

# Critical Care News

## First impressions of NIV NAVA in a general ICU environment

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Dr Peter Nordlund with COPD patient after treatment with non-invasive NAVA. The Edi catheter remained for Edi monitoring

## First impressions of NIV NAVA in a general ICU environment

The Ryhov Regional Hospital in Jönköping, Sweden has an uptake area of about 150,000 inhabitants. The seven bed intensive care unit, which is directed by Dr Peter Nordlund, treats a wide variety of surgical, medical, sepsis and pediatric patients.

About 65% of the patients in the ICU are treated with mechanical ventilation. In the past year, Peter Nordlund and ICU colleagues have been gaining experience with invasive NAVA in over 80 patients, or about 30% of the annual total of mechanically ventilated patients. This extensive recent experience with invasive NAVA and several decades of experience with conventional non-invasive ventilation placed the Ryhov Hospital ICU department in a position to evaluate NIV NAVA: a totally new solution for delivery of non-invasive ventilation, providing synchrony independent of leakage or patient interface. Critical Care News spoke with Dr Peter Nordlund to hear about the recent experiences with this new solution in non-invasive ventilation.



Dr Peter Nordlund is Head of the ICU at Ryhov Hospital in Jönköping, Sweden

### Can you give a general description of your ICU; average number and types of patients and number of staff members?

Our province has 300,000 inhabitants, and the uptake area is about 150,000 inhabitants. We have a few patients from other parts of the country that come for specific neuro-orthopedic procedures, so neuro-orthopedic trauma patients may therefore be treated in the ICU. This hospital has about 500 beds, of which 7 beds in the general intensive care unit. There is also a dedicated NICU, but all children and infants from the age of one month and up are treated here in the general ICU, where our main patient mix is comprised of infection, medical and surgical intensive care patients, as well as for pediatric intensive care. We average about 80% of capacity in the ICU, and 65% of our patients undergo mechanical ventilation, of which 25% receive non-invasive ventilation during some part of their treatment process. The trend for treating with non-invasive ventilation has been increasing, and we have been using it increasingly in post-extubation as well. We have two senior intensivists that are accredited with European Diploma of

Intensive Care, as well as two intensive care physician specialists, and we have residents with different competencies. In terms of nursing, we have 60% with ICU specialist level training and our nursing coverage is 1.24 per patient bed 24 hours a day. We have a good level of nursing competency and nursing capacity here, with opportunities for continued development in nursing.

### Which are the most frequent types of patient situations that you encounter?

Our mix of patients has varied throughout the years, but in recent years the mix has been 30% surgery, 30% medical and 30% sepsis with 10% pediatric patients. We see all sorts of patients. The most common type of sepsis patients may be peritonitis-related sepsis, pneumonia-related sepsis or renal-related sepsis. Respiratory insufficiency and COPD patients are another common group we treat; the respiratory insufficiency cases we see may be related to many factors: pneumonias, sepsis, and neuromuscular disease. We also treat a great deal of coronary failure, or other coronary related conditions

as well as gastrointestinal patients, patients with secondary bleedings, pancreatitis, and epilepsy and so on.

### Please describe how and when you started utilizing conventional non-invasive ventilation therapy?

Depending if you include CPAP in the non-invasive therapies, we started using CPAP in the 1980s. After that we started using other non-invasive ventilation including a SERVO 900C with a mask in 1996 – it was not designed for that purpose but it worked with some limitations. Then we had the SERVO-i with non-invasive modes which became easier and more dedicated for use.

### Which patient interfaces do you frequently use for non-invasive therapy, nasal prongs, face masks or helmets?

We use a combination of nasal masks, facial masks and helmets. There are some patients that like the helmets, and they have worked extremely well in these cases, but there are also other patients that feel constricted or uncomfortable or anatomically might present difficulties with the helmet, so we use the helmet more seldom. We use a full facial mask most frequently, but the patient interface may vary from patient to patient in connection with non-invasive ventilation.

### How do you make a determination when non-invasive ventilation is indicated?

We follow a protocol where we have certain indications for non-invasive ventilation. Back in the beginning of the 1990s, we were doing non-invasive on almost every patient for a while, but we discovered in time that this was contra-productive in many ways. This led to a protocol where we consider non-invasive ventilation in patients with respiratory insufficiency and NIV is also used primarily for COPD patients that are not too acidic; we use non-invasive ventilation on these patients and measure certain parameters to see how they respond to treatment. If they respond positively we continue NIV, if



Dr Peter Nordlund with intensive care nurses Karin Johansson and Mikael Jardenius

the situation worsens we prepare for intubation and invasive ventilation. Heart failure patients are treated according to the same procedure, and post-extubated patients after major surgeries that have risk factors are also treated with non-invasive ventilation according to this procedure. Currently, there are a number of patients that we defined for indication of NIV, and this protocol has been in use since the beginning of 2000.

#### How do you wean from non-invasive ventilation?

We do not follow any set protocol; we have a physician led process in initiating weaning in these patients. We follow conventional weaning standards, so when the patient has obtained certain pressure levels and PEEP conditions, we look at oxygenation of 35-50%, and if they fulfil these criteria and if the patients are awake and capable of following the instructions and collaborating in the weaning process. If they can spontaneously breathe for 20-30 minutes with an unchanged status, we stop non-invasive ventilation. The nurses help us to monitor the patients, especially those who are intubated and sedated, to look for signs to help weaning.

#### When did you implement NAVA in the ICU?

We began in October 2008 with education and training, and started to use invasive NAVA in late autumn 2008 about 1 year ago. We have now used invasive NAVA in over 80 patient cases. If 65% or 300 patients are mechanically ventilated in our unit, this means that 80 patients with NAVA is a high proportion of the total. To get experience with NAVA and become familiar with it, we chose a strategy to use it in a wide number of patients during the past year. We monitored their ventilation when they were switched to NAVA, and we also monitored the Edi signal, and how it presented itself in patients over time. It was an interesting and educational period, and we studied asynchrony in all patients, who were all asynchronous according to the Edi signal no matter which type of conventional mode they were receiving, which for the most part was Pressure Support, before being switched over to NAVA. There were no patients that had asynchrony during that period with NAVA. These 80 patients with invasive NAVA corresponded generally to the patient mix we have here in the ICU: 30% surgical, 30% medical, 30% sepsis and 10% pediatric cases.

#### Was NAVA easy or difficult to implement in your department?

To teach NAVA and gain understanding was not difficult, but it was a process to adapt to tidal volume variations with NAVA. We are used to a continual value of 6ml/kg bodyweight in conventional mechanical ventilation in all patients, and this will be variable with NAVA, depending on the individual patient and their variability of breaths. This could be stressful to some of the staff members originally, and we went over to traditional Pressure Support in the beginning. In teaching the concept of NAVA and practical application with placing the Edi catheter, etc, there were no difficulties. It is a learning process to understand the Edi signal. NAVA level has been used in different ways, there was a default level to begin with of 2.0 cm H<sub>2</sub>O/μV, which we felt was a little high, and we started at lower NAVA levels and increase if necessary by means of the NAVA preview screen. We use the tool to coordinate values with PS and set the NAVA level accordingly.

#### Have you had any specific patient experiences with NAVA that you would like to share?

In addition to the cases described by my colleague Dr Armela Khorassani at the NAVA Summit meeting last year (Editors note: CCN 19), we were monitoring the Edi signal in a middle aged man with a neuromuscular disease, seeing that he could be switched to NAVA and it worked very well. He was sedated with Propofol and as we woke him, he was a bit stressed in transferring over to oral sedation, but did not trigger strongly, and suddenly the entire signal disappeared, and we had to go over to Pressure Support with flow trigger which worked fine. The Edi signal reappeared after about 8 hours, he was awake but he got a low dose of oral lorazepam again, but his Edi signal disappeared again. It was totally substance-related, and his respiratory muscles under sedation were not strong enough to trigger an Edi signal. We did not see this effect with opioids or Propofol; it was only oral lorazepam. We diagnosed perhaps the reason why he ended up with us in the ICU: he had received Stesolid® with



Dr Peter Nordlund

subsequent secretions which induced breathing difficulties and pneumonia. This means that his primary physicians could be warned against prescribing this substance to him – information would not have been available for diagnosis without the help of his Edi signals.

#### What is your general opinion of NAVA?

I am positive – there are benefits to NAVA and Edi monitoring. Some of my colleagues have differing opinions and want more evidence and hard facts and multicenter studies compared to

conventional mechanical ventilation. I think it is very individual when it comes to which patients that have more benefit. I hope that we can change our sedation regimes; sedation is needed but is not always optimal, and in fact can cause troubles. Some sedation substances may lead to a hemodynamic instability. NAVA can contribute to synchrony that means that we may minimize sedation or hemodynamic instability – I see advantages here. Some of the most severely ill patients may benefit from implementing NAVA early, by using their diaphragmatic muscles for regulating their own ventilation and minimizing atrophy.

It is a generational challenge to change a treatment culture – we see the changes from volume to pressure, and volume is still more commonly used in some places in the United States for example. To go from Pressure Support and other supported modes to signals that are generated by the patient himself is a generational cultural shift – a process that will take time.

#### Why are you and your department interested in participating in the evaluation of NIV NAVA?

It was easy since we have so much experience with conventional NIV, and in the past year with invasive NAVA in so many patients, it seems a natural step to utilize NIV NAVA in patients who would receive NIV ventilation. The problem with these patients is that they always have respiratory distress in some way with non-invasive ventilation, due to asynchrony, which Brochard has outlined in his study. Leakage is always a problem. We want to see non-invasive NAVA in these patients, for better synchronization, and to minimize the difficulties that leakage presents in conventional non-invasive ventilation. It was not so hard to see the advantages of evaluating this opportunity.

#### What are your first impressions of treating patients with NIV NAVA so far?

We have run a limited amount of patients so far, including respiratory insufficiency with COPD, post-op after peritoneal sepsis and intoxication cases.

It has been very simple – we had leakages of up to 80% in patients due to patient interfaces, but it did not affect the patient ventilation in any way at all and there were no alarms. I have never seen a patient with such an extensive leakage, where the non-invasive ventilation was no problem at all. We used the new interfaces and they seem to work just fine. It was what you could expect with NIV NAVA, good patient ventilation values even in the presence of a large leakage – but it was still surprising to

see the first time that NIV NAVA works as it is intended to. None of the patients have had any discomfort in relation to their Edi catheter, we started directly with non-invasive in Pressure Support and went over to NIV NAVA, and there does not seem to be any problem. We

ran NIV NAVA continually, with shorter pauses to moisten the lips and mouth and brush teeth. Most of the patients have been able to leave non-invasive NAVA within a few hours of ventilation, faster than with conventional non-invasive ventilation. The COPD patient

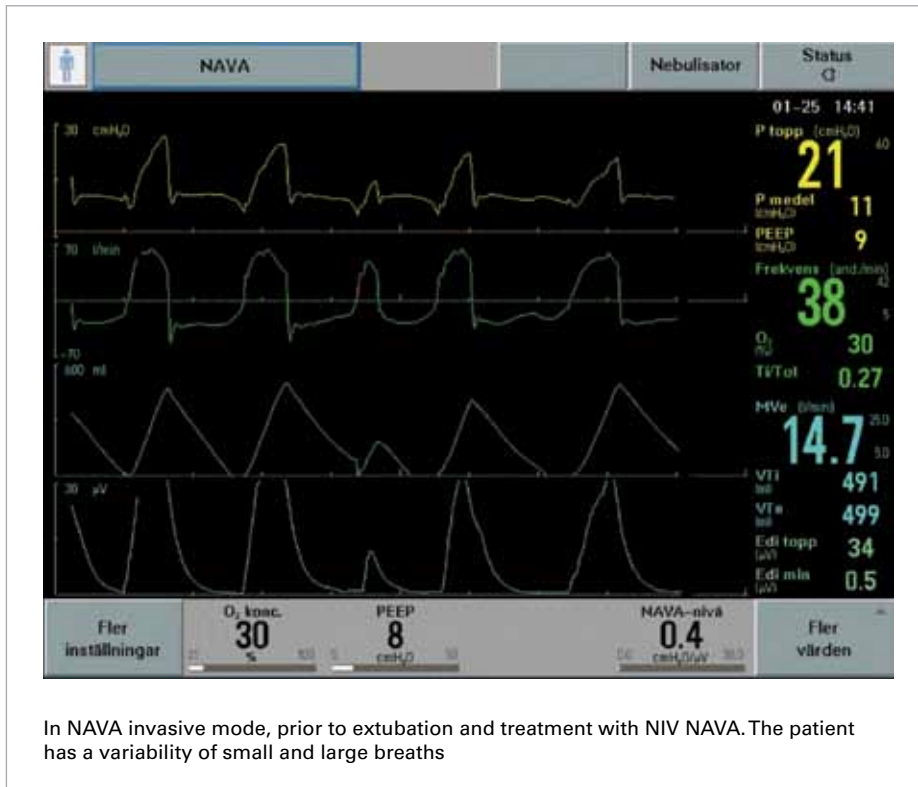
improved quickly too and could leave NIV NAVA after 6 hours. It is too early to say if this result will be maintained in larger groups of patients, but for the few patients where we have tested NIV NAVA so far, it has been simple – just like regular invasive NAVA, NIV NAVA gives the patients what they want and need. We have seen lower Edi levels in NIV NAVA than we have in invasive NAVA. It has looked very comfortable in each patient. The COPD patient was very affected when he presented to the ICU, he was a borderline case for invasive or non-invasive therapy, very acidic, high  $PCO_2$ , but he had a strong Edi signal so we started NIV NAVA. He quickly showed signs of improvement, within one hour his ventilation status had improved significantly.

#### Is the Edi catheter stable in placement in NIV NAVA?

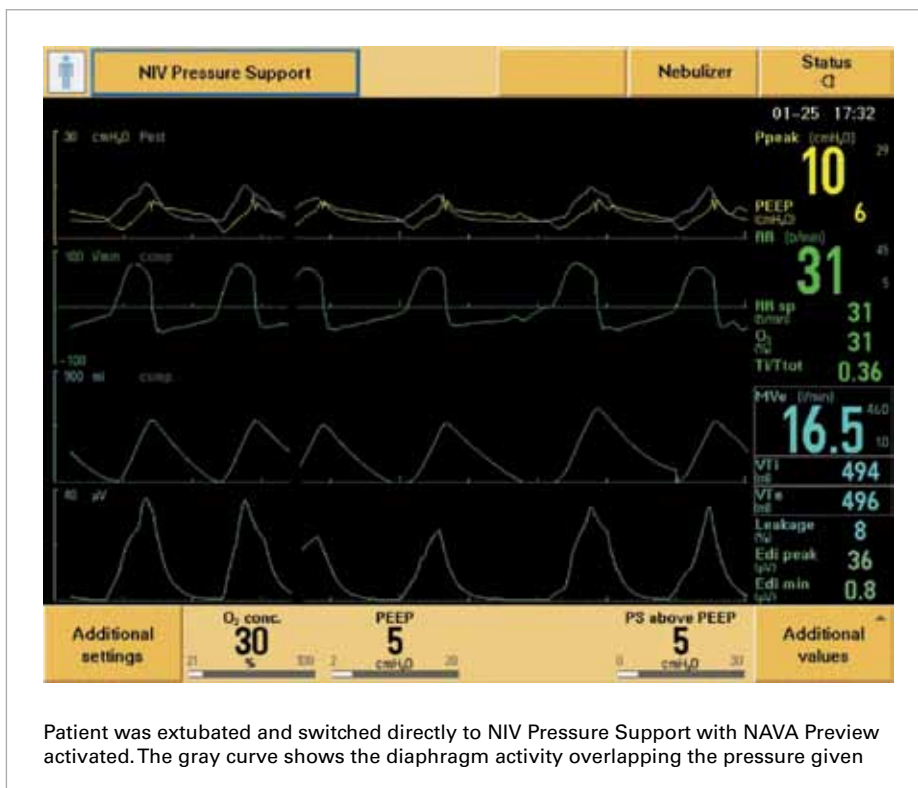
Yes, we have been using the 8 French Edi catheters and we have been able to place this without any difficulties and they have remained stable. NAVA levels in NIV NAVA have been around 0.3 or 0.4  $cm\ H_2O/\mu V$ ; we thought it would be higher. We started from 0 when we initiated therapy but then we have observed the Edi signal as the NAVA level was increased and obtained good ventilation in range of 0.3-0.4  $cm\ H_2O/\mu V$ , and reduced if needed but no problem thereafter. We have had no problems with air in stomach using NIV NAVA. Air in stomach can always be problematic in non-invasive ventilation; it could be due to that in conventional non-invasive ventilation asynchrony is present.

#### Is there any patient category where you are especially curious in evaluating non-invasive NAVA?

Yes, I am definitely curious about testing NIV NAVA in pediatric patients. We have used conventional non-invasive ventilation in pediatric patients, but some of them can be difficult to treat, depending on their age and so on. I am interested in using non-invasive NAVA rather than conventional non-invasive ventilation in pediatric patients, or in children that have been sicker and on invasive ventilation, such as septic children. With invasive NAVA



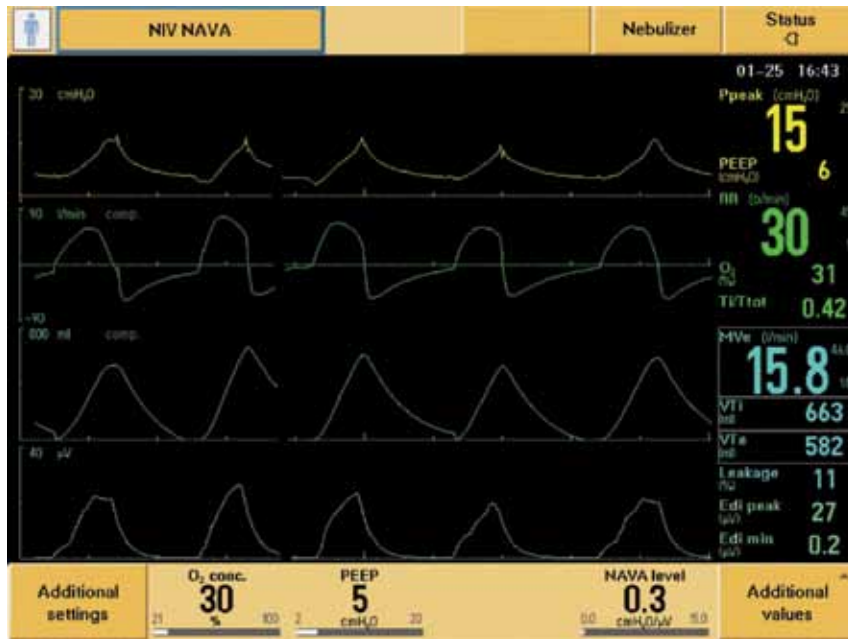
In NAVA invasive mode, prior to extubation and treatment with NIV NAVA. The patient has a variability of small and large breaths



Patient was extubated and switched directly to NIV Pressure Support with NAVA Preview activated. The gray curve shows the diaphragm activity overlapping the pressure given

we have found that we could extubate these types of children 24 hours earlier than with conventional ventilation, and reduce sedation. It would be good to see NIV NAVA on these small children, who are problematic to communicate with and may have large leaks with ordinary non-invasive ventilation. I would like to continue to

use it on COPD patients, who are acidic to begin with. With non-invasive NAVA, they can steer their ventilation in a totally different manner and get a longer expiration time as they may want to have, without influencing their ventilation values, to provide better synchrony and minimize the side effects of leakage. ■



NIV NAVA. The patient was comfortable in NIV NAVA and the breathing looks natural and synchronized



Peak trends in NIV NAVA, identifying that the patient wanted to have different levels of support

## Biography

**Dr Peter Nordlund** received his initial medical degree in 1988 at the University of Lund, Sweden.

During the years of 1988 - 1997 he worked at the University Hospital of Lund, Malmö and Kristianstad in southern Sweden. He obtained his specialist degree in anesthesia and intensive care in 1994.

Dr Peter Nordlund became Chief of the Intensive Care Unit at Ryhov Hospital in Jönköping in 1997, and currently holds this position. He has been active in research and collaboration in the publication of various outcome studies in intensive care.

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