MEASURE THE ANS
TITRATE ANALGESICS
IMPROVE POSTOPERATIVE PAIN

ANI and NIPE in OR

Analgesia
Nociception Index
New born Infant
Parasympathetic Evaluation
The problem
Pain is the conscious perception of nociception

Nociception (from Latin nocere ‘to harm or hurt’) is the process of the sensory nervous system response to certain harmful or potentially harmful stimuli. In nociception, intense chemical (chili powder in the eyes), mechanical (cutting, crushing.), or thermal (heat and cold) stimulation of sensory nerve cells, called nociceptors, produces a signal that travels along a chain of nerve fibres via the spinal cord to the brain.

Nociception triggers a variety of physiological changes and usually results in a subjective experience of pain (in the conscious patient). Therefore in unconscious patients there is nociception and autonomic reflex rather than pain.

The physiological changes that occur in the autonomic nervous system (ANS), following a nociceptive stimulation, are due to the activation of the sympathetic nervous system. With increased sympathetic activity the production of stress hormones (catecholamines and cytokines) increase which is a major cause of physiological stress.

A change in the anaesthesia paradigm

In 1960, Dr. Gray changed his previous Pain, Narcosis and Neuromuscular Blockade concept by substituting pain with areflexia (1).

Dr Eger defined anesthesia as Amnesia and Arreflexia (2), including muscle activity into the reflexes. Dr Egan affirmed that the use of opioids and other analgesics in general anesthesia is to control the autonomic reflex to nociception (3).

Control Surgical Stress

It is the ANS response that causes the stress and immunity system activation, increasing inflammation and affecting outcomes (4) morbidity and mortality [5], and this response is what should be kept under control.

In order to control surgical stress analgesics, often opioids, are administered, but overdosing and infra-dosing can cause side effects such as: longer recovery times (12), PONV (13), urine retention (14), shivering (15), thromboembolism (16), pulmonary complications (17), bradycardia (18), hypotension (19), ileum (14), respiratory failures (14), post-op hyperalgesia (15), delirium (16) (17), POCD (18), cancer progression (18) and chronic pain (19). By using ANI and NIPE monitors MDoloris offers insights into the sympathetic/parasympathetic balance allowing titration of analgesics (24) and the ability to IMPROVE OUTCOMES. (21,23,25)


Our Solution
ANI Measures the Autonomic Nervous System Response to nociception

Time between heart beat to heart beat changes due to ventilation. This phenomenon is know as heart rate variability and is controlled by the ANS. Heart rate variability reflects the activity of the sympathetic and parasympathetic nervous systems (6). The nucleus accumbens and nucleus ambiguous, in the brain, make the heart beat slower during expiration due to vagal activation and faster in inspiration because of sympathetic innervation (7). MDoloris Medical Systems has developed a technology based on heart rate variability analysis; The NIPE from 26 weeks gestational age to 2 years, and the ANI from 2 years and above, to measure the activity of the ANS and to control surgical stress. The ANI and NIPE express 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/NIPE range between 50-70 relates to adequate analgesia (11,21), meaning that antinociception is adequate and that parasympathetic activity is mildly predominant over sympathetic activity. If ANI/NIPE value falls below 50 the occurrence of a hemodynamic response within the following 10 minutes is very likely (8). This information can be used to predict and avoid a hemodynamic response by increasing analgesia.

The result

Analgesics are titrated based on heart rate and blood pressure. Funcke et al., demonstrated that ANI is more sensible and specific than haemodynamics to detect nociception in adults (9) and children (10). NIPE is able to show the effect of the analgesic provided and detect nociception better than heart rate (11). ANI/NIPE has been recommended with a B level by The Society for Pediatric Anesthesia in their recommendations for the use of opioids in children during the preoperative period (11).

**Detect nociception in adults**


**Detect nociception in pediatrics**


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**Interpretation of ANI**

- **Possibility to decrease opioids administration without any risks**
- **Optimal range; Adequate analgesia**
- **Probability of a hemodynamic reaction in the next few minutes, possibility to anticipate analgesic’s needs**

*nb: the energy must be between 0.05 and 2.5 for an interpretable ANI.*

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Picture modified from Funcke et al. (9)

Picture modified from Weber et al. (11)
I use daily the ANI monitor during my opioid-free anesthesia to titrate the non-opioid analgesic drugs. It allows me to reduce the dexmedetomidine and lidocaine dosages, which results in a faster and better awakening process of the patient as hemodynamics do not always reflect the surgical stress of the patient.\textsuperscript{34}

Dr. Jan Paul J Mulier MD
Department of Anaesthesiology & Intensive care, AZ Sint-Jan Brugge KULeuven & UGent

NIPE is an excellent intraoperative tool for pediatric anesthesiologists who assist neonates and infants. NIPE device allow us not only to confirm the efficacy of regional blocks but also to titrate analgesic drugs like opiates, dexmedetomidine while tailoring hypnotic agents, achieving a very early and comfortable extubation in these very young patients.\textsuperscript{35}

Dr. Francisco Reinoso Barbero
Chief of Anaesthesia of Paediatric department
Hospital la Paz, Madrid

At the heart of Enhanced Recovery After Surgery (ERAS) programs is the reduction in surgical stress. Whilst there are many approaches to this (such as minimally invasive surgery) a key area is excellent pain control. The ANI monitor allows objective intraoperative assessment of analgesia, permitting titrated pain control, optimizing patient analgesia and comfort, and thus minimizing the stress response.\textsuperscript{36}

Dr. Bill Fawcett
Professor of Anesthesia, Consultant anesthesia/pain medicine, Guildford

Testimonials

The main benefits of using ANI technology

- Refine opioids titration (23)
- Predict post-extubation pain (27)
- Predictivity of hemodynamic reactivity (8)
- Reduce post operative pain (21)
- Helpful to diagnose the etiology of a hemodynamic event (26)
- Reduce length of stay in outpatient surgery units (25)
Published evidences:

**Intraoperative “Analgesia Nociception Index” – Guided Fentanyl Administration During Sevoflurane Anesthesia in Lumbar Discectomy and Laminectomy: A Randomized Clinical Trial**

Henry D Upton, Guy L Ludbrook, Andrew Wing, Jamie W Sleigh

1.3 less NRS in PACU
64% lower PACU total fentanyl
82% lower nausea / 23% shivering

**Evaluation of the variability of ani values in digestive surgery**

Nguyen Quoc Kinh, Trinh Ke Diep, Emmanuel Boselli, Luu Quang Thuy

Decreased pain in PACU
Less Opioid dosage during surgery
50% lower nausea / vomiting 75%
Lower respiratory failure

**Analgesia nociception index (ani) monitoring in patients with thoracic paravertebral block: a randomized controlled study**

Nurseda Dundar1, Alparslan Kus2, Yavuz Gurkan2, Kamil Toker3, Mine Solak2

34% less remifentanil dosage during surgery
Haemodynamic stabilization
ANI helps guiding analgesia

**A targeted remifentanil administration protocol based on the analgesia nociception index during vascular surgery**

Georges Daccache1, Edouard Caspersen1, Michel Pegois1, Kelly Monthé-Sagan1, Ludovic Berger1, Dominique Fletcher1, Jean-Luc Hanouz1

Low remifentanil dosage during surgery
Lower need of analgesia in PACU
Lower postoperative pain
Can be safely used in diabetics and betablocked patients
Lower haemodynamic events (11% vs 40% historically)

**Usefulness of ANI (analgesia nociception index) monitoring for outpatient saphenectomy surgery outcomes: an observational study**

Adolfo Ramos-Luengo1, Adela Gardeta Pallarés2, Fernando Asensio Merino2

11% reduction in length of stay in outpatient surgery

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ANI Monitor V2, ANI MOC-9, NIPE Monitor V1 and the ANI-MR are class Ila medical device, manufactured by MDoloris Medical Systems. CE evaluation was performed by Bureau Veritas Italy (1370) for the ANI Monitor V2, NIPE Monitor V1 and the ANI MOC-9. CE evaluation was performed by BSI (2797) for the ANI-MR. © 2021 MDoloris Medical Systems. All rights reserved. MD/QUA/EN143. v.04