HUMIDIFICATION

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CNM 2

- During normal breathing the upper respiratory tract warms, humidifies and filters inspired gases – primarily in the nasopharynx where gases are exposed to a large area of highly vascular, moist mucus membrane.
- In the normal person:
  - Rostrum Air - 22°C, 10mmHgO(L)
  - Larynx – 31-32°C, 26-32mmHgO(L)
  - Main trachea - 34°C, 34-38mmHgO(L)
  - Main bronchi (Carina) - 37°C 44mmHgO(L) (Isothermic Saturation Boundary)
- Optimal gaseous exchange occurs when air in the lungs reaches 37°C with 100% humidity (44mmHgO(L)), the physical properties of alveolar mucosa are optimised and mucous transport is maximal... the point where gases reach this condition in known as the Isothermic Saturation Boundary (ISB). Under normal breathing conditions ISB resides just beyond the carina and its position remains fairly constant. (Russell 2005, Woodrow 2002, Carroll 1997, Branson 1999)
- When heat and humidity drop below these levels the ISB moves further into the lungs causing more stress on the mucosal lining (Carroll 1997)

- Once a tracheostomy is formed the passage of inspired air is via the tracheostomy without passing through the upper airway... the human air conditioning system is bypassed. (Russell 2005)
- Therefore:
  *Every patient with a tracheostomy much have some form of artificial humidification*

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Consequences of Under-Humidification

- Severe heat and moisture loss from the respiratory mucosa leading to destruction of cilia and damage to mucus glands
- Pooling of mucus due to slowing of mucociliary system leading to increased sputum retention and atelectasis.
- Tracheitis
- Infection
- Bronchoconstriction leading to reduced airflow and decreased oxygenation and SpO2
- Airway obstruction

Consequences of Over-Humidification

- Excessive moisture into dependent bronchi
- Reduced residual lung capacity
- Increased volume of secretions due to overloading of the mucociliary elevator
- Arterial hypoxemia
- Mucosal heating or burning
- Infection
(Jackson 1996; Buglass 1999)

Types of Humidification

- Heated humidification
- Heat Moisture Exchange Filter
- Nebulizers
- Soft Shield Humidification Bib
1. Heated Humidifiers
- These devices produce heated water vapour held in a gas source.
- Active humidification
- Particle size is extremely small and not visible to the naked eye.
- Used with for:
  - Patients with newly formed tracheostomies
  - Ventilated patients
  - Dehydrated patients
  - Immobile patients
  - Patients with tenacious secretions
  - Respiflo – Aerodyne humidifiers.
  - Fisher Paykel breathing circuits

Points to Consider!
- Where possible have equipment set up prior to arrival of patient.
- Ensure apparatus is working by checking for fine mist at end of elephant tube.
- Set temperature dial a number 6 (Kendal Respiflo) (assess temperature of mist on your inner arm)
- To avoid ‘rain out’ (condensation) in the elephant tubing:
  - Do not cut elephant tubing too long (120-180cm)
  - Avoid cool air blowing onto elephant tubing (fan's, open windows)
  - Empty elephant tubing and water trap 4 hourly (when carrying out tracheal observations)

Avoid dips in the tubing that allow water to collect
- Elephant tubing must be dated and changed weekly or as required.
- Water bottles need to be changed on average every 4 - 5 hours.
(SJH 2008, Kendall user guidance manual)

2. Heat Moisture Exchange Filters (HME/Swedish Nose)
- Attaches over the end of the of the tracheostomy tube and makes use of the patients exhaled air. (Buglass, 1999)
- Passive humidification
- May be used when patients become more independent/mobile.
- Disposable if soiled

Points to Consider!
- Passive form of humidification
- Not suitable for patients with thick or copious secretions
- May need regular changing if sputum is coughed into it. (Change daily/PRN)
- Educate patient regarding removal of the device if he/she experiences breathing difficulties.

3. Saline Nebulizers
- Nebulization produces a mist saturated with moisture droplets.
- The moisture content is greater than humidified gas and due to particle size it penetrates further down the respiratory tree.
- Providing humidification via a vapour or an aerosol has been shown to thin secretions and promote clearance
(Fowler 2000, Griggs 1998)
**Points to Consider!**

- Not Heated!
- Prolonged nebulization can lead to fluid overload and increased airway resistance.  
  (Fowler 2000)

**4. Soft Shield Humidification Bib**

- Cotton Bib with foam lining – uses patients expired air.
- Suitable for patients with loose secretions.
- Can be hand-washed up to 10 times.

**Remember!**

- Humidification of inspired gases is essential for patients with a tracheostomy.
- There are serious consequences associated with both over and under humidification.
- Do not combine methods of humidification – use one at a time.
- Systemic hydration is also essential in order to prevent thick secretions

**References**

- St James’s Hospital (2008) Tracheostomy Guidelines. SJH.