

22.0 Ventilation Management policy



PURPOSE AND SCOPE

This policy informs staff on the appropriate procedures for ventilation management and including related escalation procedures.

Ventilation Management

Ventilatory support is a life-saving intervention taken when a Client is unable to facilitate their own breathing due to low oxygen levels, severe shortness of breath, chronic respiratory illnesses or other causes of respiratory impairment such as neuromuscular conditions, parenchymal lung disease, sleep-disordered breathing, and chest wall deformities (ATS 2020, Dale et al. 2017).

A ventilator is a machine that supports a Client's breathing. It delivers moist, warm, oxygen-rich air through either an endotracheal tube or interface (depending on whether the ventilatory support is invasive or non-invasive) and into the patient's lungs using positive pressure. The Client will either exhale on their own or the ventilator will do so for them, depending on their condition (idsMED 2019; Elsevier 2019)

The ventilator assists the Client to intake and expel adequate amounts of oxygen and carbon dioxide, respectively. The amount of oxygen delivered to the Client, as well as the size and frequency of each breath depends on how the Client normally breathes and can be managed by the Nurse as prescribed through the ventilator's monitor (idsMED 2019; Elsevier 2019).

Ventilation takes over the work of breathing by delivering oxygen into the lungs, reducing the level of effort required by the client. A Client can receive ventilatory support in several ways:

- Mechanical ventilation is invasive and involves the insertion of an endotracheal tube through the client's mouth or nose into the trachea or directly to the trachea with a tracheostomy tube. This tube is connected to a mechanical ventilator, a machine that moves air in and out of the patient's lungs.
- Non -Invasive Ventilation (NIV) is the provision of ventilatory support through an external interface (mask or helmet). Intubation is not required.
- Clients with a tracheostomy may receive ventilatory support through mechanical ventilation.

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What is NIV?

Non-invasive ventilation (NIV) refers to the administration of ventilatory support without using an invasive artificial airway (endotracheal tube or tracheostomy tube). The goal of NIV is to assist the muscles used for breathing by providing mechanical support. This also helps the client become less tired during the day and reduce daytime somnolence (sleepiness).

- Modes of NIV– Spontaneous/Timed Modes

-Continuous Positive Airway Pressure (CPAP)

- ✓ CPAP provides continuous positive pressure throughout the spontaneous respiratory cycle, recruiting collapsed (atelectic) alveoli, resulting in increased functional residual capacity. It is predominately used in clients with type 1 respiratory failure (hypoxia without hypercapnia) due to problems with airway recruitment/atelectasis such as occurs with pulmonary oedema or post-operative atelectasis.

- Bi-level Positive Airway Pressure Ventilation – also known as BiPAP*

(original registered trademark of the supplier of the original machine)

- ✓ BiPAP cycles between an upper pressure level (IPAP- inspiratory positive airway pressure) and a lower pressure level (EPAP- expiratory positive airway pressure).
- ✓ BiPAP provides spontaneous ventilator assistance CPAP with the added benefit of decreasing the work of breathing and increases tidal volume and minute volume ventilation. It is used in the management of clients with type 2 (hypercapnia) respiratory failure
- ✓ The most common application of BiPAP is for the management of acute exacerbations of Chronic Obstructive Pulmonary Disease (COPD). Other indications include chronic use in obesity hypoventilation (Pickwickian) syndrome, respiratory muscle weakness due to neuromuscular disease and reduction in thoracic compliance due to chest wall abnormalities and/or abdominal pathology

Patient selection criteria for NIV

- Spontaneous breathing
- Ability to maintain airway
- Ability to clear secretions
- Ability to cooperate
- Ability to tolerate face mask

Benefits of Home Ventilation

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Home ventilation allows Clients with chronic respiratory needs to live in the community with greater autonomy. It also decreases hospitalisations, burden of symptoms and enhances quality of life. It is the purpose of INTENSIVE CARE AT HOME (ICAH) to help Clients meet these goals.

Staff Requirements:

All ICAH Nurses will have complete understanding of the tasks below and shall follow all manufacturer's recommendations as well as the Individual Client's care plan for ventilation management prescribed by the care team.

- Confirming the Client's need for ventilation.
- Following instructions to identify, connect or assemble components of ventilator equipment.
- Following instructions to prepare the ventilator for operation.
- Fitting the breathing interface.
- Checking to ensure the ventilator settings match prescribed settings on care plan
- Commencing ventilation and ensuring it is functioning effectively including observing the Client's status.
- Following troubleshooting procedures to appropriately respond to alarms and maintain equipment.
- Following hygiene and infection control procedures.
- Ventilator control panel and alarms of ALL ventilators used in the Client's home.
- Ensuring backup equipment, such as ventilators and suction equipment are always charged and ready for use.
- Maintaining tubing circuit including cleaning and circuit changes per manufacturer's recommendations.
- Maintaining humidifier or heat moisture exchanger (HME) per recommendations
- Maintaining proper cleaning procedures for all related equipment
- Administering nebulized medication for inhalation if prescribed ; follows all manufacturers' recommendations about equipment usage.
- Skill requirements with each clinical visit shall include but not be limited to the following items:
 - Ability to operate suction machine
 - Ability to properly mix solutions used in airway suctioning and tracheostomy care
 - Tracheostomy care » Changing tracheostomy dressings » Cleaning of inner and outer tracheostomy cannula
 - Operation of manual resuscitation bag.

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NOTE:

ICAH clients on ventilation have a developed ventilation management plan with ventilator settings already prescribed. This plan should include possible risks, incidents and emergencies, and what actions need to be taken to manage these situations, including the escalation of care, if necessary, communication methods for tracheostomy clients, and day and night routines, all of which are vital for the Client's safety and comfort. The client's health status will be reviewed by the medical care team periodically as agreed upon with the Client and as needed with any changes to the Client's status. The Clinical Liaison Nurse at ICAH will arrange team meetings regularly with Client's consent and participation to review the care plan and update changes, as necessary. ICAH Nurses managing ventilation will be informed of all appropriate updates in policies, procedures, and training plans.

Essential Care Principles of Ventilation

Caring for a Client receiving ventilatory support involves communicating effectively with the Client and other members of the care team as well as

- Doing safety checks at the beginning of every shift to ensure all emergency and backup equipment necessary to provide care and keep clients safe are functional and available.
- Checking the ventilator settings and identifying any changes in the Client's condition
- Monitoring the Client's oxygenation and vital signs per recommended frequency in ICAH Clinical Observation's Policy unless otherwise specified by Client's care plan and or change in Client's status requiring more frequent monitoring.
- Responding appropriately to ventilator alarms and troubleshooting as needed
- Suctioning the Client as needed
- Assessing the Client for pain or anxiety and providing reassurance and or appropriate prescribed treatment
- Ensuring the Client is hemodynamically stable.
- Ensuring there is a backup plan in the event of power failure and or ventilator failure such as generator if available or solar power source and or escalation to emergency services as needed for failure of all the above
- Ensure the emergency evacuation plan is well established in case of such emergencies requiring Client evacuation as well as mobility equipment such as hoists, wheelchairs are charged and working appropriately.

Ventilation Procedure

- Perform Hand hygiene

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- Don PPE if required.
- Explain the procedure to the Client.
- Review the ventilator type and settings to ensure they adhere to the current prescribed orders.
- Ensure the connections and tubing are intact.
- Assess the Client's lungs.
- Monitor and record Client's vital signs including oxygen saturation, frequency per policy unless specified otherwise on Client's care plan.
- Suction if required.
- Perform routine tracheostomy care if applicable.
- Check humidification.
- Ensure the tubing is free from condensation.
- Monitor and record the level of oxygen in the tank if in use as well as back up oxygen tanks and or check oxygen concentrator equipment.
- Ensure the backup ventilator and spare batteries are present and working correctly.
- Check and test alarms.
- Assess the Client's gastrointestinal status.
- Assess the Client's cardiovascular status.
- Assess the Client's fluid balance.
- Assess the Client's nutritional status.
- Check for signs of infection (take the Client's temperature, check for increases in heart rate, check for changes in secretions).
- Assess the psychosocial health of the Client and their loved ones regularly. Provide support as required and coordinate for relevant resources as needed with the care team.
- Clean the ventilator equipment per cleaning schedule established in the plan of care.
- Reassemble the equipment.
- Discard soiled supplies appropriately.
- Update relevant documentation.

Ventilator-Associated Pneumonia

It is important to note that mechanically ventilated Clients are at risk of developing ventilator-associated pneumonia (VAP), which is estimated to occur in 9 to 27% of this population (Furesz 2016). Strategies to decrease the likelihood of VAP include:

- Maintaining a bed elevation of 30 to 45 degrees if possible.
- Maintaining the Client's oral cavity hygiene if possible.

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- Encouraging the Client to sit up if possible, as this improves lung compliance and gas exchange and maintain as much mobility as they can.
- Providing adequate nutrition will improve the immune system.
- Suctioning visible secretions; and
- Practising aseptic technique per infection prevention and control policy

Other Complications of Ventilation

In addition to VAP, mechanical ventilation is associated with other complications that Clients should be monitored for including:

- Barotrauma (alveolar rupture e.g., pneumothorax)
- Haemodynamic instability
- Volutrauma (ventilator-associated lung injury)
- AutoPEEP (hyperinflation of the lungs)
- Sinusitis
- Laryngeal injury
- Tracheal stenosis
- Increased incidence of infection.
- Tracheal erosion may result from irritation and necrosis of the mucosa resulting in fistula formation. Air embolism may result if the fistula tracks to a vein.
- Aspiration is a risk if it tracks to the oesophagus.
- Tube obstruction
- Tube displacement
- Loss of electrical power to the ventilator or equipment malfunction

(Furesz 2016)

Less severe complications of home ventilation that may cause discomfort to the Clients include:

Wind or distended abdomen.

Pressure injury from trach securement devices

Dry mouth.

Nasal irritation or congestion.

(NHS 2018)

Other Considerations for Clients on NIV

- Enteral feeds can be administered during periods of CPAP/NIV. However, staff should be mindful of the increased risk of abdominal distension and need for increased venting/aspiration of nasogastric

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(NGT) or other gastrostomy tubes.

- Time spent on NIV may impinge on the client's ability and opportunity to take adequate nutrition and/or fluids orally. Therefore, alternative feeding methods may need to be used. If the client has an NGT, a nasojenunal tube (NJT) or a nasopharyngeal airway (NPA) insitu there is an increased risk of pressure area formation and air leak.
- Change / clean circuit weekly, prn or *as per manufacturer recommendation*.
- Clean/change straps weekly, prn or *as per manufacturer recommendation*.
- Clean mask daily or *as per manufacturer recommendation*.
- Refresh humidification water daily (wash & air-dry humidifier reservoir on applicable drivers as per home care plan) Use bottled sterile water or cooled boiled water for irrigation.
- Poor oral hygiene especially with prolonged periods of NIV with mask on and dry oral cavity. Frequent oral care is recommended.
- Ocular complications/eye soreness due to the increased gas flows drying the cornea. Frequent eye care is recommended, and eye moisturizing drops or creams if prescribed.
- Pressure injury development on face due to mask interface and on dependent areas due to decreased movement during therapy. May need to utilize skin protecting foams /tapes prior to mask application. Monitor skin each shift. Provide pressure area care.

Humidification

Humidifiers are used to warm and moisten inspired air/oxygen in a customer with a Tracheostomy tube and to assist in preventing the Clients' secretions becoming tenacious.

During normal breathing the body heats and humidifies air as it passes through the mouth and nose to the trachea. When a Client is breathing via a Tracheostomy tube, these natural mechanisms are bypassed; therefore, artificial means of heating and humidifying air must be employed. The air or oxygen supply to the airways of a Client with a Tracheostomy needs to be heated to a temperature of 37°C.

The following must be taken into consideration:

- Inspired air for all Tracheostomy Clients is usually humidified using humidification via ventilator tubing.
- A heat and moisture exchanger may be used during a client's hygiene, transport or physiotherapy session in place of heated humidification. Some Clients may use a combination of heat and moisture exchanger and saline nebulisers as an alternative form of humidification. This humidification is only used after a careful trial process and included in the Client's care plan. NOTE: saline nebulizers are client specific (current evidence indicates saline nebulizers are not efficacious. Ensure there is an

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order on the client's drug chart prior to administration)

- All Clients with a Tracheostomy must have their humidification needs and oxygen requirements assessed and monitored. Any concerns should be communicated to the care team.
- Follow humidification recommendations for clients on NIV

Clinical Staff need to be aware of and alert for:

- Inadequate humidification can lead to drying of secretions and sputum plugging. This can lead to partial or complete occlusion of the Client's airway.
- Tracheostomy occlusion is generally preceded by partial blockage. Be alert for signs of partial blockage e.g., difficulty passing a suction catheter or a "whistling" noise or stridor when the Client breathes. Also reduced Tidal Volumes, Minute volumes and/or increased Peak pressures.
- The inner cannula must remain patent and free from sputum for clients with trachs
- Care should be taken to ensure that the condensation that accumulates in the corrugated tubing does not pour back into the Clients' airway.

Maintenance / Care of Humidifier

- Ensure the water reservoir does not run empty. It should be rinsed daily with clean tap water and refilled.
- Maintain the temp at 37.0 degrees for clients with tracheostomy. Ensure the circuit is intact with no kinks. Follow recommendations for NIV humidifiers.
- Check the tubing for rain out when humidifier is in use
- The disposable circuit and chamber components of the humidification system should be changed weekly or as per manufacturer recommendation.
- Humidification can be augmented using additional nebulisers such as normal saline or Ventolin which would need to be prescribed.
- Document any changes or concerns about humidification in the Client's medical record.

Use of heat and moisture exchangers (HMEs)

- HMEs are a group of humidification devices sometimes referred to as "Swedish noses" or "Trachvents". They act by passively collecting heat and moisture from the Client's expired gas and returning it to the airway during inspiration.

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- The HME fits directly on to the external connector of the Tracheostomy tube.
- HMEs do not provide the same level of humidification as heated water humidifiers. If the Client is inadequately humidified, they are at risk of Tracheostomy occlusion and/or sputum retention.
- Clients with large amounts of secretions are not suitable for management with an HME as the HMEs can block.
- HMEs may require an increase in work of breathing, which may not be tolerated by some Clients. All Clients should be monitored for dyspnoea, fatigue and oxygen desaturation.
- Suction the Client if necessary, to ensure a clear airway prior to placing the HME.

Maintenance / Care of HME

- The HME should be changed every 24 hours or more frequently if visibly soiled with secretions.

Signs that a Client is not adequately humidified:

- Thick or tenacious secretions
- An irritable cough
- Trouble coughing up or suctioning secretions.
- The tracheostomy tube/inner cannula is becoming clogged with secretions.
- Reduced Tidal Volume
- Reduced Minute Volume
- Increased Peak Pressure
- Secretions are very slow to move up the catheter during suctioning.
- Secretions are collecting on the outside of the catheter during suctioning.

BACKUP EQUIPMENT

Policy

A list of all equipment including backup equipment related to ventilation and tracheostomy management procedures will be made in collaboration with the Client and maintained by ICAH through team leaders and Clinical Liaison Nurse to track service and maintenance schedules as well as equipment malfunction and replacement procedures.

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Procedure

1. Ventilators

All ventilated Clients should have a backup ventilator that must remain charged at all times. Nurses must perform self-tests as part of safety checks each shift. manual self-inflating resuscitation bag in the event of equipment malfunction. As previously stated, the caregiver shall be provided instruction in its use.

2. Internal Batteries

The ventilator's internal battery is a lithium-ion battery. If the ventilator is disconnected from the AC power source and has no external battery to receive power from. the ventilator will automatically switch to the internal battery. When functioning properly the internal battery will power the ventilator for about three hours depending on battery condition and Client settings. Some ventilators also have a detachable internal battery that will give even more operational time without AC power.

3. External Battery

Clients with home ventilation may have a backup external battery. If this battery has been fully charged, it will power the ventilator for approximately 6-20 hours of operation. Staff should follow manufacturer's recommendations in maintaining the external battery.

EQUIPMENT MAINTENANCE AND FUNCTIONAL CHECK

Policy

ICAH Nurses shall perform all equipment functional checks each shift as part of safety checks and document on the safety checklist. Any faults noted must be escalated and an incident report generated. This is to be certain that the equipment is safe for use and continues to operate as required. ICAH will maintain an equipment service schedule for Clients and provide relevant services for equipment unless a Client has their own bio medical service provider and is documented as such in the care plan. In that case, ICAH will still track service dates and prompt Clients as needed for maintenance.

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EMERGENCY PROCEDURES

Policy

Staff will be informed of emergency procedures for our Clients receiving home mechanical ventilation.

Procedure

1. Machine Failure

Immediately remove the Client from the machine and manually ventilate with the resuscitation bag device. Obtain backup equipment and follow proper procedures in connecting the Client to the backup ventilator.

- a. Attempt to identify and correct the problem with the steps outlined in the trouble-shooting guide.
- b. If the above is not successful, continue to manually resuscitate the Client and notify the care team immediately. **Call 000 if no immediate solution is available.**

2. Power Failure

- a. Check to be certain that the ventilator has not been disconnected from the electrical outlet.
- b. Be certain the ventilator is operating on the external battery. Connect to alternate power source if available. Ensure the Client is safe and ventilating well.
- c. Notify Clinical Liaison Nurse and care team. Ensure the Client is informed of all escalation procedures. It may be necessary to transfer the client to the relocation address.

3. Obstructed Airway

- a. If the tracheostomy tube is either completely or partially obstructed, you will notice an increase in pressure to ventilate and the high-pressure alarm will sound with each breath.
- b. If the Client is not in distress, suction the Client.
- c. If the Client appears to be in distress, remove the Client from the ventilator and manually ventilate with 100 percent oxygen. (The Client may be

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difficult to bag if the tube is obstructed.) Attempt to suction the Client.
Lavage may be required.

- d. Continue to evaluate the Client for skin colour, pulse, and breathing difficulty.
- e. If you feel that the obstruction has been adequately removed, connect the Client back to the ventilator and observe.
- f. If the obstruction has not been removed, continue to manually ventilate the Client with 100 percent oxygen and call 000.

4. Emergency Reinsertion of the Tracheostomy Tube:

- a. If the tracheostomy tube accidentally comes out it must be replaced immediately.
 - Stretch peristomal skin above and below stoma to facilitate tube insertion with obturator in place
 - Using the other hand, gently insert the new tube (lubricated) into the trachea with an inward, downward rotating motion
 - Remove obturator
 - Hold the clean tracheostomy in place and secure the ties
- b. The following should always be close to the Client care area:
 - Two Tracheostomy tubes (one the same size and the other one a size smaller)
 - Face mask for manual resuscitator
 - Xeroform gauze
 - Water soluble lubricant
 - 100 percent oxygen source
- c. Stay with the Client, reassure them, and assess for change in colour, pulse, and breathing difficulty.
- d. If the Client is in severe distress, hold Xeroform gauze over the stoma and ventilate them via mask to mouth with 100 percent oxygen. If the upper airway is non patent, deliver manual ventilation over the stoma using a pediatric face mask
- e. After the Client's colour returns, lubricate the spare tracheostomy tube, and attempt to insert into stoma.

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- f. If unable to insert, open the smaller tracheostomy tube, lubricate, and attempt to insert.
- g. If you are unable to insert the smaller tracheostomy tube, continue to manually ventilate and call 000.
- h. If the Client is not in severe distress repeat steps e-g.
- i. If the tube is successfully inserted, stabilize the tube with the tracheostomy ties and notify the Home Care Practitioner of the event immediately.

NOTE:

All incidents related to escalation of treatment due to equipment failure or power failure and or change in Client's status MUST be documented as an incident report for review.

Related Policy

22.1 Tracheostomy Management Policy

Additional Resources

[American Thoracic Society, Mechanical Ventilation](#)

[Department of Health, COVID-19 Guide for Home Care Providers](#)

[Elsevier, Ventilator fact sheet](#)

[NDIS Practice Standards: Skills Descriptors](#)

[NDIS Practice Standards: NDIS Practice Standards and Quality Indicators](#)

[VNHCSB, Nursing Management of the Ventilator-Dependent Patient In The Home](#)

[NDIS Practice Standards and Quality Indicators module for High Intensity Daily Personal Activities](#)

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