

Critical Care News

First impressions of NIV NAVA in neonatal patients

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

©Maquet Critical Care 2010. All rights reserved.

Publisher: Fredrik Wetterhall

Editor-in-chief: Kris Rydholm Överby

Contributing editor: Judith Marichalar-Sundholm

Order No. MX-0636

Printed in Sweden

www.criticalcarenews.com

info@criticalcarenews.com

The views, opinions and assertions expressed in the interviews are strictly those of the interviewed and do not necessarily reflect or represent the views of Maquet Critical Care AB.

The product NIV NAVA may be pending regulatory approvals to be marketed in your country. Contact your local MAQUET representative for more information.

©Maquet Critical Care AB, 2010.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any other means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the copyright owner.

The following designations are registered or pending trademarks of MAQUET Critical Care AB: Servo-i®, Automode®, Open Lung Tool®, NAVA®



A 600 gram infant patient being ventilated with NIV NAVA

First impressions of NIV NAVA in neonatal patients

The staff members of the Neonatal Intensive Care Unit of Turku University Hospital in Turku, Finland treat over 600 newborns on an annual basis, with a total of over 6,000 care days per year. With the objective of reducing days to extubation by means of earlier extubation, the NICU implemented an active weaning policy in 2001, resulting in a dramatic reduction of days to extubation from median of 31 in 2001 to only 2 in 2007 in extremely low birth weight infants, by means of allowing the babies to regulate their breathing with CPAP.

With this culture of allowing the babies to regulate their own breathing, the implementation of invasive NAVA was introduced in the NICU in the past few months, and most recently, non-invasive NAVA was clinically evaluated in a series of pre-term and very low birth weight infants. Critical Care News spoke with Dr Liisa Lehtonen, Director of the NICU, about her observations and experiences with NIV NAVA.

Can you describe the size of your NICU and PICU department at the hospital, average number of patients on a daily/annual basis and amount of staff?

Our NICU has 18 patient beds in total, and our average capacity is filled to 100% most of the time; in fact much of the time we are overbooked. Our uptake area includes the southwest region of Finland, which means that we have 5,000 deliveries within our region, as well as challenging neonatal cases we receive from neighbouring regions brings the total to 7,000 deliveries per year. In Finland, we are effectively centralized regarding neonatal intensive care; with 5 university hospitals in 5 regions of the country. About 90% of very preterm infants are born in university hospitals; we prefer in-utero transport to postnatal transfer. When the baby is stable we transfer them back to home hospital again. We have 600 babies in our unit on an annual basis, and 6,000 care days. In terms of staffing, we have 4 neonatologists, among the NICU, newborn nursery and follow-up clinic. We have 1 resident and 45 nurses on staff as well.

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

Most of our babies are full-term infants, who come for suspicion of infection, hypoglycaemia, and some long term cases, such as withdrawal symptoms for maternal drug abuse. We do get cases with congenital defects, but we do not perform open heart surgery at this university hospital, so these cases are usually transferred. We do not provide ECMO in this hospital; since we only have maybe one case per year.

About one-third of our infants are preterm infants. Of all preterm patients, we have about 50-60 very low birth weight infants per year on average, which are below 1500 grams, and below 32 gestational weeks at birth. These very low birth weight infants represent about 10% of the patient number. The length-of-stay statistics in Finland show that these infants generally stay for 2 months in the NICU, but naturally there is a wide variability depending on if it is a



Dr Liisa Lehtonen is Director of the Neonatal Intensive Care Unit of Turku University Hospital

23 week neonate or a 32 week neonate in terms of length-of-stay. Half of our care days are from pre-term infants.

For pre-term infants, care routines change at 28 weeks; below that we give prophylactic surfactant and intubate them, and they will be on a ventilator for a period of time. For babies born at 28 weeks or later, we primarily start with CPAP, and intubate only if needed. This differs in different hospitals in Finland, but those are our guidelines here in Turku. We try to avoid delivery room intubations whenever possible. We start nasal CPAP at delivery when the baby is spontaneously breathing usually at

2 minutes of life. We start CPAP very early to avoid atelectasis of the lungs and we bring the baby to the NICU on early nasal CPAP. If the baby is below 28 weeks, we electively intubate the baby and give the baby surfactant in the NICU within 30 minutes of life, early enough to be prophylactic. We wean the baby off the ventilator as soon as the baby can tolerate it. If the preterm baby is older than 28 weeks, we continue with nasal CPAP in the unit as long as needed, if there are signs of IRDS, we intubate the baby accordingly. Early extubation is always our objective.

We have dramatically reduced the



Mari Kaukonen, NICU nurse and Dr Liisa Lehtonen with their 600 gram patient

time to extubation during the past decade. In babies less than 1 kilogram, we have come down from median 30 days time to extubation in 2001 to median 2 days in 2007. However, in order to support this policy in babies of less than 1 kilo we always extubate these infants early to CPAP.

What is your general background experience in regard to non-invasive ventilation?

Of our total patient material, in all newborn patients that have been ventilated, we have come down in ventilator days per year by 40% since 2001. This is a significant change, come by means of active use of early CPAP and active use of early extubation. This means that not only the ventilator days have decreased, but this means that the babies can go home earlier too.

We try very firmly to reduce the need for mechanical ventilation in our infants, which I think is a universal trend as well. We realise that there are dangers in mechanical ventilation.

In terms of additional therapies, we had 20 patients on HFO last year, we do not use it primarily but we use it as rescue if the baby is not ventilating well enough with relatively high settings in conventional ventilation, then we start HFO. On the other hand we don't use it primarily, but we do see benefits in some cases of rescue situations. In many ways it intensifies the treatment. You have to take more blood gases, and x-rays, which may be disturbing to the baby, and the intensity of treatment increases, which is the cost of HFO.

How many years has non-invasive ventilatory support been used in your department, and for which patient categories?

CPAP has been used here as non-invasive support for longer than 20 years, long before I came here. But the increasing use and advances in technology means that we have intensified our use of it in recent years, and CPAP has succeeded better and become more acceptable for us. In weaning, we wean the baby off of CPAP in steps; the nurses will observe

the baby during a break from CPAP, if that interval goes well; they lengthen the times of intervals. That brings us to when the baby has feeding intervals with CPAP and without CPAP; they increase the number of intervals. Traditionally we have used 4 cm H₂O of pressure to wean, as we have not had a smart way to monitor the exact need of pressure in the past but now with the Edi signal we can get feedback to adjust the pressure. If no intervals from CPAP are given for the baby, there is a higher risk for nasal problems from the nose pieces.

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

I was in Dublin at the Our Lady's Children's Hospital to observe and learn about NAVA for the first time about one year ago. I saw two patients that were treated with NAVA, and I was very impressed by those two cases. I knew that this was a new option that was coming, and I had heard about NAVA in some sessions in congresses in recent years as well. All the information

supported the idea to implement invasive NAVA last autumn, and to evaluate NIV NAVA at the present time.

What is your general background experience in regard to invasive NAVA?

We implemented invasive NAVA in the NICU and have been using it since last autumn. We have used Edi signals to monitor central apnea in some cases. On our babies in whom we did use NAVA we used Edi monitoring as a factor to help determine when to extubate, and we monitored Edi signals for a time after extubation in these patients. It was helpful to observe the babies' respiratory drive with Edi monitoring, as it helped to titrate medication for surgical patients. We have patients that undergo surgery for gastroschisis or for diaphragmatic hernias, and in the post-operative phase we titrate the medication so that the baby gets enough painkilling, but not too much to suppress breathing. We have had very good recoveries of some of these babies from surgeries, and we can see where we could reduce the analgesic medication when the babies were on NAVA as they were comfortable on NAVA ventilation. The analgesics we use for post-operative pain are opioids and acetaminophen. We use Midazolam as sedation as needed but we try to avoid it due to side effects. NAVA and Edi monitoring gave us the possibility to monitor the sedation levels and spontaneous breathing post-operatively in these surgical infants.

Was NAVA easy or difficult to implement in your department?

It was surprisingly easy; it was one of these things where you immediately see the benefits, which makes it easier to accept as new method or tool. Nurses and parents see the babies sleeping more comfortably and for all of us seeing how some of our babies need less medication makes us feel that this is the right thing to do. The nurses all understand the concept and application of NAVA. We also have many physicians on call who have learned quickly the NAVA concept, and NAVA has succeeded very well also during on-call hours.



SERVO-i delivering NIV NAVA to neonatal patient

Naturally, irrespective of NAVA, we always get some cases where the baby is not breathing, such as cases where the baby may have received a higher dose of medication or due to disease. NAVA switches to back-up settings in these, and if this situation is prolonged, it is a clinical indication that the baby is not ready for spontaneous breathing just yet.

The NAVA philosophy makes perfect sense – let the baby regulate their ventilation just as they do in CPAP. We were already accustomed to treating very small babies who regulate their breathing with CPAP very early in our unit; relating historically back to our goal to reduce extubation days in 2001 with the active weaning policy we introduced at that time. We documented significant decreases from 31 days in 2001 to 2 days in 2007, with 50% decrease in the first year of the policy. The long process of teaching staff members to believe in the baby's own capacity to breathe started back in 2001. It is a cultural shift, and it takes a few years to change a treatment culture.

Can you tell about your current observations or experiences with NIV NAVA in neonates?

We started using non-invasive NAVA in mid-January, and we have experienced it on 7 patients during the course of the evaluation. One infant who had non-invasive NAVA was in the incubator, and the next day in kangaroo care. NIV NAVA worked well in both situations, as well as in a pre-term twin with respiratory difficulty and a very small 600 gram preterm baby that we are currently treating with NIV NAVA.

The small 600 gram preterm baby is an interesting case. We did not think this infant initially would be easy to treat – she is so very small and any nose-piece felt quite large for her. We thought we could not use NIV NAVA for very long, there was also a problem with the humidifier, but we tried another nose-piece and adjusted the humidifier, and she settled in nicely. After that everything worked

beautifully. We have had a very high leak with this 600 gram patient on NIV NAVA, with leakage close to 90%. The baby is ventilating well without any difficulties despite the high leakage.

The preterm twin that was born was at

34 weeks gestation and weighed 2.3 kilograms. She had enough breathing problems to get CPAP at birth at 5 o'clock in the morning. We switched her to NIV NAVA around 10:00 that morning. The PCO_2 level was a little high due to her initial lung problem, but the baby was

started on NIV NAVA at a level of 0.2 cm $H_2O/\mu v$, where she stayed comfortably for the rest of the day. There was also a response seen in the Edi signal level which was reduced on NIV NAVA compared to Pressure Support-CPAP, and it stayed down, so we knew that the treatment with NIV NAVA made a difference. We continued until about 5:00 in the evening, when we switched her back to regular CPAP and we continued to monitor her Edi signal to determine the level of conventional CPAP she should receive. The Edi signal stayed low using CPAP level of 4 cm H_2O , and at 8 in the evening the CPAP was discontinued. The Edi signal was monitored for the rest of the night and stayed at a low level so we knew she was doing well without any support.

Which types of patient interfaces are you using with NIV NAVA on your infant patients?

We are evaluating the Medin interfaces in the process of the NIV NAVA evaluation. They seem to work and are comparable to what we were using traditionally, which are the interfaces by Fischer Paykell. Certainly you need to find the right size and make adjustments for the products from each of these manufacturers.

What are the advantages of being able to provide therapies such as conventional non-invasive ventilation, NAVA and NIV NAVA with the same ventilator?

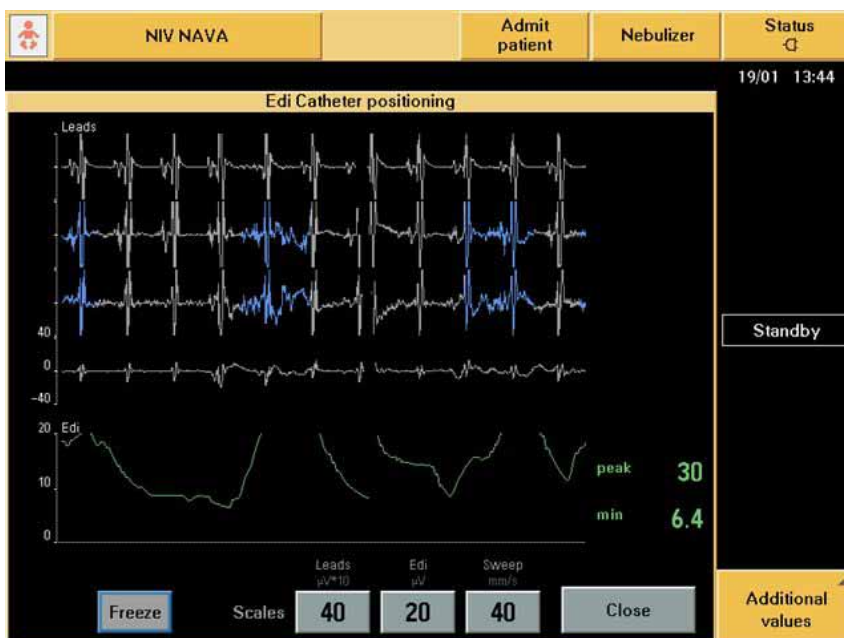
I see a clear benefit, in our cases where we follow our system of one or two days in invasive ventilator care, when giving invasive NAVA. The Edi catheter is already in place and it is easy to switch to non-invasive NAVA after extubation, and to continue Edi monitoring on non-invasive NAVA and thereafter until the nasogastric tube is removed.

Is the Edi catheter placed in the nose as well as the prongs for non-invasive NAVA?

We are used to placing nasogastric



Premature 600 gr NIV NAVA patient



Edi catheter positioning in premature 600 gr infant prior to treatment with NIV NAVA



Dr Lehtonen with neonatologist colleagues Vilhelmiina Parikka, resident and Samuli Rautava

tubes for feeding in the other nostril during CPAP treatment, and it has always worked well for us. We never use oral intubations or oral tubing; we believe that this disturbs the sensory input and process of the child to enjoy feeding.

We did use one of the new Medin nosepieces for NIV NAVA with a curve to allow for a bottle to be used. One baby was bottle-feeding without any problem while on NIV NAVA.

Have you observed if the Edi catheter signals are stable in NIV NAVA?

We have had 2 babies on NIV NAVA on kangaroo care, and the fathers are patting the babies and keeping them close without any problems with signal disturbance at all.

Which NAVA levels have been used in the NIV NAVA evaluation?

We went up to a level of 0.2 cm H₂O/ μ v but we really did not have any patients with bad lungs, so we have not had a chance to test higher levels. We had 0.5 cm H₂O/ μ v in one patient, but he had a tendency for burping, even without NIV NAVA. We were worried that 0.5 cm H₂O/ μ v would be pushing too much air in his stomach and would

disturb his feeding, and therefore we reduced the level from there. The babies we have had so far seem to be doing fine on a NIV NAVA level of 0.2 cm H₂O/ μ v.

In summary, what are your initial impressions about NIV NAVA from this evaluation?

I think that this proof of ventilation with NIV NAVA is apparent to me, even after only a few patient experiences. I think we can also say that we have had two cases where kangaroo care seems to be completely compatible with NIV NAVA, without any disturbance to the Edi catheter or Edi signals. We have had a few minor technical problems during this evaluation, but on the other hand we have had good education and training. Our strategy continues to focus on gentle, as non-invasive treatment as possible, and invasive NAVA and NIV NAVA work well within this strategy.

We have always used CPAP as a standard of care, and I have not been interested in other means of non-invasive ventilation without synchronization, which has made no sense to me in the past. However I can say that non-invasive NAVA is completely synchronized to the patient in a reliable manner. How much this aspect helps the baby remains to be seen. ■



Dr Liisa Lehtonen shows statistics of the reduction of days to extubation from 2001 to 2008

Biography

Dr Liisa Lehtonen received her initial medical degree at Oulu University in Finland in 1986. She joined the Turku University Hospital as board certified pediatrician in 1993, and received her PhD from the same institution in 1994. She obtained her board certification as neonatologist in 1996, and received her ECFMG certificate in the United States in 1997.

Dr Lehtonen was Research Fellow at the McGill University-Montreal Children's Hospital Research Institute from 1996-1997, and was Fellow in Neonatology at Rainbow Babies and Childrens Hospital, Case Western Reserve University in Cleveland, Ohio from 1997-2000.

Liisa Lehtonen was named Docent in Neonatology at Turku University in 2002. She is member of several Nordic Societies in Pediatrics and Neonatology. Dr Lehtonen has supervised a number of PhD students as well as acted as reviewer of PhD theses. She has published numerous clinical studies on pre-term and very low birth weight infants in a wide number of peer-reviewed journals.

Dr Liisa Lehtonen has worked as the Director of the Neonatal Intensive Care Unit of Turku University Hospital since 2000, a position she currently holds.