Royal Hospital for Women (RHW)
NEONATAL BUSINESS RULE
COVER SHEET

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SUMMARY	To guide nurses on the care of neonates receiving invasive NAVA ventilation

Royal Hospital for Women (RHW)
NEONATAL BUSINESS RULE

NAVA Nursing Management for Invasive Ventilation — RHW CLIN042

This Clinical Business Rule is developed to guide safe clinical practice in Newborn Care Centre (NCC) at The Royal Hospital for Women. Individual patient circumstances may mean that practice diverges from this Clinical Business Rule. Using this document outside the Royal Hospital for Women or its reproduction in whole or part, is subject to acknowledgement that it is the property of NCC and is valid and applicable for use at the time of publication. NCC is not responsible for consequences that may develop from the use of this document outside NCC.

1. BACKGROUND

Neurally Adjusted Ventilatory Assist (NAVA) is a synchronised mode of ventilation intended for use in spontaneously breathing infants. NAVA can be used as both a Non-Invasive and Invasive mode via the Servo-n Maquet ventilator. NAVA modes require the placement of an Edi (electrical diaphragmatic index) catheter, which reads the diaphragmatic activity of the infant and adapts ventilation based on the measurement. This policy will guide nurses on the insertion of Edi catheter, interpretation of Edi monitoring and placement, understanding of NAVA levels and function, and the nursing care and management of infants on Invasive NAVA ventilation.

2. RESPONSIBILITIES

Medical and Nursing Staff

3. PROCEDURE

3.1 Equipment

- Maquet Servo-n Ventilator – set up and ready for use
- Edi catheter
- ENfit connector adaptor
- Leucoplast tape (thin)
- Barrier wipe
- Comfeel
- 1L bag of water for injection

3.2 Clinical Practice

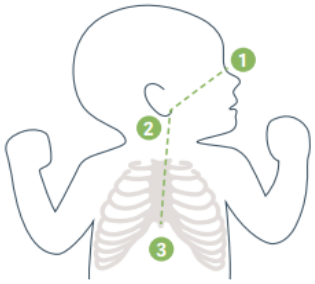
Commencing a patient on invasive NAVA

1. Collect equipment as above.
2. Plug in Maquet ventilator to wall gas and power. Turn on (on/off switch is located at the back of the ventilator (Picture 1).

Picture 1

3. Commence pre-use check on ventilator by following instructions on screen. Ensure flow sensor block and cable are attached to ventilator for invasive modes.
4. Measure infants NEX score (Nare to tragus to xiphisternum) (Picture 2).

NOTE:
- **NEX measurement is NOT a determent of insertion depth for NG/OG tube.**
- **NEX is ONLY part of for the calculation of placement of Edi catheter.**



Picture 2

5. Click on Edi & NAVA on the main screen (Picture 3)
6. Select Edi catheter insertion calculation tool.
7. Calculate Edi catheter depth of insertion by entering all necessary information. (Picture 4)

Picture 3

Picture 4

8. Apply barrier wipe and Comfeel to cheek or chin to secure Edi catheter. Note that nasal insertion of Edi catheter is preferred.
9. Connect Edi catheter to Maquet Servo-n Edi module and cable.
10. Insert Edi catheter to pre-determined depth from calculation tool. Confirm placement on ventilator by using the positioning tool, assessing P wave formations (decreasing in size from top signal to bottom) (Picture 5).

Picture 5

11. Secure Edi catheter using brown tape. Note final depth of insertion.
12. Spike water bag with humidifier base line.
13. Turn on humidifier base once commencing patient use.
14. Ensure correct mode of ventilation has been chosen NAVA-PS and settings are correct as selected by the medical team. (Other modes of ventilation with Edi monitoring is available, but only the active NAVA modes will use the Edi signal to determine ventilation.)
15. Attach ENfit connector adaptor to allow oral syringe attachment to Edi catheter and confirm pH if feeding through.
16. Ensure ventilation has commenced.
17. Attach infants ETT to Servo-n ventilator.
18. Observe for chest rise, tidal volumes and clinical stability on ventilator to ensure adequate ventilation achieved.

NOTE:
Ensure the Edi catheter is documented in eRIC.

- Click on *NICU Nursing* icon → *Procedures and Tubes* tab →select *NAVA* →click and follow prompts.
- Document the type of catheter (Gauge and length) as well as depth of insertion.

- Continuous cardiorespiratory monitoring.
- Standard ventilatory care.
- Blood gases PRN.

Troubleshooting

Problem/Alarm	Response
Edi catheter blockage	Due to the addition of an electrical wire/probe, the Edi catheter has a smaller internal diameter lumen than the usual NG tube. This means that it can become blocked more easily. It is routine practice to have a second NG/OG tube inserted for the administration of feeds and medications. If the Edi catheter becomes blocked: • Remove the catheter, flush with 3-5ml of sterile water for injection and gently clean the tip of catheter with sterile water and gauze. Reinsert catheter to same depth. • If catheter remains blocked, remove, and replace with new Edi catheter.
No patient effort	If machine alarming for No Patient Effort: • Ensure Edi is correctly positioned by checking depth of insertion at mouth/nare and Edi signal. • Check patient for respiratory effort to see if infant is breathing. If infant is breathing but Edi signal is saying infant is not breathing, there may be an issue with the electrodes. • Consider removing catheter, flushing with water and cleaning electrodes with gauze and sterile water before reinserting. • Back up rate should be initiated by machine if patient apnoeic. • Consider reducing the apnoea time if patient is not adequately supported in back up mode (discuss with medical team).
Gaseous distension	Because of the smaller internal diameter of catheter, difficulty in aspiration, as well as high flow rates, there may be air trapping in the gut leading to abdominal distention. • Place second NG/OG tube (if not already down) for aspiration of gas. • Monitor abdomen and immediately escalate any concerns including absence of bowel sounds, changes in abdominal colour, abdomen appearing ropey/veiny.
Volume Delivery Restricted Alarm	If you receive this alarm, it is usually because the infant is requiring a PIP (based on NAVA calculation) higher than what the ventilator will allow based on alarm settings. Medical staff should:

	• Enter alarm limits and reset PIP maximum alarm limit (as these functions as a pressure limiting alarm like PMAX). Note that the ventilator will cap the baby 5 below the set PIP max limit (i.e. if PIP alarm set at 25, maximum PIP that can be delivered is 20).

Pain and Comfort

- Ensure non-pharmacological interventions such as non-nutritive sucking, ISOC and dummy, comfort holding/kangaroo care and nesting/infant positioning are utilised for infant requiring invasive NAVA.
- Perform 4 hourly NPASS scores and commence/add pharmacological interventions based on the result.
- Medical team to consider commencement of Morphine infusion for intubated infant.
- Prevent tug or drag from weight of tubing through positioning of infant.
- Support inspiratory and expiratory tubing to prevent unplanned extubation using tree limb.
- Attend 4 hourly position changes on infant with second nurse to prevent developing pressure sores.

3.1 Educational Notes

- Edi stands for electrical diaphragmatic index. This is measured in microvolts (µV). 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 electrical signal, displayed as Edi peak and minimum. Edi peak represents neural respiratory effort and is responsible for the size and duration of the breath. Edi min represents the spontaneous tonic (or resting) activity of the diaphragm in between inspirations, which prevents de-recruitment of the alveoli during expiration.
- Edi Peak is 5-15.
  - If Edi peak is >15, this indicates the diaphragm muscle is working hard and that the babies breathing is being under-supported. This can be seen clinically through increased work of breathing, increased oxygen requirements, more frequent desaturations or bradycardias or increasing respiratory acidosis on a gas.
  - If Edi peak is <5 there is a weak signal from brain to diaphragm and is a sign that the baby is being over-supported. This can also present as an increase in frequency of apnoeic episodes due to hypocapnia.
  - In an infant requiring higher percentage of back-up and having increasing periods of ‘no patient effort’ it is important to assess what the Edi peak trends have been as this could be a sign of the baby being under or over supported .
- Edi min
  - Edi min should be targeted <3.
  - If Edi min is consistently greater or equal to 3, consider increasing PEEP to reduce the tonic activity of the diaphragm and to maintain Functional Residual Capacity.
- Edi Trigger
  - Edi trigger is the minimum increase in electrical activity that triggers the ventilator.
  - Usually set at 0.5 microvolts and triggers NAVA 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. That prevents neonates from going into backup ventilation and may result in under-ventilation.

- NAVA Level
  - Determines the positive inspiratory support the baby receives based on the Edi peak and min values. PIP level is determined based on the following calculation:

(Edi Peak – Edi Min) x NAVA + PEEP

  - For example, if NAVA level is set at 1.0, Edi Peak is recorded as 15, Edi min was 2 and PEEP is set at 6 cm then the ventilator calculates (15-2) X 1 + 6 = 19. This means on the next breath; the ventilator will support infant to a PIP of 19. The neonate is also responsible for determining the inspiratory and expiratory times and respiratory rate whilst actively breathing.
  - If the infant does not make respiratory effort, however, the calculated PIP based on the NAVA level is disregarded and the infant will automatically receive the pre-set back up settings.
- Apnoea Time
  - Determines the amount of time the neonate can be apnoeic before the ventilator switches into backup mode. Apnoea is typically defined as no respiratory effort for 20 seconds; however this typically results in clinical symptoms including bradycardia and desaturation.
  - Setting a shorter apnoea time allows the machine to revert into back up, preventing clinical signs of apnoea.
  - Apnoea time is generally set at 2 seconds i.e. after 2 seconds of no respiratory effort, the ventilator will switch into back-up mode.
  - A neonate who remains apnoeic will continue to be ventilated in backup mode until respiratory effort returns.
- Edi Monitoring only
  - Medical team may request an infant be ventilated through the Servo-N Marquet ventilator using standard modes of ventilation, including PS and PRVC, but with the placement of an Edi catheter for monitoring. This can be beneficial as it allows clinicians to assess respiratory drive and diaphragm activity to allow clearer indication of readiness for extubation. In these instances, no NAVA levels are set, and no ventilation settings are changed based on Edi readings. It is purely for monitoring purposes only.
- Other considerations
  - Internal expiratory block of ventilator only needs to be changed at the end of treatment when it has been used on an infected patient (e.g. MRSA, serratia, RSV). At all other times it can be reused if the additional disposable filter has been in situ for the duration of the treatment.
  - The disposable filter attached to white expiratory line should be changed 48 hourly during use.
  - Ventilator circuit should be changed every 14 days.
  - Change flow sensor every 14 days with circuit change. It may be necessary to intermittently remove flow sensor from circuit to remove excess water and perform flow sensor calibrations between this time.
  - If having continued issues with flow sensor despite removing water and calibration process, consider changing flow sensor out sooner.
- Edi Tips
  - Ensuring the Edi catheter is in the correct place is essential to ensuring that the patient is receiving effective ventilation, given that PIP is determined by catheter readings.
  - Edi signal should be checked every hour at a minimum, and any changes to signal should be rectified promptly.

- Looking at the Edi placement screen, the waves on the top should have pronounced P & QRS complex. As you move down the screen dampened or absent P waves and dampened QRS complex appears indicating ideal placement. On smaller babies, it is not uncommon that P waves will still be pronounced in the bottom waveform due to span of electrodes and cardiac interference. Therefore, the aim should be to see some decreasing size of P waves from top to bottom, even if absence of P wave in bottom waveform can't be achieved.
- The catheter insertion positioning tool will indicate if movement of the Edi catheter needs to occur (Picture 12 and 13).

Picture 12

Picture 13

- Edi catheters can be used for 4 weeks. The site should be rotated weekly, and the catheter cleaned with sterile water and dried with gauze prior to reinsertion. More frequent changes may be required if feeding through catheter.
- Edi catheters can be placed orally or nasally. Be aware of the risk of pressure injuries that can occur, in particularly, on very small infants. Despite preference for nasal insertion (due to less movement of the catheter and therefore more reliable readings), an orally placed Edi may be necessary for small infants.

3.4 Abbreviations

NAVA	Neurally Adjusted Ventilatory Assist	PIP	Positive Inspiratory Pressure
Edi	Electrical Diaphragmatic Index	PMax	Maximum pressure
NEX	Nare, Ear, Xiphisternum	ISOC	Immuno-supportive Oral Care
NG	Nasogastric Tube	NPASS	Neonatal Pain and Sedation Score
OG	Orogastric Tube	µV	Micro Volt
NAVA-	Neurally Adjusted Ventilatory Assist –	PEEP	Positive End Expiratory Pressure

PS	Pressure Support		
pH	Power of Hydrogen	CPAP	Continuous Positive Airway Pressure
ETT	Endotracheal Tube	PS	Pressure Support
eRIC	Electronic Record for Intensive Care	MRSA	Methicillin-resistant Staphylococcus Aureus
NICU	Neonatal Intensive Care Unit	RSV	Respiratory Syncytial Virus

3.5 References

1. Maquet Gentinge Group (2015) Servo-n Self-Guided Education Presentations. Maquet. Rastatt (Germany)
2. Maquet Gentinge Group (2015) Neurally Adjusted Ventilatory Assist (NAVA) - Synchrony redefined. [online] available from www.maquet.com (Accessed on 3/12/23)
3. Maquet Getinger Group (2013) Ventilation Servo-I for Neonates. Synchrony for those who need it most. Maquet. Solna (Sweden)
4. Servo-n Hands on guide. 2023. https://getinge.training/wp-content/uploads/2023/02/MCV00096728-REVA-Servo-n-2.1-Training-Hands-On-Guide-for-US.pdf Accessed 24/03/2024.

4. RELATED BUSINESS RULES AND POLICY DOCUMENTS

- RHW NCC Nursing- Non- Invasive NAVA Ventilation – Nursing Care
- RHW NCC Nursing- Maquet Servo – N set up
- RHW NCC Medical- NAVA (Neurally Adjusted Ventilatory Assist) Clinical Guidelines

5. CULTURAL SUPPORT

- When clinical risks are identified for an Aboriginal family, they may require additional supports. This may include Aboriginal health professionals such as Aboriginal liaison officers, health workers or other culturally specific services.
- For a Culturally and Linguistically Diverse CALD family, notify the nominated cross-cultural health worker during Monday to Friday business hours.
- If the family is from a non-English speaking background, call the interpreter service: NSW Ministry of Health Policy Directive PD2017_044-Interpreters Standard Procedures for Working with Health Care Interpreters.

6. IMPLEMENTATION PLAN

This revised CBR will be distributed to all medical, nursing and midwifery staff via @health email. The CBR will be discussed at ward meetings, education and patient quality and safety meetings. Education will occur through in-services, open forum and local ward implementation strategies to address changes to practice. The staff are asked to respond to an email or sign an audit sheet in their clinical area to acknowledge they have read and understood the revised CBR. The CBR will be uploaded to the CBR tab on the intranet and staff are informed how to access.

7. RISK RATING

- Low

8. NATIONAL STANDARDS

- Standard 3 Preventing and Controlling Infections
- Standard 5 Comprehensive Care
- Standard 6 Communicating for Safety
- Standard 8 Recognising and Responding to Acute Deterioration

9. REVISION AND APPROVAL HISTORY

Date	Revision No.	Author and Approval
04/10/2016	1	A Ottoway (ACNE/CNS)
20/03/2024	2	E Deibe (ACNE/CNS), C Walter (CNE); NCC CBR Committee Endorsed 23 April 2024 at BRGC