NAVA
Neurally Adjusted Ventilatory Assist
In Neonates

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Disclaimers
Dr Stein:
- Is discussing products made by Maquet
- Has no commercial interest in NAVA or Maquet
- Has received no financial support or incentives from Maquet to use NAVA or collect this data

Toledo Children’s Hospital
151 bed hospital
Level 3 NICU
60 beds
Inborn – 70%
Outborn – 30%
2012: > 800 admissions/year
Average daily census 40 – 45 patients

Neuro-ventilatory Coupling

How NAVA works

Conventional Ventilation

NAVA Ventilation

Patient Controls using Flow Trigger:
- Initiation of Breath
- Rate (in some modes)

Ventilator Controls:
- Peak Pressure or Tidal Volume
- Inspiratory Time
- Termination of Breath
- PEEP
- Minimum Rate
- FIO2

Synchrony:
- Only for Initiation of Breath

Patient Controls using Neural Trigger:
- Initiation of Breath
- Inspiratory Time
- Peak Pressure
- Termination of Breath

Ventilator Controls:
- PEEP
- NAVA Level
- Apnea time (minimum rate)
- Peak Inspiratory pressure alarm

Synchrony:
- Initiation of Breath
- Size of Breath
- Termination of Breath
Is SIMV (pressure control) in premature infants really ‘synchronized’?

SIMV (pressure control) with EDI superimposed shows the lack of synchrony on the flow triggered breaths.

‘Apnea’ - Failure to trigger

Data from Toledo Children’s Hospital’s NICU

- Normative Edi data
  - Term neonates
  - Premature neonates

- Prospective controlled study in VLBW neonates between NAVA and PC

Term Neonates with no active respiratory problems and feeding normally

Normative Edi Peak and Min at various gestational ages in non-ventilated premature neonates
NAVA Versus Pressure Control

- Gestational age: 26.2 ± 0.8 weeks
- Birth weight: 810 ± 245 grams
- Age at study: 24 ± 10 days
- NAVA ventilation for 4 hours
- Pressure Control ventilation for 4 hours
- Cycle repeated for 24 hours

Non-Invasive NAVA Ventilation

- Available since July 2010
- About 90 patients treated with NIV NAVA
- Uses:
  - Prevent intubation
  - Facilitate earlier extubation

Clinical Guidelines

- Ventilator settings in NAVA:
  - Apnea time
  - Peak Inspiratory pressure alarm
  - How to set the NAVA level

Case Presentation

- 26 weeks, 655 grams
  - Extubated on day 1 to NIV NAVA
  - NIV NAVA for 6 days and then HFNC 5 lpm

- 23 weeks, 650 grams
  - NAVA invasively by 2 hours
  - Extubated at 36 hours to NIV NAVA
  - NIV NAVA for 8 days, CPAP for 1 day and then HFNC 5 lpm

Apnea Time

- Time the neonate is apneic before getting a backup breath
- Apnea time can now be lowered to minimum of 2 seconds
  - After 2 seconds the neonate gets a pressure control breath
  - This allows the user to deliver a minimum guaranteed back-up rate of 30 breaths/min
Apnea Time

- **Apnea alarm**
  - 15 sec: 4 breaths/min
  - 10 sec: 6 breaths/min
  - 5 sec: 12 breaths/min
  - 4 sec: 15 breaths/min
  - 3 sec: 20 breaths/min
  - 2 sec: 30 breaths/min
- **Minimum rate**
  - 10 sec: 6 breaths/min
  - 5 sec: 12 breaths/min
  - 4 sec: 15 breaths/min
  - 3 sec: 20 breaths/min
  - 2 sec: 30 breaths/min

This is different from the backup rate: RR when the neonate is apneic and getting pressure control.

Peak Inspiratory pressure alarm

- **Case presentation:**
  - 32 weeks gestation
  - Primary C-section for maternal PIH
  - 1.8 kg Apgars 7/8
  - 8 minutes developed grunting and retractions – placed on CPAP 5
  - CXR showed mild to moderate RDS

How to set the NAVA level

- NAVA level is the proportionality factor that converts the Edi signal into a pressure
- The higher the NAVA level the more work of breathing the ventilator does
- The lower the NAVA level the more work of breathing the patient does
- Goal – to unload the work of breathing from the patient to the ventilator without over assisting the patient
- The ventilator continues to respond to the patient’s respiratory drive but supports the patient’s respiratory effort

Edi Titration Study – to determine the optimal NAVA level

- NAVA Level
  - Time (minutes)
  - Edi Peak (mcV)
  - Peak Inspiratory Pressure (cmH2O)
  - Edi Peak (mcV)
  - NAVA Level
  - Time (minutes)
**Edi Titration Study – to determine the optimal NAVA level**

![Graph showing NAVA Level vs. Edi Peak (mcV) and Peak Inspiratory Pressure (cmH2O)]

**Determining the Breakpoint (BP)**

![Graph showing Breakpoint vs. Edi Peak (mcV) and Peak Pressure (cmH2O)]

**NAVA WORKS IN NEONATES!**

But does it make a difference?

TCH VON data - neonates < 1500 grams
Comparison group – Level 3 B NICUs

Time line events:
- Feb 2008 – moved into the new NICU
- May 2008 – NAVA
- 2009 – OPQC collaborative – line infection
- July 2010 – NIV NAVA

**Changes in practice in TCH NICU**
From VON Database for Neonates < 1500 grams

![Graph showing changes in ventilation methods (NAVA, OPQC, NIV NAVA) over time]}

**% Late infection in neonates < 1500 grams - VON Data**

![Graph showing late infection percentage over time (NAVA, OPQC, NIV NAVA)]

**% CLD in neonates < 1500 grams - VON Data**

![Graph showing CLD percentage over time (NAVA, OPQC, NIV NAVA)]
NAVA WORKS IN NEONATES!

But does it make a difference?

- Large multi-center trials are needed to answer questions if:
  - NAVA prevents intubation or decreases time on ventilators?
  - NAVA decreases the incidence of chronic lung disease?
  - NAVA improves outcomes?
  - NAVA decreases costs

NAVA Graduate to Halloween Hotdog