MDoloris
Medical Systems

MEASURE THE ANS
CONTROL NOCICEPTION
IMPROVE OUTCOMES

ANI in the ICU

Analgesia
Nociception Index

V2021

The problem

In the intensive care unit (ICU) there are patients requiring mechanical ventilation and sedation. Analgesia is key to help patients with a high respiratory drive adapt to the ventilator and prevent patient–ventilator asynchrony (PVA).

To achieve good patient-ventilator synchrony optimal balance between sedation and analgesia is required. This balance can be achieved more effectively by monitoring the effect of each procedure with:

An EEG monitor
To control the desired level of consciousness.

The ANI monitor
To detect noxious stimulation. ANI may help to guide analgesia [8].

ANI MOC-9 Module

ANI-MR Module

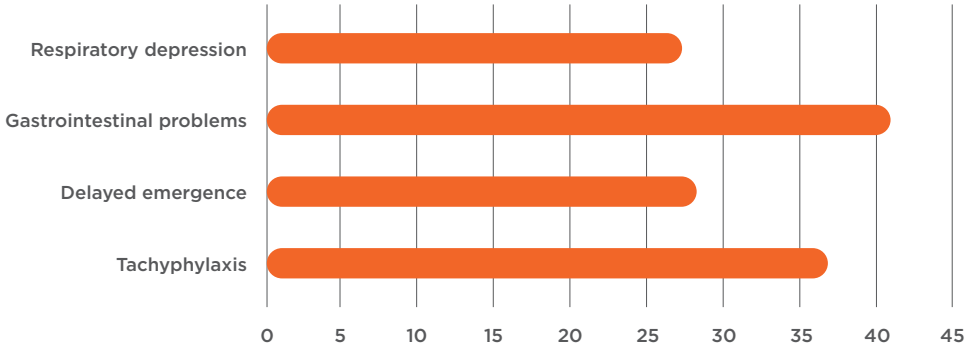
ANI Monitor V2

Several publications have proven that, in mechanically ventilated patients, an analgosedation protocol will improve pain scores, **reduce sedatives (54%)** and their overall consequences as delirium, **decrease length of stay (50.8 h), decrease time on ventilation (45.5h)** and decrease associated medication costs [1]. However, overuse of analgesia, especially opioids, must also be avoided as 20% to 70% of patients that receive opioids will have side effects such as; respiratory depression (27%), gastrointestinal problems (41%), delayed emergence (28%) and tachyphylaxis (37%) [2]. Hence, it is key to be able to specifically titrate the analgesic requirements of each patient.

The benefits of an analgosedation protocol

54%	50,8h	45,5h
reduction of sedatives	decrease length of stay	decrease time on ventilation

% of opioid-overdosing side effects



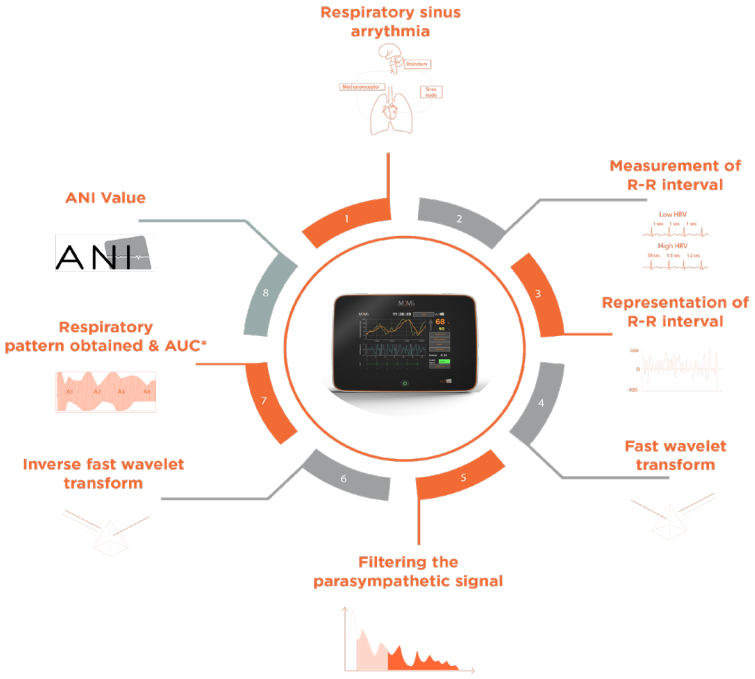
Our solution

Measuring the autonomic nervous system (ANS) with the analgesia nociception index (ANI)

Heart rate variability (HRV) is a well-known phenomenon that controls the regulation of the cardiovascular system via the ANS. By analyzing the HRV oscillations it is possible to measure the activity of the sympathetic and parasympathetic nervous systems [3].

All mammals exhibit what is known as respiratory sinus arrhythmia. This process is controlled by the sympathetic and the parasympathetic branch of the nucleus accumbens and nucleus ambiguous, causing the heart to beat slower during expiration, due to vagal activation, and faster in inspiration due to sympathetic innervation [4].

How to obtain ANI from ECG



*AUC : calculation of area under the curve of the respiratory pattern

The ANI value measures the relative parasympathetic activity of the patient

The total energy of the ANS is shown in the screen of the monitor. During general anesthesia, an ANI range between 50-70 relates to adequate analgesia, meaning that antinociception is adequate and that parasympathetic activity is mildly predominant over sympathetic activity. When the ANI value falls below 50, the occurrence of a hemodynamic response within the following 5 minutes is very likely [5]. This information can be used to predict and avoid a hemodynamic response by increasing analgesia.

Interpretation of ANI

Possibility to decrease opioids administration whitout any risks

Optimal range Adequate analgesia

Probability of a hemodynamic reaction in the next few minutes, possibity to anticipate analgesic's needs

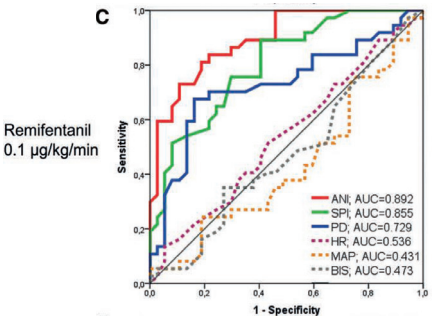
nb : the energy must be between 0,05 and 2,5 for an interpretable ANI.

The result

ANI can detect nociception [6] and may help to take the decisions to control the autonomic response improving patient outcomes [17]

In Anesthesiology 2017, Funcke et al. show that ANI is the best in its class for detecting nociception versus other parameters, especially under opioid conditions [6]. While titrating analgesics based on heart rate and blood pressure might be common, Funcke et al. demonstrated that ANI is more sensible and specific than haemodynamics to detect nociception [6].

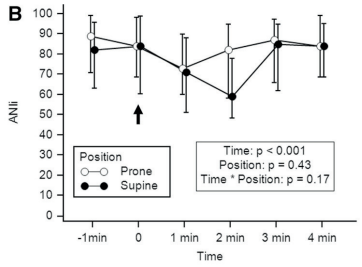
Validation of Innovative Techniques for Monitoring Nociception during General Anesthesia: A Clinical Study



Picture modified from Funcke et al. [6]

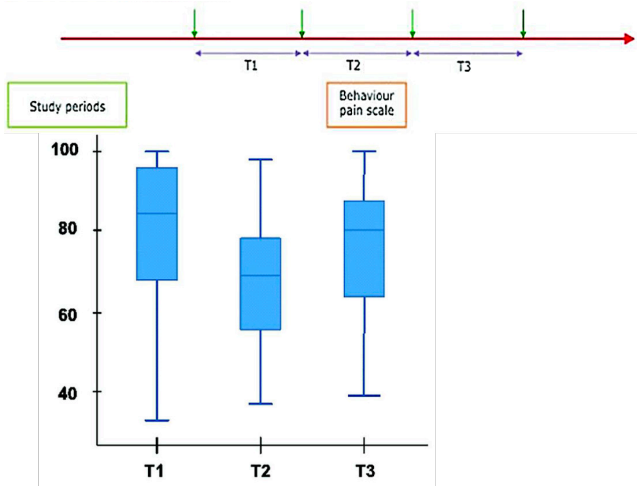
Several publications indicate ANI can detect nociception and be safely used in the ICU setting for guiding analgesia in deeply sedated patients, even under catecholamine treatment [10-12].

ANI and BIS variations in supine and prone position during closed-tracheal suction in sedated and myorelaxed ICU patients with severe COVID-19: A retrospective study.



Picture modified from Boselli E, et al. [11]

Measurement of Heart Rate Variability to assess pain in sedated critically ill patients: A prospective observational study.



Picture modified from Broucqsault-Dédrie C, De Jonckheere J, Jeanne M, Nseir S. [10]

ANI can detect nociception and correlates with Numerical Rating Scores in postsurgical patients who underwent anesthesia with halogenated agents [13].

What medical societies say about ANI in ICU

ANI has been pointed out as an interesting technology for nociception detection in the 2018 Society of Critical Care Medicine clinical guidelines for sedation in ICU [14], in the sedoanalgesia and ventilation protocol for Covid-19 patients from Hospital Puerta de Hierro de Madrid [15] and by the SEMICYUC (Spanish Society of Intensive Care Medicine) [16]. MDoloris technology is being increasingly used worldwide for the detection and management of nociception.

To find out more about MDoloris technologies please visit our website https://mdoloris.com/

The main benefits
of using ANI technology

ANI shows the sympathetic/parasympathetic allowing taking better decisions to control nociception improving outcomes.

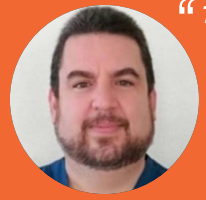
- Predictivity of hemodynamic reactivity [5]
- Helpful to diagnose the etiology of a haemodynamic event [7]
- Predict post-extubation pain [9]
- Refine opioids titration [8]

Testimonials

"ANI monitor is very useful for monitoring the patient's autonomic nervous system, especially in those undergoing mechanical ventilation, to titrate analgosedation. This allows good patient synchrony to the ventilator, avoiding the side effects of overdose, saving drugs, and allowing for earlier weaning from mechanical ventilation."

Dr. Carlos Chamorro Jambrina

Intensive Care Unit -
Hospital Puerta de Hierro Majadahonda, Madrid



"The measurement of parasympathetic tone with ANI to continuously evaluate the level of analgesic comfort of the patient, optimizes the consumption of opiates, achieving adequate analgesia, and with a high negative predictive value that helps to differentiate the etiology of hemodynamic adverse events in the ICU mainly in patients under mechanical ventilation. It allows managing individualized doses to each patient managing to avoid sub or supratherapeutic doses, which has been of particular relevance during the COVID-19 pandemic due to the decrease in the supply of medicines for sedoanalgesia."

Dr. Angel Augusto Pérez Calatayud

Chef of Critical Area Division,
Hospital General de México

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