No. 20

MAQUET
GETINGE GROUP

Critical Care News

Experience and implementation of NAVA in COPD 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

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

Dr Felipe Saddy with COPD patient in the Ventilatory Care Unit of Hospital Copa D'Or

Experience and implementation of NAVA in COPD patients

The Hospital Copa D'Or in Rio de Janeiro, Brazil has maintained a focus on the development of standards and quality, resulting in 2007 by winning the international certification by the Joint Commission International. Excellence in care is the primary goal of the institution, and this progress is monitored by continuous development within all departments of the hospital.

The Hospital Copa D'Or offers comprehensive critical care services with general ICU, Neuro ICU, Cardio ICU and Pediatric ICU departments. To support and maintain quality in ventilatory care, the hospital is one of the very first in Brazil to implement a Ventilatory Care Unit, headed by Dr Felipe Saddy, which also functions as a step-down unit. In turn, the Ventilatory Care Unit was one of the very first in Brazil to implement NAVA – Neurally Adjusted Ventilatory Assist in mid 2008.

What are your primary responsibilities and the average number of staff members in the Ventilatory Care Unit, which is the step-down unit for the 4 intensive care departments at Copa D'Or?

In the Ventilatory Care Unit, which is a step-down unit we have 3 physicians, or 4 in total including myself. The work for the step down unit is to follow the patients closely in the ICUs and to follow the patients in invasive mechanical ventilation. We are also called in cases of chronic long-term patients depending on ventilatory support that are being treated in the hospital for extended periods of time. My colleagues and myself go to the patients in the other acute ICU departments to follow the patients and to collect and analyze the patient data for continuous mechanical ventilation and other parameters such as glycemic control, fluid balances and lab data as well. Data for ventilator parameters and modes are collected twice a day since 2004. We monitor the patients in the other ICUs and we treat the patients that end up here in the step-down unit. When the patient comes to our unit, we already know him, so it is easier. We maintain the same level of care as the ICU in the respiratory care unit. We manage the strategy to wean the patient, which starts with the resolution of the clinical problem, the most important thing to do. Sometimes we have ventilation related problems, where we can use NAVA or other tools to manage the situation.

Dr Felipe Saddy conducts research and is active in educational activities in mechanical ventilation

You have conducted some research in regard to assisted ventilatory modes in mild acute lung injury models as well as interruption in weaning in mechanical ventilation. Are there standard modes of ventilation that are being used in specific patient categories in the ICU, and what is the basis of the choice for these modes?

In terms of global care, we use controlled modes on the most severely critically ill patients, but as soon as possible we change this to spontaneous modes. In 70% or more of the time on mechnical ventilation we use spontaneous modes in the hospital; it may be CPAP plus Pressure Support, NAVA or APCV (assisted pressure control ventilation). We use Pressure Support and Bivent a lot, as soon as we can, in patients with acute lung injury, to prevent collapse. With this strategy it is very unusual to have to use recruitment maneuvers. We can manage these patients on spontaneous ventilation, pressurized with high level of pressure, around 28-30 maximum, high levels of PEEP as necessary depending on the gas exchange, respiratory system mechanics and radiologic data, but using much less sedation using Pressure Support with Bivent. This was the strategy on my experimental study of Bivent with Pressure Support, APCV and PCV, and the results were better for Bivent in terms of protective elements of the lungs, inflammatory mediators and mechanics. We have a plan to manage a study with Bivent in acute lung injury patients, however it is nowadays becoming very rare to have those kinds of patients; the emergency room has a protocol to resuscitate these patients much earlier than in the past. When the patient with ARDS and ALI presents, it is related to something going wrong in the operating room or present in a patient coming in from another hospital. However those are the types of patients that are decreasing in the past five years. This view was discussed together with the Mayo clinic and they have experienced the same impression. More protective ventilation strategies and earlier resuscitation is having a positive effect on these patient categories.

You have had experience of NAVA for a period of time. What was the starting point for your experience of NAVA, how many patients have you treated with NAVA and in which patient categories?

The initial protocol we studied was a small protocol of 10 COPD patients, tracheotomized; of which 8 patients were included from our unit and 2 from the medical ICU. All the patients were on the ventilator more than 10 days, and we compared the energy expenditure between Pressure Support

Dr Filipe Saddy and COPD patient

and NAVA, using both modes to result in a p01<2. This means that the patients were comfortable, which was the most important factor of this work. We wanted to compare the modes in a comfortable scenario in these patients. We analyzed energy expenditure in each mode and could not find any differences in this scenario of comfort. When Pressure Support was set correctly and analysis made of cycle off and other criteria, there was no difference to NAVA. However, I believe that the patients' demands can change during daytime and nighttime, but Pressure Support is constant ventilation. NAVA provides variable ventilation during daytime and nighttime; NAVA is more physiological than Pressure Support in this respect.

Another important observation is synchrony. NAVA is synchronous and provides information directly from the phrenic nerve. In this respect, we break the vicious cycle of asynchrony, since the mode is always stimulated by the phrenic nerve, compared to pneumatic modes. It is easy to understand, but it depends on the neurological input muscle strength of the patient.

The mean NAVA level used was about 1.5 cm $H_20/\mu v$, the patients were very stable. Before this protocol we made some tests and it was very interesting that we could use the NAVA but the patients were weaned before we could include them. When we use a high NAVA level, the patient demand was sustained and sufficiently stable, the tidal volumes could vary, but the minute ventilation was sustained independently of the level of NAVA. Sinderby has shown that before and the Stefano Nava group, and in October A Slutsky and Sinderby published an experimental study in Intensive Care Medicine of ALI in rabbits, with the same result. We have to work with the physiology of the patients and respect it. We don't need "stable" ventilation, but we need to sustain a reasonable minute ventilation to reach patient`s demands and not just the same tidal volume in every breath. I believe that NAVA and other modes that can respect that the patient's breathing differs from breath to breath and variation is important, to be sure.

With reference to your general experience of conventional mechanical ventilation and standard modes, what are your impressions of mean/peak inspiratory airway pressures in your experience with NAVA this far? Which levels of tidal volumes and respiratory rates are you observing with NAVA, compared to other modes of ventilation?

The conventional modes limit pressure and tidal volume and/or time, so that NAVA gives us pressure as a huge parameter to measure and monitor. I think that the physician that is using NAVA needs to know what parameters result in the inspiratory pressure the patient will receive with NAVA, the principle of equation of motion must be there. However the main parameter which will result in inspiratory pressure and tidal volume will be the gradient between the lower level of Edi and the higher Edi, this maximum and minimum gradient must be reliable, the signal must be very clean. Others parameters that will interfere are PEEP and the NAVA level. In a first place you have to "homogenize" this mode using the NAVA preview tool. If the patient is ventilating on Pressure Support, you may sustain the same level of pressure, and for that you need to set the NAVA level to result in the same level of inspiratory pressure if it is adequate for that patient. Then you can not turn back, you have to stay there in NAVA, to see the power of muscle strength which is related to the gradient of Edi activity. This will be the main parameter to result in a higher or lower respiratory pressure. Look at the Edi and monitor it from the bedside, and the patient will also help you by means of lung mecanoreceptors to sustain its optimum minute ventilation. If you have a hypothetical hyperdistention situation, the closed loop physiological information from lung reflexes will protect the ventilatory system and the stimulus will decrease. The physiology must be completely connected to the ventilator, and the neurological reflexes and the receptors in the lungs are very important to sustain a healthy system. If the patient breathes with a higher NAVA level or a huge gradient of Edi, the patient will receive a higher level of pressure, however in the next breath he will regulate himself physiologically. It is a self-regulating situation, the patient is informing the ventilator about his diaphragmatic activity, and the ventilator will respond and deliver respiratory pressure related to the diaphragmatic request.

You have done some research in regard to weaning and weaning interruption in mechanically ventilated patients. What is your perception of patient – ventilator synchrony and weaning in regard to NAVA?

I think this is one of the most important factors in relation to NAVA and that is ventilator-patient synchrony. Not only the fact that patients synchronized with the ventilator can reduce the time the patient spends on mechanical ventilation, I believe that it is very usual in the ICU that the physicians are not prepared to recognize or understand that the usual screen on the ventilator does not reveal asynchrony. Asynchrony is extremely difficult to detect in normal pneumatic ventilatory modes and you really need to know what is going on. I really think NAVA may help, because of the Edi activity. We can recognize the activity of the Edi of the patient and synchronize the mode with that. We have many cases of COPD patients on Pressure Support where we could literately see the asynchrony by means of the Edi parameter. With NAVA, you simply synchronize the COPD patient and monitor him.

Are there any specific patient experiences with NAVA that you would like to share with us?

We have been working with NAVA since June 2008 and have used it mainly on COPD patients and synchronization has been the most important factor to us so far. However, in these patients we also find the variability of the tidal volume and maintenance of minute ventilation to be very interesting. This aspect is even more important on patients with ALI, but I have no experience yet of NAVA in this patient category. In COPD

Dr Felipe Saddy has been working at Hospital Copa D'Or for many years

Dr Felipe Saddy

patients, I believe that synchronization with NAVA is perfect in these patients. My COPD patients have not had any problems in triggering the ventilator with NAVA; in fact it is very easy for them.

You have a profile in education and training, as coordinator of ventilation in your institution as well as giving lectures in mechanical ventilation. What is your opinion regarding the advantage of Edi signals as a completely new parameter in ventilation?

I am continuing to learn myself about these advantages, but first in terms of the concept – it is basic physiology and it was easy to monitor the Edi signal and learn about the diaphragmatic electrical activity, a very impressive parameter in the first place. After initial observation, we understood the potential and what to do and the first thing to look at is synchronization. The second question is muscle strength – is it strong or weak in any particular patient? We need to recognize this behavior with the Edi signal and there is a learning curve. In terms of educating, it is easy to teach how to place the Edi catheter and recognize the Edi signals, the basis is just the ECG and the machine can manage the ideal placement by means of the markers. You need to monitor the amplitude of the ECG signal, and look in terms of your placement, if you need to reposition or not. But it is not difficult; I think it is easy for people to learn very quickly.

All of the physicians and respiratory therapists in Ventilatory Care Unit here at Copa D'Or are completely educated in NAVA and familiar with the protocols for NAVA and Edi monitoring. It has been easy to educate them.

If you would give advice to other intensive care colleagues who are just starting out with NAVA and Edi monitoring, what do you think is important for them to learn about NAVA and the capture and interpretation of Edi signals?

The first thing is know the physiology – that is the most important factor. Synchrony in spontaneous ventilation is the most important factor, and NAVA will help, for sure. The next big question is which categories of patients will be helped the most by NAVA? These categories need to be identified in the next step, and I think we will start to see answers in the next few years. We have two areas right now to work in, spontaneous ventilation and weaning, and monitoring of Edi will help us to synchronize and to understand what is going on with the patient and in some cases to diagnose tachypnea, for example. In terms of weaning and synchronizing, the COPD patients are usually the most challenging, and NAVA is valuable in this group.

Synchronization and variation of volume are important factors to be familiar with and to research in terms of NAVA in ALI patients. We need more studies about NAVA in these patients, and how to manage them and sedation levels in this respect.

This hospital has been one of the first to have implemented NAVA and Edi monitoring in Brazil. With consideration to the rapid advances in development and technology in other sectors that have been taking place in this country, what do you feel about the future of NAVA and Edi monitoring in South America in general, and Brazil specifically?

I think it will be related to the financial circumstances here in Brazil. We are growing rapidly, and developing, but we have a lot of other things to do in the health care system. We do not yet have the full infrastructure in many hospitals in regard to basic elementary care. At my hospital a department dedicated to mechanical ventilation is completely new here in Brazil: a dedicated ventilatory care

unit within the hospital. I think that NAVA and other technologies will grow in Brazil, but we need first to sustain the growing scenario of financial circumstances. I think that will depend on the financial background in terms of insurances and the government – we have two healthcare policies here in Brazil – the private insurance and the governmental sector. They unfortunately are not at the same level. Brazil may become positioned in the world to allow for more technology in future, even producing technology ourselves, but for sure we need to offer the patients the best care. If the best thing for that patient is a certain type of technology, we need to have the access to this by means of the insurance systems and the national health policies.

Non-invasive NAVA is coming; do you see any opportunities with that new development in the future?

Yes, I think that non-invasive ventilation and asynchrony are complex issues that occur in patients like the COPD patients, since leakage is such a problem. When you have an interface, like the helmet, to help manage the leakage aspect, or in the case of NAVA when it is independent of leaks to trigger the ventilator, it is very interesting at many levels. I think this is something for sure I would like to use in future, in COPD patients and other patient categories.

We have discussed your clinical research in mechanical ventilation earlier in this interview. Which other research opportunities do you see with the clinical application of NAVA in the coming years? Are there any particular patient categories that you are interested in gaining experience with NAVA in the future?

In the experimental scenario, we are currently studying comparing NAVA and Pressure Support in acute lung injury. It is the first area of interest. In terms of a clinical scenario, I really would like to use NAVA early in invasive ventilation and compare the time of using NAVA and other modes, it would be interesting to study this in terms of an international multicenter study on mechanical ventilation of more than 24 hours and compare these patients to using Pressure Support and other conventional modes. I am very satisfied with NAVA in terms of synchronization and functionality in COPD patients, and I feel very secure with it. But I still don't know which the best patient category is for NAVA, and for this we need patient numbers.

Biography

Dr Felipe Saddy received his medical degree from the University of Rio de Janeiro, Uni-Rio, Faculty of Medicine. He obtained his specialization as Adult Intensivist – from the Brazilian Intensive Medicine Association, AMIB. Dr Saddy became a Fellow of Master Sciences, Internal Medicine, Sector Pneumology, Federal University of Rio de Janeiro, UFRJ. He is also invited researcher of Pulmonary Investigation Laboratory, Carlos Chagas Filho Biophysics Institute, Federal University of Rio de Janeiro, UFRJ.

Dr Felipe Saddy is currently working as Intensivist of the Intensive Care Unit of Hospital Pro Cardiaco and is Head of Ventilatory Care Unit, Hospital Copa D`Or.

References

1) Saddy F, Oliveira GP, Garcia CSNB, Nardelli L, Rzezinski A, Moralles M, Pelosi P, Rocco PRM. Assisted ventilation modes reduce the expression of lung inflamatory and fibrogenic mediators in a model of mild acute lung injury. Intensive Care Medicine 2010; in press.

2) Goldwasser R, Farias A, Feitas EE, Saddy F, Amado V, Okamoto V. Mechanical ventilation of weaning interruption. J Bras Pneumol 2007; 33: 2S: 128-136.

3) Brander L, Sinderby C, Lecomte F, Leong-Poi H, Bell D, Beck J, Tsoporis JN, Vaschetto R, Schultz MJ, Parker TG, Villar J, Zhang H, Slutsky AS. Neurally adjusted ventilatory assist decreases ventilator-induced lung injury and non-pulmonary organ dysfunction in rabbits with acute lung injury. Intensive Care Med 2009; DOI 10.1007/s00134-009-1626-x.

4) Kou YR, Bien MY. Ventilatory management of acute lung injury by neurally adjusted ventilatory assist and positive end-expiratory pressure. Crit Care Med 1006; 34(12): 3055-3056.

5) Sinderby C, Spahija J, Beck J, Kaminski D, Yan S, Comtois N, Sliwinski P. Diaphragm activation during exercise in chronic obstructive pulmonary disease. Am J Respir Crit Care Med 2001; 163(7): 1637-1641.

6) Yan S, Sinderby C, Bielen P, Beck J, Comtois N, Sliwinski P. Expiratory muscle pressure and breathing mechanics in chronic obstructive pulmonary disease. Eur Respir J 2000; 16(4): 684-690.

7) Sinderby C, Navalesi P, Beck J, Skrobik Y, Comtois N, Friberg S. Gottfried SB, Lindström L. Neural control of mechanical ventilation in respiratory failure. Nat Med 1999; 5(12); 1433-1436.

8) Saddy F , Thompson A, Gago F, Serafim RB, Rocha E, Pantoja J, Rocco PRM. Comparison of energy expenditure between neurally adjusted ventilatory assist and pressure support ventilation in COPD patients. Am J Respir Crit Care Med 2009; 179: A 3817.