

# Critical Care News

## Interdisciplinary implementation of Neurally Adjusted Ventilatory Assist – Robert Wood Johnson University Hospital

CRITICAL CARE NEWS is published by MAQUET Critical Care.  
Maquet Critical Care AB  
171 54 Solna, Sweden  
Phone: +46 (0)8 730 73 00  
www.maquet.com  
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Publisher: Fredrik Wetterhall  
Editor-in-chief: Kris Rydholm Överby  
Contributing editor: Judith Marichalar-Sundholm  
Order No. MX-0554  
Printed in Sweden  
www.criticalcarenews.com  
info@criticalcarenews.com

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William Twaddle, RRT and Jagadeeshan Sunderram, MD at bedside with MICU patient

## Interdisciplinary implementation of Neurally Adjusted Ventilatory Assist – Robert Wood Johnson University Hospital

The award-winning Robert Wood Johnson University Hospital and its associated Bristol-Myers Squibb Children's Hospital have been at the forefront in implementing new innovations in patient care. They have been ranked among the top 50 in Cardiac and Respiratory Services in the US by US News and World Report for the past two years.

The institution was among the very first in the United States to introduce Neurally Adjusted Ventilatory Assist, or NAVA to the Medical ICU, Surgical ICU, Cardiac ICU as well as the Pediatric ICU and Neonatal ICU. Critical Care News spoke with members of the interdisciplinary teams to hear about their experiences with NAVA, and plans for the future.

## Gaining experience with NAVA in the neuro and cardiac units of the surgical ICU

**Kumar DeZoysa**, who is surgical clinical care coordinator, has been working within Robert Wood Johnson University Hospital for over 20 years, and has seen implementation of a number of ventilatory modes during that time span. He describes his experiences and impressions: "When NAVA became available to the US, we were one of 4 centers to begin to implement it. I am very excited about NAVA because I think it is the future within respiratory care."

"Our first case was a cardiac surgery patient, and we learned a lot from him. The patient was paralyzed and sedated, and it was tumultuous, a CABG surgery. We did not get good Edi signals to start out with, but it was a learning experience."

"Each NAVA patient was a memorable experience, but probably the most memorable experience was a patient who presented with chest pain in the emergency room. He was transferred to the floor, and the patient coded while being transferred. They intubated him and brought him down and for the next two weeks he was considered a failure to wean patient. We had two major disciplines involved in the case, pulmonary and cardiology services. Each conflicted in the diagnosis. Pulmonary insisted that it was cardiac etiology that kept the patient from being weaned; cardiology insisted it was a pulmonary issue. The attending intensivist who was a pulmonologist requested that an Edi catheter be placed so we could monitor the Edi during the weaning process. The patient did not demonstrate any increasing Edi, which the physician implied was correlated to no increase of work of breathing, so cardiac insistence that this failure to wean was due to pulmonary etiology was ruled out. The Edi provided information that we would not have otherwise."

Kumar DeZoysa sees a role for NAVA as well as Edi monitoring in NAVA and in conventional ventilation modes in future: "I think there are a few things that will be developing in the future:



Kumar DeZoysa, RRT, is Surgical Clinical Care Coordinator at Robert Wood Johnson

amounts of tidal volume and rates as prescribed by the Edi signals will become more acceptable, as well as the amount of PEEP that will be prescribed by the patient Edi signals. Once that is established, the future is set. Hospitals generally use inadequate PEEP, and once we start using optimal PEEP, patients will recover faster, we will see patients leaving the unit and the hospital faster, all of those things will fall into place. Right now, everyone prescribes a standard PEEP level, which may not be right for every patient. In general, we are not giving the PEEP required, so patients struggle with a lot of tension

on the backbone and a lot of work of breathing, with difficulties to wean."

Kumar DeZoysa regards every patient admitted to the ICU as a potential candidate for Edi monitoring and NAVA. He also regards NAVA as a generational shift in ventilation therapy: "The analogy we draw is the Swan-Ganz catheter to the heart is what the Edi catheter is to the lung. What did we have to monitor the lung prior to this? We only had x-rays, blood gases, and respiratory rates. I do encourage anyone in respiratory care to learn about NAVA and use it when possible."



Medical Director Jagadeeshan Sunderram, MD, shared his experiences with NAVA in MICU and CCU patients

### NAVA in the MICU and the CCU at Robert Wood Johnson University Hospital

**Dr Jagadeeshan Sunderram** is Medical Director and head of the Medical Intensive Care Unit with 16 beds and overflow Critical Care Unit with 15 beds since 2002. He has also been a member of the faculty of the Robert Wood Johnson Medical School since 1999. When he first heard about the possibility to implement NAVA within the unit, it was not a totally foreign concept to him. "My research actually was implanting diaphragmatic EMG electrodes and measuring neural output directly in animal models, so obviously that piqued my interest in NAVA."

"We saw our first NAVA patient about a year ago, which was a patient overflow from the MICU to CCU, a case of failure to wean. The question was if there was a cardiac element to his failure to wean, or was it a problem with strength? I thought he would be a good candidate for NAVA, which would assist us to differentiate the two. That was our first start."

"It was interesting with the Edi catheter detecting the diaphragmatic effort, and as we monitored the Edi we were able to see a cardiac issue that led to his inability to get off the ventilator, and once that was fixed, he was weaned. NAVA helped us to distinguish if it was an issue of heart failure or strength."

Dr Sunderram sees a role for NAVA particularly in the failure to wean category, which he estimates to be about 10% of patients with persistent respiratory failure. "The other 90 percent of our patients are extubated within 2 days of their intubation, on average. It is the ones that do not wean successfully that we suspect may have an issue of ventilator dyssynchrony, impaired drive or strength, or a cardiac versus lung related issue, where NAVA is able to help us and we use NAVA in these situations," explains Dr Sunderram. He describes another NAVA patient case: "We have had a situation in another patient where he was transferred from another hospital due to failure to wean, with repeated episodes of hypercapnia and respiratory

failure and we did not know the cause of that. We decided to place an Edi catheter so we could better understand what was going on and we could see what was happening with his diaphragmatic status and ventilator synchrony. He had multiple infiltrates, and heart issues, among other complications. When we placed the Edi catheter we could see that he was in total synchrony with the ventilator, his diaphragm was working fine, and within a couple of days we were able to extubate him without a problem. NAVA really gave us an insight into his problem, and his hypercapnic respiratory failure turned out to be more of an issue of cardiac loading that needed fixing.”

Dr Sunderram states that the educational effort for NAVA and Edi monitoring is an ongoing process of experience by doing. “Every patient on NAVA gives us a learning opportunity, and we work together and review Edi monitoring during rounds.” He also states that in the difficult to wean category of patients, such as COPD, patients with neuromuscular weakness, patients with issues of drive or stroke and/or cardiac problems are particularly interesting in regard to NAVA: “Those are the patients that if they stay on the ventilator for a longer period of time, we start to have a difficult time discerning the physiology behind their failure to get off the ventilator. The more ventilator support ICU patients are given, the greater potential for diaphragmatic muscle atrophy. I think NAVA is a very valuable tool for us to understand their diaphragmatic effort, issues of drive and strength versus load, and to separate them and to treat them accordingly. I see a clear benefit for NAVA in this group of patients.”

**William Twaddle**, who is clinical coordinator for the MICU, and CCU at Robert Wood Johnson University Hospital has been working in this capacity for the past few years, and has been working at the hospital for more than 20 years as a respiratory care staff member. He is very excited about NAVA, and clearly recalls his first NAVA experiences in the MICU: “Our first patient was a tough patient. We wanted to use it on a COPD patient to start out with, and we had a physician who said to try it on a bad asthmatic.



William Twaddle, RRT, is MICU and CCU Clinical Coordinator at Robert Wood Johnson

Our experience with that was actually very good, since we saw all kinds of different and new things. We saw by the Edi signal that the patient was still in status asthmaticus, and was not ready for weaning. The Edi catheter was in for a while and we monitored and saw when the patient was ready to wean. It was a very valuable learning experience for us. That maybe should have been our fifth patient, but was our first which was good since it was more challenging and we learned so much in the process.”

William Twaddle says that Edi monitoring is also valuable in conventional ventilation modes: “If we can get them to NAVA, we want to try, since we want them

to be spontaneously breathing. If I have to work with them, depending on the patient response, we look at the Edi signal to take workload off, to put workload on, we look at Edi to see if they are tolerating and when they are failing.”

He describes the Edi catheter insertion and placement procedure: “When it comes to Edi catheter insertion, it is a nursing process here, per hospital policy. The nurses verify placement as a nasogastric tube, and we verify placement as an Edi catheter with the preview screen and the ECG readings, and we do tend to reposition slightly if needed for the Edi signals.”



Dana Saporito, RRT is Clinical Coordinator of the NICU at Bristol-Myers Squibb Children's Hospital of Robert Wood Johnson University Hospital

### Experience transitioning from jet ventilation to NAVA in the NICU

Neonatal Intensive Care Unit Clinical Coordinator **Dana Saporito** has seen NAVA in two infants with bronchopulmonary dysplasia patients, which were patients of attending neonatal physician Dr Mehta. She describes these cases: "Both of the patients were difficult to wean, but one was more difficult than the other to wean from the jet ventilator. One baby who we thought would be a candidate was born on December 24, and he had a week of conventional ventilation, after two weeks we tried to wean him but at every weaning attempt we saw his CO<sub>2</sub> rise into the 70s and 80s. Dr Mehta had read about NAVA and wanted to try it. After we started NAVA in this baby, the very first blood gas we got back was phenomenal. The improvement was pretty instantaneous. The baby

was on NAVA for five days and he was doing wonderfully. We were planning to extubate him but he had a seizure."

"Because of what we saw in this patient, we decided to try NAVA on another difficult to wean patient that was on conventional ventilation on a baby ventilator by another manufacturer. We inserted and placed the Edi catheter and monitored the baby on the baby ventilator by another manufacturer, but he seemed very out of synch. We monitored the asynchrony by means of Edi signal for 24 hours and switched him over to the SERVO ventilator and NAVA after that. He was on NAVA on the SERVO ventilator for 24 hours and we extubated him with no difficulties. He had failed two prior extubations on the baby ventilator."

Dana Saporito sees a continued role for NAVA and Edi monitoring of both NAVA and conventional modes in the NICU:

"I definitely think that we will see the continued use of NAVA as well as Edi monitoring of NAVA and conventional modes. Dr Mehta is interested in utilizing NAVA in looking at apnea of prematurity, where he sees a potential value."

### Increasing future use of NAVA and Edi monitoring in the PICU

The first patient experience with NAVA in the PICU of the Bristol-Myers Squibb Children's Hospital of Robert Wood Johnson University Hospital was a 4 month old infant, where NAVA ventilation and Edi monitoring were utilized on the child for one week. **Jacqueline Williams-Phillips, MD**, Director of Pediatric Critical Care Medicine describes the case: "This child presented with respiratory failure a number of times of unclear etiology. We were unsure if it was a muscular-skeletal problem or a neurological problem. Genetic issues could come into play. We thought we would try NAVA to see how his brain stem and diaphragm relationship was working, before more invasive measures such as muscle biopsies or diaphragmatic biopsies."

"He continued on NAVA for some time, and Edi monitoring gave us a lot of valuable information in terms of neural input to his respiratory function, and we could avoid painful muscular biopsies and nerve conduction velocities and took that diagnostic arm out of the process. He did go on for further tests at another institution after he left us."

Dr Williams-Phillips is excited about some opportunities she sees with NAVA and Edi monitoring in future. "I am very excited about a couple of ideas I have. Within the evolution of pediatric critical care, we have all experienced a cohort of patients who develop chronic respiratory failure. There is a time frame in these patients when tracheostomy is needed, but we cannot predict reliably when that will occur. It may be due to genetic disorders, neuromuscular disorders, and there will be a time when we must inform the parents that their baby or child is ready for tracheostomy. We do not have objective data about when that time is. What we do now is evaluate after the first respiratory failure event, and see how frequently it may



Jacqueline Williams-Phillips, MD, Director of Pediatric Critical Care Medicine, is excited about many potential opportunities with NAVA



Gerald Schlette, Director of Respiratory and Pulmonary Services, sees the capabilities of utilizing Edi monitoring, in NAVA and conventional modes

recur, every month or a few times a year. Sometimes these patients do better with tracheostomy later on with better quality of life. Many patients have parents that then tell us, "We wish this would have been done earlier" but we do not have any data to help us know when the optimal time for tracheostomy is. We know that once we do tracheostomy that it decreases hospitalization in this patient category. My thought is when these children come in with respiratory failure, NAVA and the Edi catheter can provide us with information about the status of the diaphragm in relation to the respiratory failure, and other information. NAVA would be a useful tool to predict if tracheostomy should be initiated in patients with chronic respiratory failure due to neuromuscular diseases and other diseases. It would also be useful to look at the condition of the diaphragm post tracheostomy, if nighttime ventilation is needed in some circumstances."

"The second idea I have is that we have the largest pediatric rehabilitation hospital in the country right next to us, and we often send children from our PICU to them for rehabilitation for better outcomes in neurological recovery after brain injury. I think that NAVA and Edi can provide valuable information in these patients to help determine when to wean them and bring them to the next level, as a means of transitioning the patient off the vent, to improve the rehabilitation potential, and bring them home more quickly."

#### Summarizing experiences with NAVA and Edi monitoring to date at Robert Wood Johnson University Hospital

The Respiratory Care Department at Robert Wood Johnson University Hospital has grown in recent years, from 45 to a total of 56 registered respiratory

therapists on staff, according to **Gerald Schlette, Director of Respiratory and Pulmonary Services**. He states: "Pretty much all respiratory therapy staff members working in ICUs have been trained in the use of NAVA at this point and I feel that support from the physicians has been strong." "The capabilities of utilizing the Edi monitoring gave us much more than we expected, the diaphragmatic condition is revealed to us. This was an eye-opener for us, although we had expected this was to be the case, this is the first time we had our own evidence. Seeing is believing."

As Robert Wood Johnson is one of the first university hospitals in the US to start to use NAVA, as a teaching institution, there is motivation to include training and education about NAVA for future clinicians. Gerald Schlette explains: "Training physicians is an ongoing

process, and every July 1st we have an onslaught of new physicians. We have a course we teach for residents in surgical and medical. We will be including NAVA in these courses, so after a four year period everybody will have had an in-service and there will be a continuum from now on.”

**Derikito Servillano** is Critical Care Coordinator within Respiratory Care at Robert Wood Johnson. He has been working for 14 years in respiratory therapy and is responsible for coordinating all other coordinators in MICU, SICU, PICU, and NICU as well as the educational staff members. In this capacity, Derikito Servillano has had an opportunity to observe almost every patient that has been treated with NAVA at the institution. He recalls his first NAVA patient experience: “The first patient I remember very well, my first impression was letting go – it is very important to let go but difficult to transition from absolute control to no control. It was an asthmatic patient, that was difficult but we took the opportunity since the physician requested for NAVA to be used. We learned many things from that patient. I remember revisiting my physiology book to relearn how the diaphragmatic and respiratory muscles work. That first patient gave us a huge educational advantage of what the Edi signal really measures, and the learning curve was so high that I vividly remember it.”

“After seeing it for the first time, it was really a validation that what they were saying about NAVA was true. One thing that helped us was the monitoring capability of the Edi signal. It is easier to convince the physicians that it is a good tool as it shows better synchrony than any other means we currently have available.” In his role as Critical Care Coordinator, Derikito Servillano also had to coordinate the educational effort to prepare for implementation of NAVA and Edi monitoring. He describes this process: “We had a core group of people trying to learn as quickly as we could before starting. When we had one patient we could coordinate all of the staff and nurses to observe and understand the application, so that they would have a buy in to what we were doing. The CICU



Derikito Servillano is Critical Care Coordinator for Respiratory Care, and has observed almost every patient treated with NAVA at Robert Wood Johnson

in the open recovery area started out with the Edi signals as a monitoring tool.”

From there we went on to implement NAVA as a mode of ventilation and Edi monitoring in the MICU, CCU and in the NICU and PICU. I recall a particularly amazing experience in the NICU with NAVA in two patients. This experience showed me that these kids can be off sedation and they respond right away.” “In the adult arena, we continue to collect experience with NAVA and Edi monitoring in the hard or difficult to wean patients. We try NAVA and build confidence that the patient is strong enough, and so far we have not seen any reintubation or reinstatement of mechanical

ventilation with any of our NAVA patients yet. In this respect, we need more time with NAVA. I think maybe we need to go to NAVA earlier in the process of hard to wean patients, and evaluate from there.”

Derikito Servillano says that the physicians have been accepting of NAVA as a mode of ventilation, and Edi monitoring as a new vital sign in the ICU: “Yes, actually they are the driving force. I would say about 50% of our patients so far have been physician driven, and the rest have been on our recommendation. To me, the monitoring tool is a future value for us, especially as an educational institution it is important to identify and tell where dyssynchrony is on any mode.”

**Doug Campbell, Assistant Vice President of Operations** at Robert Wood Johnson leaves a final summary of the implementation of NAVA at Robert Wood Johnson University Hospital: "The introduction of NAVA has been in a structured manner, through means of input and feedback from key staff members, which provides a solid base for the next level of experience. It is important that there is a forum for communication between user groups from different hospitals using NAVA to sharing the experiences as everyone goes forward with quantum leaps in technology. NAVA is cutting edge and we want to make sure that we are on the forefront of that process, in order to be competitive." ■



Derikito Servillano, with Doug Campbell, Assistant Vice President of Operations at Robert Wood Johnson, has been supportive of the implementation of NAVA at Robert Wood Johnson University Hospital

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