a patient. This can be enteral, intravenous or even subcutaneous.

## Documentation

- Record the method of humidification in use in the patients care plan or clinical record as per local procedure.
- Record evidence of evaluation and instigation of action taken in the patients care plan or clinical record as per local procedure.
- Record signature for accountability of care for each shift as per local procedure.
- Record date and time that devices are changed and/or are due to be changed.

## Humidification ladder

The level of humidification required by patients will change depending on their clinical state, level of respiratory support required and their degree of hydration. If the current degree of humidification is not adequate enough, then the patient should be 'stepped up' to the next level. Patients with tracheostomies and laryngectomies are incredibly vulnerable to complications due to inadequate humidification and its importance in preventing tracheostomy-related complications cannot be emphasised enough. This becomes even more important if the patient is unwell, dehydrated and has purulent secretions.

### The humidification ladder

Heated water bath (active humidification)

- Ventilated patient with thick secretions
- Self-ventilating patient (on oxygen) with thick secretions

HME for breathing circuit

- Ventilated patient with minimal secretions (replace every 24 hrs)
- Monitor effectiveness (less likely to be effective if required for more than 5 days)

Cold water bath

- Self ventilating patient (on oxygen)

HME (Buchanon bib, Swedish nose)

- Self ventilating patients (no oxygen)

Add saline nebulisers or mucolytics and ensure adequate hydration if secretions aren't improving.

## Other methods of improving secretions

### Mobilisation

There is good evidence, borne out by expert opinion and commentary, that mobilising patients will help to improve the clearance of secretions. Mobilisation should be encouraged for all patients with an airway stoma. The assistance of physiotherapists is essential for patients who cannot mobilise independently, or who are sedated and/or ventilated. These interventions can be combined with aggressive chest physiotherapy.

There is evidence that patient movements and interventions can be associated with an increased of tracheostomy tube displacement, but others have clearly shown that careful mobilisation of even the most dependant patients can be achieved safely, without increasing the risks of tube displacement, whilst reducing the risks of pneumonia and shortening time receiving invasive ventilation.

### Instilled saline

This practice is advocated by some when secretions prove difficult to manage. There is no clear evidence for benefit or harm. Saline is probably most effective when directed using a broncho-alveolar lavage, which is appropriate for discrete areas of mucus plugging, especially if associated with distal collapse or consolidation. Bronchoscopy may require sedation, but is technically straightforward via a tracheostomy in experienced hands.