CLINICAL PROTOCOL. CATEGORY: NEONATAL ICU
NEURALLY ADJUSTED VENTILATORY ASSIST, NAVA

Focus

This clinical protocol describes the rationale and patient selection involved in using invasive and non-invasive NAVA® with newborn patients.

Rationale

The neural signals for breathing are reflected by the measured electrical activity of the diaphragm (Edi). A validated and standardized method for measuring Edi signals has been described in newborn and premature infants[1-4] and involves the use of microelectrodes placed on a conventional naso/orogastric feeding tube (Edi Catheter). NAVA operates on neural and pneumatic triggering, the one which appears first will be assisted. The Edi signal is used to determine both the time and amount of assistance given by the ventilator for each single breath. Further, due to the recognition of the trigger signal already at the level of the diaphragm, the patient-ventilator synchrony is improved during NAVA ventilation[1,5,6].

The Edi max represents the maximal electrical activity of the diaphragm for a particular breath while Edi min represents the electrical activity of the diaphragm between inspiratory efforts = baseline.

The maximum pressure provided during a single breath is:

Peak inspiratory pressure (cmH_20) = NAVA level ($cmH_2O/\mu V$) x (Edi max – Edi min (μV)) + PEEP (cmH_20)

Patient selection

Sufficient respiratory effort is required for NAVA ventilation. This is dependent upon the maturity of the infant's respiratory center, the ability to respond to variations in blood CO_2 and lung mechanical state in addition to a higher responsiveness to the inspiratory inhibitory reflex.

NAVA in practice

1. Insertion of catheter

- Choose appropriate catheter size and calculate the insertion length (NEX length) according to the formula provided. Dip the catheter in water. Run the Edi module test and connect the Edi cable to the Edi catheter. Open the "neural access" menu on the ventilator and select "Edi catheter positioning". Check the Edi catheter position (P wave disappears in the lowest lead and the two middle leads are highlighted blue during active inspiration).

2. Setting the initial NAVA level

- Option 1. Set the NAVA level initially to 1 $cmH_2O/\mu V$ and optimize the level as described below.
- Option 2. Open the "neural access" menu on the ventilator and select "NAVA preview". Two pressure curves appear in the upper window: a yellow one, that represents the actual pressure delivery, and a gray one that provides an estimation of the pressure delivered (based on actual Edi and NAVA level) if the patient was switched to NAVA at this time. Adjust the NAVA level so that the estimated pressure curve (gray) resembles the actual pressure curve (yellow). If satisfactory, press "Accept". Press "NAVA" in "Select ventilation mode". The NAVA level that appears is based on the level selected in the preview window.

3. Optimizing the NAVA level

- Optimize the NAVA level according to Edi max, which should be targeted between 5-15 μV.

  - If Edi max is < 5 μV, decrease the NAVA level.

  - If Edi max is > 15 μV, increase the NAVA level.

  The changes in NAVA level should be 0.1–0.2 $cmH_2O/\mu V$ at a time. The changes in NAVA level are stabilized within a few breaths to Edi max. The usual NAVA level is 0.5–2.0 $cmH_2O/\mu V$.

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4. Setting and optimizing PEEP

- Initially, set the same PEEP as in the previous ventilator settings. If Edi min is constantly > 1 µV (as a sign of tonic diaphragmatic activity to maintain FRC), increase PEEP.

5. Setting apnea time

- Set the initial apnea time at 5 seconds. If breathing is irregular and the patient unstable, you may decrease apnea time down to 2 seconds. This will result in backup breaths after each apnea time, until spontaneous breaths occur, indicated by the Edi signal. However, make sure that the backup ventilation does not hyperventilate the patient preventing spontaneous breathing efforts (which would keep the patient unnecessarily on backup ventilation).

  The trends will show the number of backup periods and percent time the patient has been on backup per each minute. If the patient is stable and switching frequently between backup and NAVA support, you may increase apnea time to decrease backup ventilation.

6. Backup settings

- A shorter apnea time (<5 seconds) increases the significance of backup ventilation, as there is a risk for hyperventilation. This does not usually occur with NAVA ventilation. Adjust the backup settings appropriately taking into account the pre-NAVA settings and the recovery process of the patient.

7. Other settings

- Set Edi trigger to 0.5 µV and trigger sensitivity 1 to 2 (to prefer Edi triggering).

8. Weaning patients from NAVA

- Decrease the NAVA level as the patient's pulmonary status improves. Usually, the patient is ready to be extubated when the NAVA level is ≤ 0.5 cmH_2O/µV.

9. Trend curves

- The trend curves give information about respiratory variables for the preceeding 24 hours and they should be checked together with the child's clinical condition routinely.

NIV NAVA in practice

- The NAVA levels in NIV NAVA are usually lower than in invasive NAVA (0.5–1.0 µV/cmH_2O). Higher NAVA levels may increase the amount of gas entering the stomach/intestine and cause abdominal distention.

  - If Edi max is < 5 µV, decrease the NAVA level.

  - If Edi max is > 20 µV, increase the NAVA level.

- The changes in NAVA level should be 0.1–0.2 µV/cmH_2O at a time. Usually, patient can be switched to nCPAP, when the NAVA level is < 0.5 cmH_2O/µV.

Contraindications

1. Insufficient/absent respiratory effort (brain anomaly, medication)
2. Anomaly (esophageal atresia, diaphragmatic hernia before surgery)
3. Phrenic nerve injury
4. Congenital myopathy
5. MRI scanning (remove the Edi catheter before entering the MRI area)

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References

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