Basics of Non-Invasive Ventilation

Learning Module

SMRPCC

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Basics of Non-Invasive Ventilation

MND patients may in the course of their illness experience hypoventilation as a result of the progression of their disease. This may require them to undergo testing and as a result they may be fitted with Variable Positive Air Pressure (VPAP) ventilation. As their condition deteriorates, they will become more and more dependent on it. This module provides basic information about the management of the MND patient and their NIV equipment in the home environment.

Breathing (respiration/ventilation)

Breathing is a process of moving air in and out of the lungs. This supplies the body's oxygen needs and rids the body of carbon dioxide. Some conditions affect the ability to maintain normal 02 and C02 levels such as Obesity Hypoventilation Syndrome, conditions like MND which affect muscle strength around the lungs and chest wall stiffness such as Kyphoscoliosis. Often the symptoms are first noted in relation to sleep. Breathing is worse during sleep due to decreased muscle tone including the diaphragm, decreased breath volumes and decreased ventilation. This leads to hypoventilation (under breathing).

➢ Hypoventilation

Symptoms include:

- consistent morning headache on awakening
- 'fogginess'
- daytime lethargy and difficulty remaining awake,
- increasing shortness of breath without disease progression
- deteriorating sleep and poorer quality of life

➢ Respiratory failure

Decreased ventilation leads to increased C02 and decreased 02. The body's protective mechanism is to create multiple waking events to address the problem. This leads to sleep deprivation which creates worsening ventilation and decreased respiratory drive. This in turn affects daytime ventilation. As the disease progresses muscle weakness and deterioration results in respiratory failure.

➢ What is non-invasive ventilation?

Non-invasive ventilation is a method of delivering support to breathing via a bi-level machine (e.g., VPAP Variable Positive Air Pressure) via tubing/mask. On inhalation the machine increases pressure to support breath and on exhalation the machine reduces pressure. CPAP (Constant positive air pressure) is not used in NIV as the pressure does not vary.

The bi-level is set with a minimum breath rate which results in increased breaths and ventilation which increases exhalation and decreases levels of C02. **O2 is not an alternative treatment** although if lung pathology is present 02 may be given. Sleep studies and tests are conducted to match a client's breathing needs. NIV restimulates and recalibrates the brain stem. Breath times are set within a window but there is some voluntary flexibility. When use of NIV is increasing to 14 hours a day or more notify VRSS so that they can provide a spare set of equipment.

➢ How does NIV help?

NIV provides minimal fluctuations in levels of 02 and C02, normalising them night and day which improves sleep, returns respiratory drive to normal, and improves symptoms.

In the case of MND the muscle weakness will progress and although the symptoms of nocturnal hypoventilation will be initially controlled through nocturnal ventilation, daytime ventilation will eventually be necessary. MND patients will become dependent on their NIV. If this is withdrawn and they have significant respiratory failure they will die within a short period of time. This is discussed when the equipment is provided. Patients are made aware of the option to choose to cease ventilation. Should this choice be made the Victorian Respiratory Support Service will ensure via their team that adequate medication and support are provided during the process while in the patient's environment.

Equipment

- ### Ventilators

There are two types of VPAP that are used –one model is older and has the humidifier as a separate external unit. It is important that this is lower than the machine to prevent back flow into the unit and the patient. Suregard filters are provided on the external humidifier to prevent water running into the machine. If these get wet they should be replaced with a new one and the filter disposed of. Normal replacement time is monthly. The new model has an internal humidifier within the machine. In this case do not tilt the machine.

If the ventilator makes a whining mosquito like noise it then it needs replacing. It is serviced annually by VRSS.

The ventilators are connected via tubing and masks with humidification for the delivery of pressurised air individually set for the patient.

When transporting patients with NIV and moving the ventilators remove and empty the humidifier, connect to portable and external battery. The battery should provide the patient with approximately 7 hours of portable ventilation.

Keep the battery charged when not in use. The battery has a life of 5 years. If the battery is only staying charged for 3 hours, it needs replacing. Batteries can be charged with a car cigarette lighter. VRSS will supply half the cost of a battery. Where financial concerns exist, they may be able to supply equipment free of charge.

Spare equipment is provided to patients on ventilators if they are dependent on the equipment in the case of blackouts. Hospitals also have generators which patients can access in an emergency.

➢ Getting equipment

Equipment is usually posted to the patient. Urgent equipment needs can be picked up from VRSS in business hours at the Austin Hospital. After hours they can contact Ward 5 West at the Austin Hospital (ph: 9496 3685) and may be able to collect equipment from there.

- General cleaning

Protect from dust when not in use. Filters should be changed regularly and disposed of. Tubes, masks and hoses are non-disposable and should be returned to VRSS. The mask cushion has a life of 18 months. Wipe the mask cushion with a wet cloth and wash mask, headgear and tubing weekly in warm soapy water and rinse. Allow to dry thoroughly. Spare tubing should be used to ensure no water will make its way into the machine or the patient after cleaning the equipment.

Patient care on Ventilation

- Masks

Check equipment for leaks, and comfort. Small leaks at the bridge of the nose are acceptable and are compensated for by the machine and are a trade off to prevent pressure on the nose. Masks are constantly being changed and monitored for correct seal due to muscle deterioration and changing client needs. Apply the mask squarely to a clean and clean shaven face with equal tension on the head gear. The top of the head gear has a dial which can be moved to patients comfort. When removing masks avoid 'shearing' of the skin via sideways dragging. Masks may be alternated to alleviate facial pressure.

Due to muscle weakness it is difficult for MND clients to remove the mask. Ensure that a buzzer or bell that is appropriate and available at all times. Headgear may be modified to allow removal of the mask for patient safety and comfort.

Condensation may form in the tubing which creates noise and moisture. This is often a problem in colder weather. Close windows, warm the room, or wrap the tubing to insulate it from the cold. Tubing covers may be supplied or made or tubing may be placed under the blankets. The humidifier may also be turned down.

Patients select their own comfort level for humidification and may use the "ramp" button to control the speed with which the ventilator reaches full volume. It is often more comfortable to slowly get up to full ventilation but this may not be helpful after exertion or movement when ventilation is needed immediately.

Any problems with equipment or pressure areas notify VRSS. They may need a review at Bethlehem Calvary Health Care at the VRSS clinic. The patient must bring their equipment with them. This is especially important for rural clients.

- Skin care

If there is any pain, redness or swelling around the mask or bridge of nose contact the Outreach service at VRSS. They will come to reassess the equipment function and fit. Facial pressure areas are often the result of poor mask application due to pressure and 'shearing' of the skin or increased use. Masks may be changed to alleviate pressure and protective dressings are applied. Due to continued disease progression, weight loss and loss of muscle tone constant reassessment of equipment is necessary. There are a wide range of options for masks including nasal and full face that are available to choose from. VRSS will check and monitor NIV on a regular basis.

- Protocols between VRSS and Bethlehem Calvary Health Care

Use witch hazel or toner that is alcohol based to ensure skin is clean. Skin may be protected and 'toughened' with the use of toner. When skin is reddened or a bit broken use: MEDIPLEX LITE. (Available from Independence Australia Health Solutions 1300 788 855).

When skin is ulcerated or has deep injury use AQUACLEAR.

- Showering

Move the ventilator to the bathroom area where it will not get wet. Patients may find showering easier in the morning when they have more energy and muscles are rested. Anxiety creates anxiety so prepare the area and be prepared. Anti-anxiety medications, having a fan in the room and showering the patient with their back to the flow of water may ease their breathlessness.

- Anxiety

Anxiety results in shortness of breath. Sometimes controlling anxiety allows the settings on the machine to be reduced. Anxiety creates more anxiety. Controlling anxiety increases well-being. Short acting non-cumulative benzodiazapines are best for managing anxiety.

- Bowels

Ensure regular bowel actions as a full abdomen impacts on the capacity for the diaphragm to function properly. Excess air in the stomach can be vented out via the Peg tube. MINTEC (peppermint oil) can also be used for wind. The ramp function on the ventilator may help to reduce distension by raising air pressure gently.

Small regular meals are necessary and it is impossible to eat and breathe. Ensure the patient is upright and the neck is supported to avoid the possibility of aspiration.

The optional use of a nasal mask at meal time may be helpful.

- Excessive thick secretions

Patients with MND may have difficulty with secretions –they may be excessive or thick and they may have trouble clearing them and this may affect how well NIV is tolerated. Should secretions be an issue medications, interventions and speech pathology review may be required.

- Concurrent illness

Illness may mean that the patient may need increased ventilation, hospitalisation or review.

Respecting patient choices

Increasing dependence on NIV is challenging for everyone. When NIV is used for 16 hours per day spare ventilators and equipment is provided by VRSS. Discussions should be carried out to allow the patient to understand their options and choices. Not all patients choose NIV. Those who do will survive for longer however they will become dependent on it. At some point they may choose to withdraw ventilation. Medication and intensive support are given via VRSS if withdrawal is requested. Advanced care planning, refusal of treatment certificate and Medical Power of Attorney documentation should be noted and kept where it is easily located.

Resources

- **Victorian Respiratory Support Service:** 24 hours 7 days per week statewide service. Outreach nurses: 9496 3665
- **Motor Neurone Disease Association** 265 Canterbury Rd Canterbury 9830 2228
- **For purchase of external battery kit:**
  Battery Place Shop 9, 13 Fawkner Street
  West Meadows 3043
  Tel: 9330 0900
  Email: sales@batteryplace.com.au

Managing Non-Invasive Ventilation in the Home

QUIZ

Question 1: **List two symptoms of hypoventilation**

1:

2:

Question 2: **What is one reason MND clients find breathing difficult during sleep?**

Question 3: **What are two benefits of NIV for the MND client?**

1:

2:

Question 4: **True or False, please circle the correct answers**

a)	Tubes, masks and hoses are disposable	**True** ☐	**False** ☐
b)	Filters at the back of the ventilators are replaced 3 monthly	**True** ☐	**False** ☐
c)	Ventilator settings can be changed by the client or their family	**True** ☐	**False** ☐
d)	"Ramp buttons" increase the air volume slowly	**True** ☐	**False** ☐
e)	Oxygen should be used for MND clients on NIV	**True** ☐	**False** ☐
f)	Equipment should be sterilised weekly	**True** ☐	**False** ☐

Question 5: **Select the correct answer (more than one answer may be correct)**

a) Humidity levels can be altered by the client?

- ☐ According to comfort
- ☐ Only when on battery support
- ☐ If the client gets permission from the treatment team

Question 5 (cont):

b) If the ventilator makes a whining noise?

- ☐ It needs a service
- ☐ It needs to be replaced
- ☐ There is dust in the filter
- ☐ This is normal

c) If replacement equipment is required …

- ☐ Call the Victorian Respiratory Support Service
- ☐ Call the Austin Hospital Ward 5 West after hours
- ☐ Call the GP
- ☐ Call an ambulance to take the client to a hospital

Question 6: **Please select the correct answers**

a)	The old model of humidifiers requires that the humidifier is kept at a lower level than the ventilator to ensure no back flow of water into the equipment	**True** ☐	**False** ☐
b)	The humidifiers must be removed prior to moving the machine to prevent backflow and damage to the unit	**True** ☐	**False** ☐
c)	The humidifier is filled with normal saline	**True** ☐	**False** ☐

Question 7: **Select the correct answer *(more than one answer may be correct)***

After cleaning the hose, the spare hose is reconnected not the recently cleaned one because:

- ☐ This helps wear and tear on equipment
- ☐ The equipment may not be dry
- ☐ If there is still water in the tube this may go into the patient's lungs

***Question 8*: Select the correct answer**

If the filter becomes wet, it may be disposed of and a new one fitted **True** ☐ **False** ☐

Question 9:* Select the correct answer *(more than one answer may be correct)

- ☐ Battery NIV allows 7 hours of portable ventilation
- ☐ NIV has a life span of 5 years
- ☐ Extra equipment i s given to ventilator dependant patients
- ☐ NIV battery can be charged via a car cigarette lighter
- ☐ If the battery is lasting only 3 hours it should be replaced

***Question 10:* List two major points of care for masks/hoses and NIV in each of the following areas:**

a) Application:

1:

2:

b) Patient safety:

1:

2:

c) Cleaning and maintenance:

1:

2:

d) Managing condensation:

1:

2:

***Question 11*: List two major points of care for masks/hoses and NIV in each of the following areas:**

a) Prevention of pressure wounds:

1:

2:

b) Pressure wound care on the nose:

1:

2:

c) Bowels:

1:

2:

d) Food and PEGs:

1:

2:

e) Showering:

1:

2:

f) Anxiety:

1:

2:

g) Thick secretions/concurrent illness:

1:

2:

***Question 12:* List three major points to remember with regards to Respecting Patient Choices:**

1:

2:

3:

Managing Non-Invasive Ventilation in the Home – eLearning Module

QUIZ ANSWERS

Question 1: **List two symptoms of hypoventilation**

- Consistent morning headache/"fogginess" on awakening
- Daytime lethargy and difficulty staying awake
- Increasing shortness of breath without progressive illness
- Deteriorating sleep

Question 2: **What is one reason MND clients find breathing difficult during sleep?**

- Decreased muscle tone including the diaphragm
- Decreased breath volumes
- Decreased ventilation
- Depressed respiratory drive in the brain stem

Question 3: **What are two benefits of NIV for the MND client?**

- Prevents hypoventilation and stabilises ventilation
- Minimal fluctuations in Co2 and O2-normalised day and night

Question 4: **True or False, please circle the correct answers**

a)	Tubes, masks and hoses are disposable	**True** ☐	**False** ☒
b)	Filters at the back of the ventilators are replaced 3 monthly	**True** ☒	**False** ☐
c)	Ventilator settings can be changed by the client or their family	**True** ☐	**False** ☒
d)	"Ramp buttons" increase the air volume slowly	**True** ☒	**False** ☐
e)	Oxygen should be used for MND clients on NIV	**True** ☐	**False** ☒
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b) If the ventilator makes a whining noise?

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Question 10: **List two major points of care for masks/hoses and NIV in each of the following areas:**

a) Application:
   i. Apply to clean and shaven face with equal tension on the headgear firm but not too tight
   ii. Masks need checking constantly to ensure that a correct seal is maintained due to muscle deterioration and client needs

b) Patient safety:
   i. Due to muscle weakness make sure the patient has a buzzer/bell that is modified to allow the client to remove the mask easily
   ii. Check equipment for leaks

c) Cleaning and maintenance:
   i. Wipe the masks/hoses with a wet cloth and wash in warm soapy water and rinse once per week

d) Managing condensation:
   i. Close windows and warm the room
   ii. Insulate tubing from the cold or place under blankets
   iii. Humidifier may be turned down

***Question 11*:** **List two major points of care for masks/hoses and NIV in each of the following areas:**

a) Prevention of pressure wounds:
   i. Reduce excessive tightness on the bridge of the nose
   ii. Apply witch hazel or toner to skin to 'toughen' it
   iii. Change equipment to reduce pressure

b) Pressure wound care on the nose:
   i. Watch for redness, irritation or swelling –use protective dressings
   ii. If reddened or slightly broken use MEPILEX LITE
   iii. If skin is ulcerated use AQUACLEAR

c) Bowels:
   i. Ensure regular bowel action as full abdomen impacts on diaphragms ability to work properly
   ii. Mintec for wind
   iii. Peg tube can vent air and ramp function can be raised gently to help reduce stomach air

d) Food and PEGs:
   i. Small regular meals
   ii. Impossible to eat and breathe optional use of nasal mask at meals
   iii. Support the neck and ensure patient posture correct to avoid aspiration

e) Showering:
   i. Move the ventilator to bathroom to a dry area where it won't get wet
   ii. Shower in the mornings at maximum muscle strength
   iii. Have patients back to water flow to help breathing

f) Anxiety:
   i. Controlling anxiety can allow the settings to be reduced
   ii. Controlling anxiety increases well-being
   iii. Anxiety creates more anxiety and shortness of breath
   iv. Short-acting non-cumulative benzodiazapines are best for managing anxiety

g) Thick secretions/concurrent illness:
   i. May need increased NIV
   ii. May need hospital or review

Question 12: **List three major points to remember with regards to Respecting Patient Choices:**

   i. Discuss with patient frequently around choices and options
   ii. Legal and medical choices should be documented and communicated
   iii. Plan for withdrawal of NIV via the Victorian Respiratory Support Service so that medication and intensive support is available.