MAQUET SERVO-N VENTILATOR- NURSING CARE FOR NON-INVASIVE MODE

INTRODUCTION

Neurally Adjusted Ventilatory Assist (NAVA) is a mode of mechanical ventilation intended for use in spontaneously breathing patients. As with all ventilation it is important to manage the machine and the patient with skill to ensure effective ventilation is delivered.

1. AIM

- To ensure neonates receiving this type of ventilation are given appropriate and safe support on the ventilator.

2. PATIENT

- Neonate

3. STAFF

- Medical and nursing staff

4. EQUIPMENT

- Maquet SERVO-n Ventilator- set up and ready for use ((Refer to Maquet SERVO-n set up protocol).
- Fisher Paykel snorkel
- Appropriate size hat and mask/prongs

5. CLINICAL PRACTICE

1. Airway management
   PRN oral and nasal suctioning may be required using a short 10 Fr suction catheter. Document all suction (R 1).
2. Ventilation (CPAP, Non-invasive NAVA)
   a. Check settings at the beginning of the shift and ensure they match those documented. Assess whether patient is adequately ventilated and that you understand the method being used. If you do not then seek advice/assistance from senior nursing staff, team leader, medical team or the education team (R 2).
   b. Ensure equipment is correctly sized for the patient (R 3). Head circumference should be measured when hat is first applied and then checked every shift. Hats may stretch and need to be replaced over time. Hats should fit comfortably over the patient's head without leaving pressure marks or excessive gaping. Hat should sit over the ears, round the back of the head and just above the eyebrows. Snorkel sizes also vary. (<1kg=50mm, <2kg+ 70mm, >2kg +100mm). Ensure you have the correct one and that it is secured to the hat using the blue and red Velcro grip. Ensure the correct size mask or prongs have been selected. They should provide an adequate seal over the nose/nostrils without causing pressure sores or excessive leak. Prongs must fit snuggly in the nostril without going up and inside the nostril. Nose should also not blanch when prongs are in. Strap the prongs/mask low onto the face using the two side straps and Velcro applicators. As a guide aim to Velcro them over the ears. You may need more or less grey foam under the snorkel to achieve an adequate seal.
   All equipment sizing should be documented on the bedside charts.

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c. Blood gases are performed PRN (R 4).
d. Change the disposable filter 48 hourly.
e. Circuit should be changed weekly.
f. Wipe down equipment with a neutral detergent daily (R 5).
g. Internal expiratory block only needs to be changed at the end of treatment when it has been used on an infected patient (eg. MRSA, serratia, RSV). At all other times it can be reused as long as the additional disposable filter has been in situ for the duration of the treatment.

3. EDi catheter management
   a. Before an EDi catheter is passed use the calculation tool to assess size and length of tube and the length that it should be passed to. To find this on the screen touch NAVA and then calculation tool. Work through the steps on the screen. The ECG has tall P and QRS waves in the top leads and no P waves in the bottom leads. Correct placement means the P waves are pronounced on the top row of ECG, become less pronounced on the middle two rows (where the purple signal should be) until there is no P wave and dampened QRS waves on the bottom ECG row. If the signal is in the bottom portion of the screen this means the catheter is too HIGH. If it is at the top then too LOW. The arrow next to the chart will indicate the movement that needs to occur. If the EDi needs to move down then the arrow will indicate as so, vice versa for up.
   b. Catheters should be changed weekly (R 6) but if they fall out before the 7 day change they can be cleaned and re-inserted.

4. Observations
   All ventilated patients should be on continuous monitoring (R 7). A leak is to be expected and will be compensated for by the ventilator. The Volume measurements will not therefore be accurate.

5. Troubleshooting

Problem/ alarm	Response
EDi Catheter won't aspirate	Aspirating the EDi catheter may collapse the bore and this may be why no aspirate is obtained. They are, however, designed to be aspirated and so gentle adjustment should allow aspiration in the case of aspirate measurement. Positioning for all other feeds and gastric medication administration can be determined using the EDi catheter positioning screen.
EDi Catheter blocked	Due to the addition of an electrical wire/probe the EDi catheter has a smaller diameter lumen than the usual NG tube. This means that it can become blocked by thick viscous medications or thickened feeds. In this case it may be necessary to pass a second NG/OGT for the administration of these products.
Excessive leak	In non-invasive ventilation modes a leak is to be expected. The ventilator will compensate for this and therefore leaks up to 90% may still guarantee effective ventilation.
No patient effort	Ensure EDi is correctly positioned, if so then patient may be apnoeic in which case the backup rate will begin. Consider reducing the apnoea time if patient is not adequately supported in back up mode.
Gaseous Distension	Because of the smaller lumen and difficulty in aspiration, often there may be air trapping in the gut. In this case, it may be necessary to pass a second NG/OGT for aspiration of gas and gastric contents

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6. Pain and Comfort
   Ensure patient is comfortable. Non-pharmacological (non-nutritive sucking, comfort holding and nesting) or pharmacological (sucrose, morphine, fentanyl, midazolam). Position the baby with the tubing in a position where it will not drag off the face and observe for pressure sores.

7. Cares
   Cares can be conducted using individual assessment but generally 6 hourly. Resite skin probes 4-6 hourly. Observe for signs of skin breakdown from pressure sores.

8. Weighing and Procedures
   Patients can still be weighed whilst on NIV NAVA either on the giraffe internal scales or the outside scales. Procedures can still be conducted in the crib. Both need to take care to ensure a stable and secure airway and need to be assessed on an individualised basis.

6. DOCUMENTATION

- Integrated Clinical Notes
- Observation Chart

7. EDUCATIONAL NOTES

- **EDi**
  Electrical Activity of the Diaphragm, measured in microvolts. It can be thought of as a respiratory vital sign.
  When the respiratory centre in the brain is stimulated it sends a signal via the phrenic nerve to the diaphragm muscle to stimulate contraction and subsequent respiration. When the muscle is stimulated it produces an electrical signal. The EDi Catheter reads this specific electrical signal in the diaphragm and we, the practitioners, are then able to assess how much or how little signal is being sent to the diaphragm to stimulate breathing. Maquet SERVO-n ventilator displays EDi as peak and minimum. EDi peak (also called EDi max) represents neural respiratory effort and is responsible for the size and duration of the breath. EDi min represents the spontaneous tonic (or baseline or resting) activity of the diaphragm in between the inspirations, which prevents de-recruitment (collapse) of lungs (alveoli) during expiration. Normal EDi Peak is 5-15. If EDi peak is >15, this means, a stronger signal is sent from brain to diaphragm to increase the size of the breath. This can be seen clinically as baby working harder with more inspiratory recessions. This means more ventilator support (more NAVA in case of NAVA mode) is required. If EDi peak is <5, this means weak signal is sent from brain to lungs indicating baby requires less support. Normal EDi min is probably <3. If EDi min is consistently ≥3, consider increasing PEEP to reduce the tonic activity of the diaphragm and to maintain FRC.

- **EDi Trigger**
  EDi trigger the minimum increase in electrical activity that triggers the ventilator. EDi trigger is usually set at 0.5 microvolts and when the EDi reaches 0.5, NAVA is triggered to assist with the breath. If the EDi trigger is set too low, the ventilator responds to small EDi signals and converts them into small breaths. This prevents neonate from going into backup ventilation and may result in under-ventilation.

- **NAVA Level**
  Neurally Adjusted Ventilatory Assist. The NAVA supports the baby's breathing by responding to the electrical signal (EDi). If the NAVA level is set at 1.0 it will provide 1.0cm/H2O for every microvolt detected. For example if NAVA is set at 1 and Edi Peak is recorded as 20, ventilator generates PIP of about 20 cm H_2O for that breath. When the EDi reaches a peak the breath and PIP will be held.
  The neonate determines the peak inspiratory pressure, inspiratory and expiratory times for each breath and respiratory rate.

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- **Apnoea Time**
  This determines the amount of time the neonate can be apnoeic before ventilating in the backup mode. Although apnoea is typically defined as no respiratory effort for 20 seconds, it will be too long for small preterm infant to be apnoeic for 20 seconds before breath is given. Apnoea time is the maximum time the neonate will be without any ventilation. This is generally set at 5 seconds. Apnoea time of 5 seconds generally guarantees a minimum breaths of 12 breaths per minute. After 5 seconds of apnoea, neonate goes into back-up ventilation at the back-up rate. The next EDI signal will restart the 5 second apnoea timer again. Apnoea time can be reduced down to 2 seconds (minimum rate of 30 breaths/min). A neonate who remains apnoeic will ventilate at the pre-set backup rate.

- **NIV PC**
  NIV Pressure control. Pre-set inspiratory pressure is delivered at a pre-set respiratory rate.

8. RELATED POLICIES/PROCEDURES/CLINICAL PRACTICE LOP

- Maquet SERVO-n set up.
- NAVA Clinical Guidelines

9. RISK RATING

- Low

10. NATIONAL STANDARD

- CC – Comprehensive Care

11. REFERENCES

- Maquet Ge~~n~~tinge Group (2015) *SERVO-n Self-Guided Education Presentations.* Maquet. Rastatt (Germany)
- Maquet Ge~~n~~tinge Group (2015) *Neurally Adjusted Ventilatory Assist (NAVA) - Synchrony redefined.* [online] available from www.maquet.com (Accessed on 3/12/15)
- Maquet Getinge~~r~~ Group (2013) *Ventilation Servo-I for Neonates. Synchrony for those who need it most*. Maquet. Solna (Sweden)

12. ABBREVIATIONS AND DEFINITIONS OF TERMS

ETT	Endotracheal tube	PIP	Peak Inspiratory Pressure
ICU	Intensive Care Unit	PRN	As necessary
MRSA	Methicillin Resistant Staphylococcus Areus	RSV	Respiratory Syncytial Virus
NCC	Newborn Care Centre	SIPPV	Synchronised Intermittent Positive Pressure Ventilation
NG	Nasogastric	Ti	Inspiratory Time
OG	Orogastric	VG	Volume Guarantee

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13. Rationale

R 1	To ensure clear airway at all times but using smallest bore catheter possible helps to minimise trauma to mucosal areas.
R 2	As a standard safety check and for the purposes of nursing observation.
R 3	To optimise seal and ventilation delivery and to maintain patient comfort.
R 4	As a form of patient assessment
R 5	In accordance with infection control protocols
R 6	To prevent infections.
R 7	To observe and record patients physiological status

14. AUTHOR:

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