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Monitorización del sistema nervioso autónomo en anestesia y en cuidados críticos. Potenciales usos y su implicación en el pronóstico de los pacientes.

Dr. Juan Vicente Martínez Giner.

Dr. Alvaro Cervera Puchades.

SERVICIO DE ANESTESIA, REANIMACIÓN Y TRATAMIENTO DEL DOLOR.

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SARTD-CHGUV Sesión de formación continuada
Valencia, 20 de Diciembre de 2022

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2. Nocicepción ≠ Dolor
3. Monitorización perioperatoria del SNA
4. Dispositivos disponibles
    1. Pupilometría
    2. ANI
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5. Monitorización del SNA en críticos
6. Conclusiones

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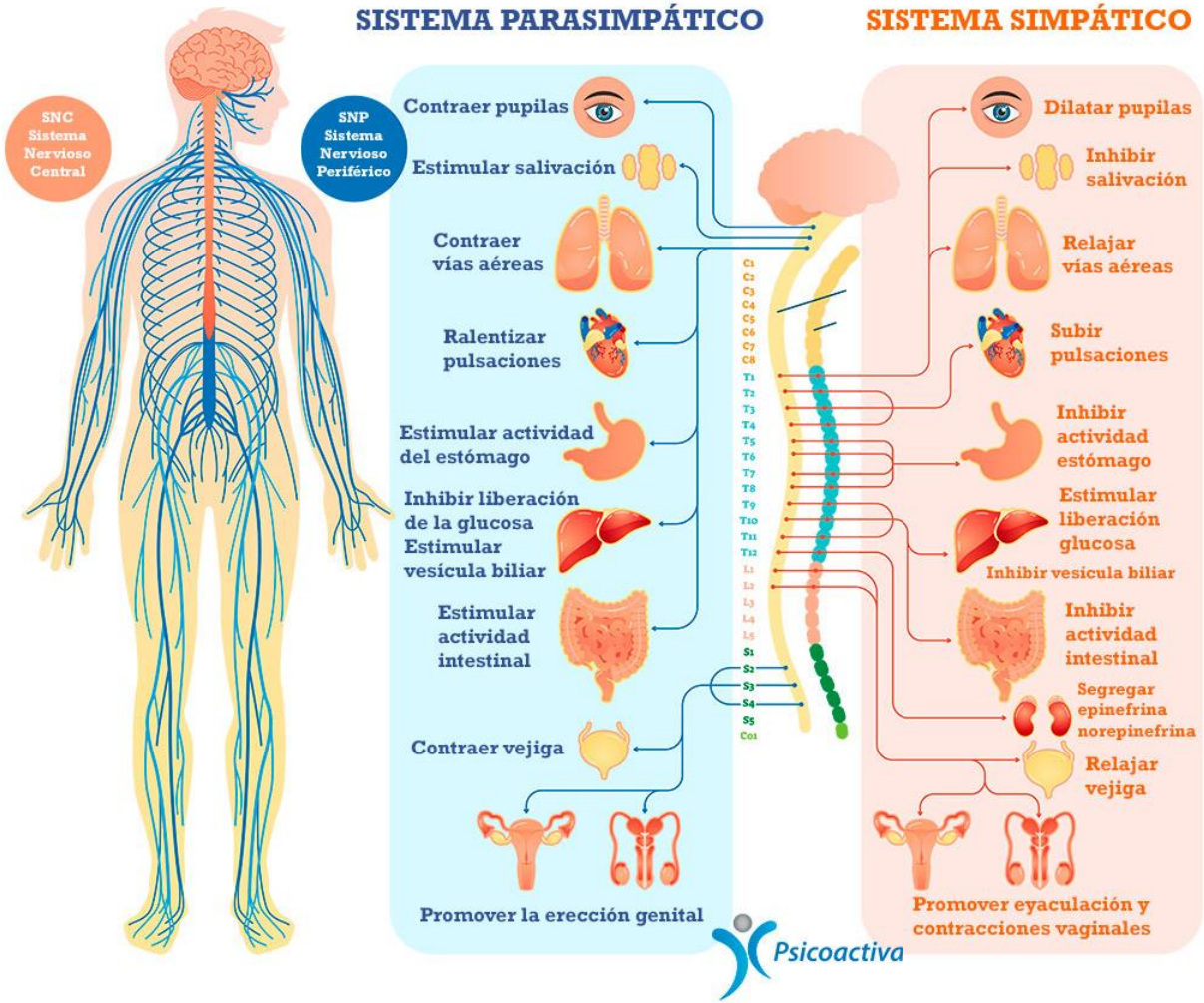
Sistema Nervioso Autónomo

- Sistema nervioso autónomo:
  - Sistema nervioso simpático
  - Sistema nervioso parasimpático



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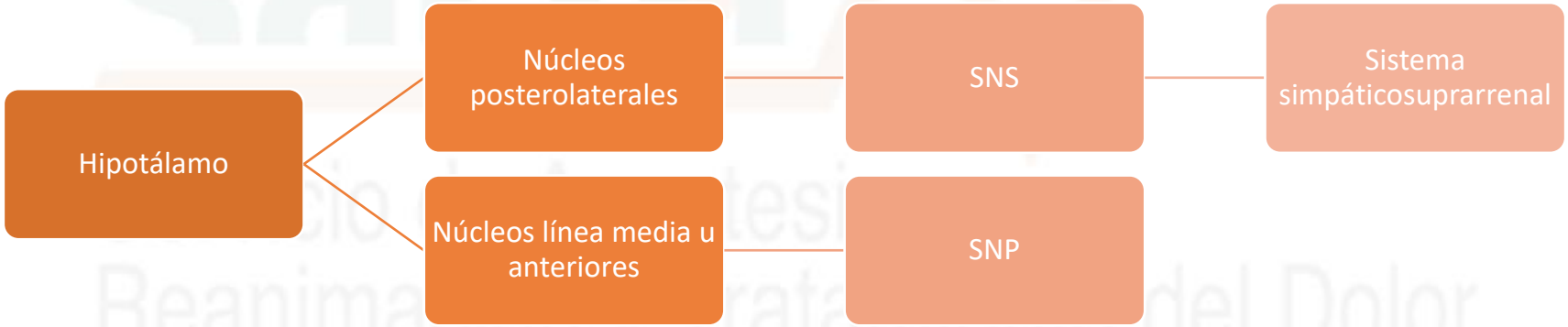
Sistema Nervioso Autónomo

- Organización autónoma central:



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Sistema Nervioso Autónomo

- Organización autónoma periférica:

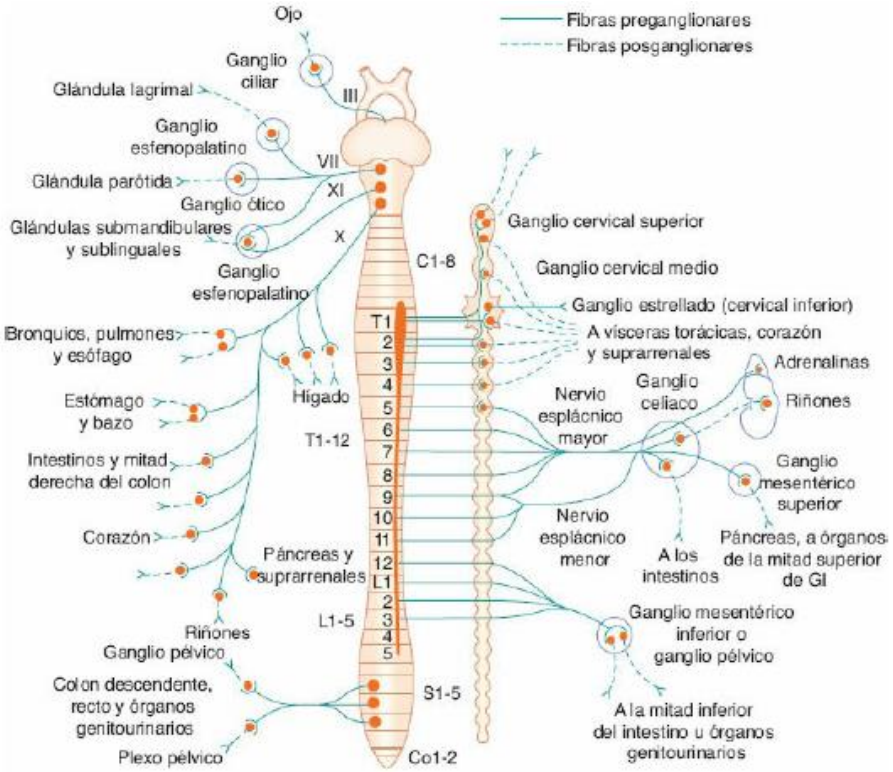

Figura 14-1 Distribución esquemática de los sistemas nerviosos craneosacro (parasimpático) y toracolumbar (simpático). Las fibras parasimpáticas preganglionares pasan al órgano en que se distribuyen, de forma directa. El soma posganglionar de ellas está situado dentro de la víscera inervada o cerca de la misma. Dicha distribución limitada de las fibras posganglionares parasimpáticas es congruente con el efecto circunscrito y limitado de la función parasimpática. Las neuronas simpáticas posganglionares se originan en pares de ganglios simpáticos o de un plexo colateral aislado. Una fibra preganglionar incluye muchas de las neuronas posganglionares. La activación del SNS origina una respuesta fisiológica más difusa y no un efecto circunscrito localizado. GI, gastrointestinal.

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Sistema Nervioso Autónomo

Dolor

↓

Sistema nervioso simpático

Exceso sedación-analgesia

↓

Sistema nervioso parasimpático

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Dolor en anestesia general

DOLOR ≠ NOCICEPCIÓN

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Dolor en anestesia general

DOLOR

- Interpretación consciente y subjetiva de la información nociceptiva.

NOCICEPCIÓN

- Propagación a través del sistema sensitivo de un estimulo nociceptivo y dañino.

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Dolor en anestesia general

- Ejemplo 1: Paciente inconsciente tras administración de Propofol.
- Incremento de la presión arterial y la frecuencia cardiaca tras incisión → **Nocicepción**

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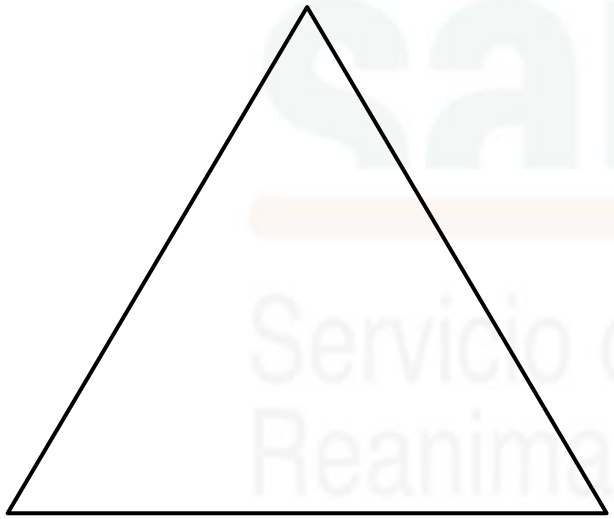
Dolor en anestesia general

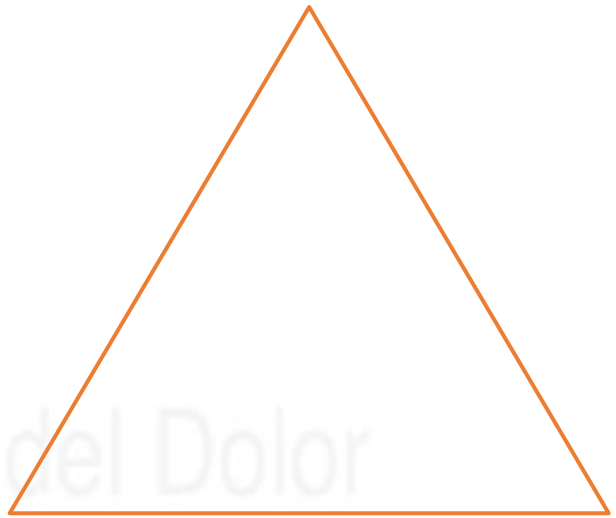
- Ejemplo 2: Mismo paciente pero con anestesia local mal administrada.
- Incremento de la frecuencia cardiaca y el paciente se queja → **Dolor**.

Analgesia



Hipnosis BNM

Bloqueo estrés quirúrgico



Hipnosis BNM

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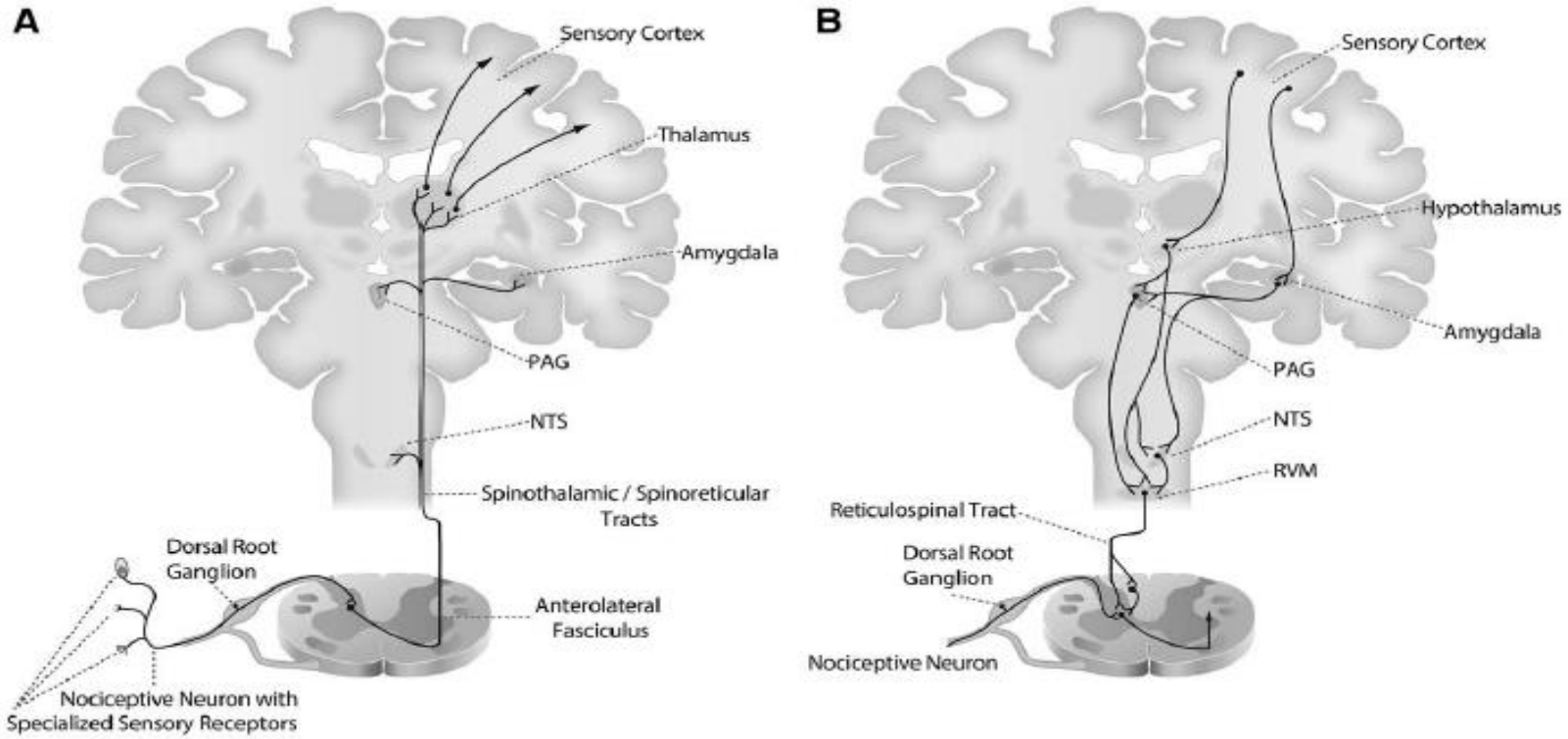
Sistema nociceptivo

Compuesto por las vías nociceptivas ascendentes y descendentes.



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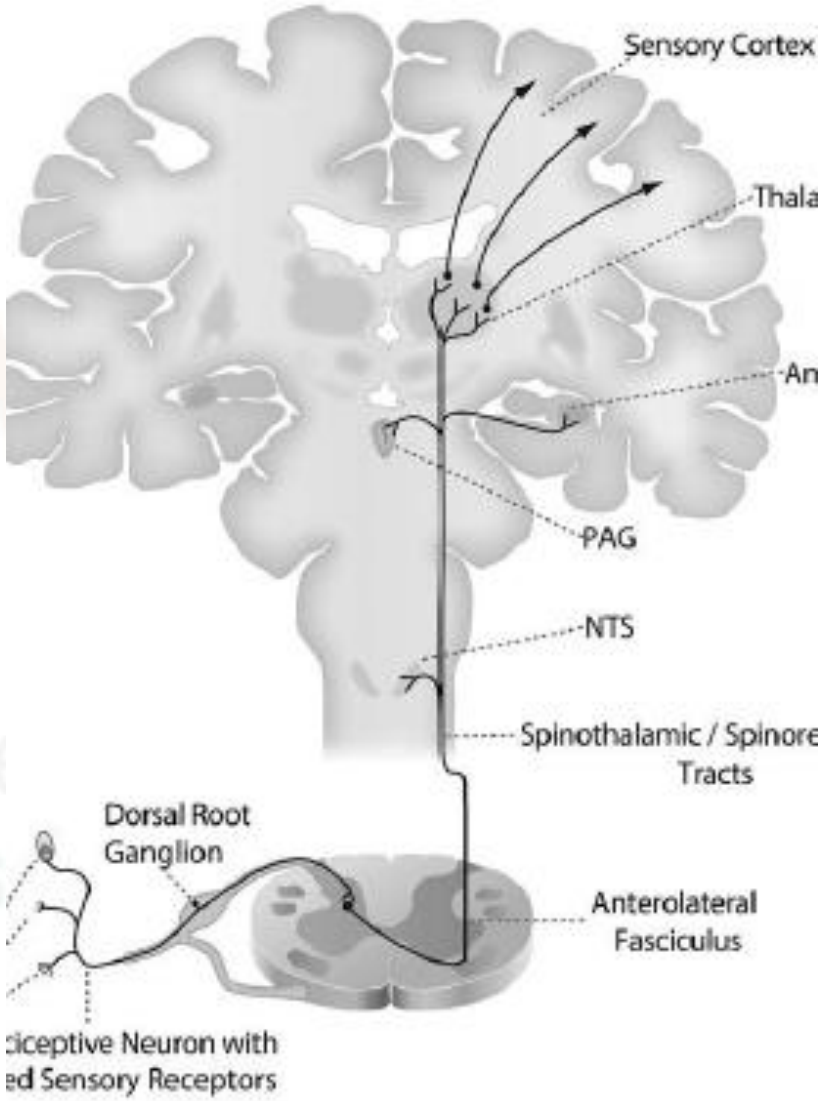
Sistema nociceptivo ascendente



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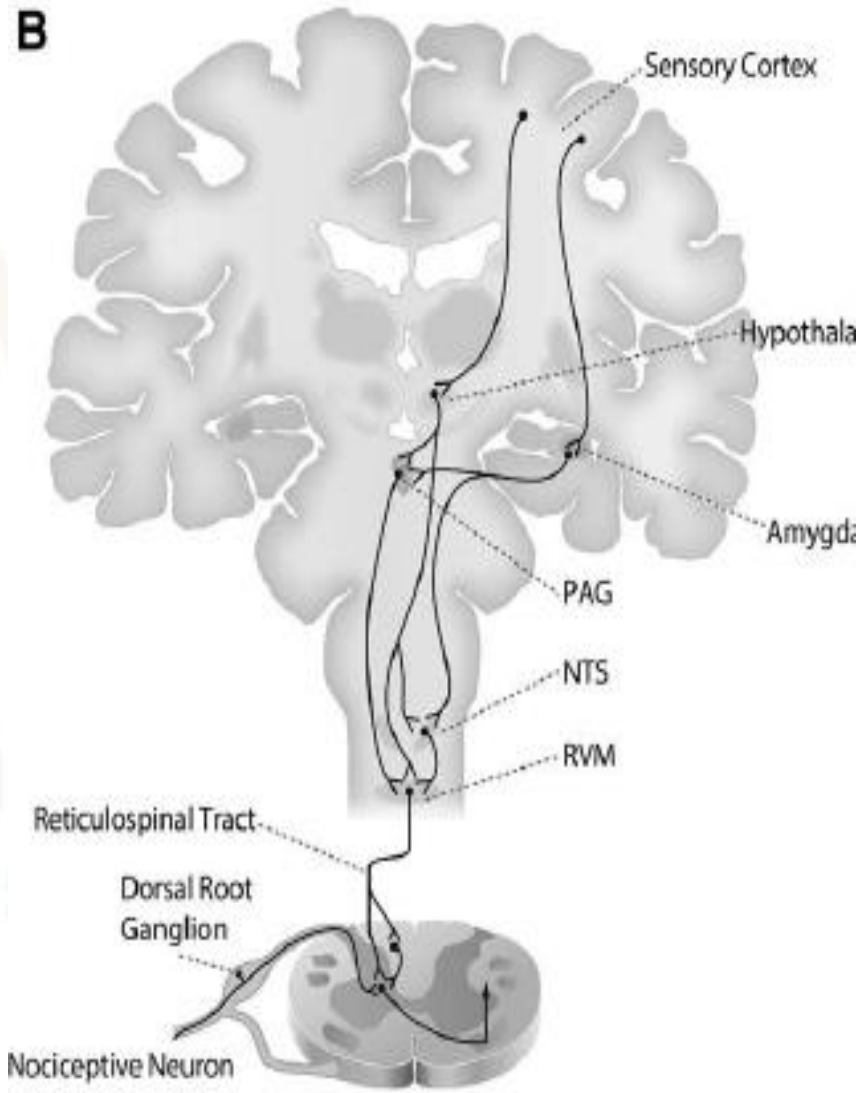
Sistema nociceptivo descendente



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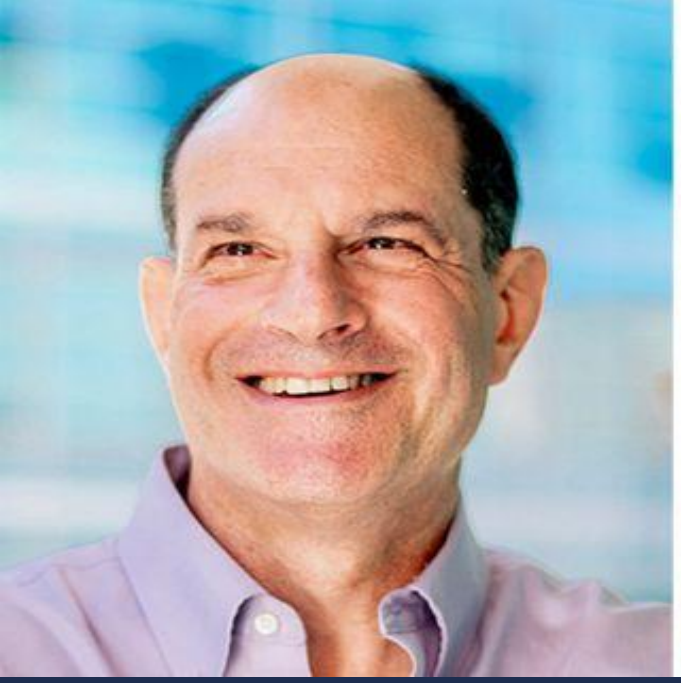
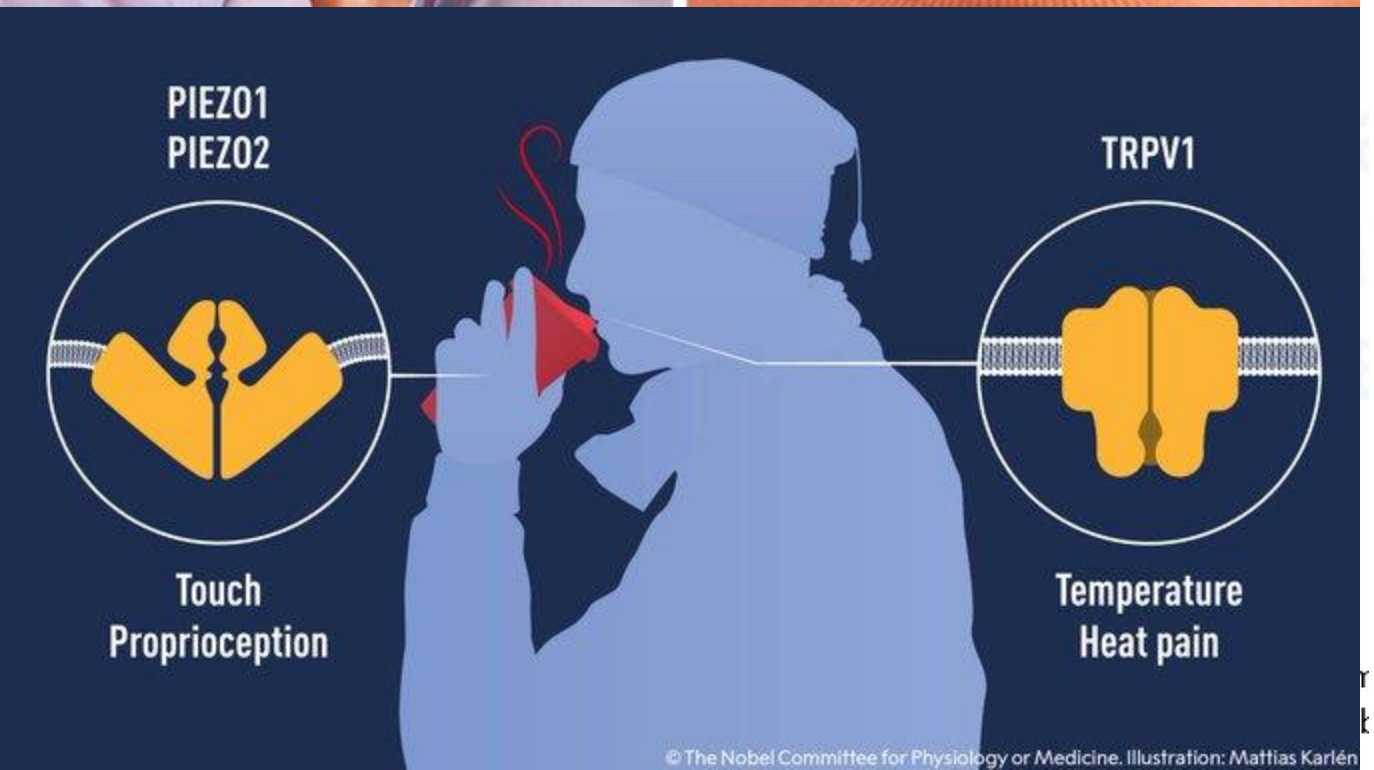
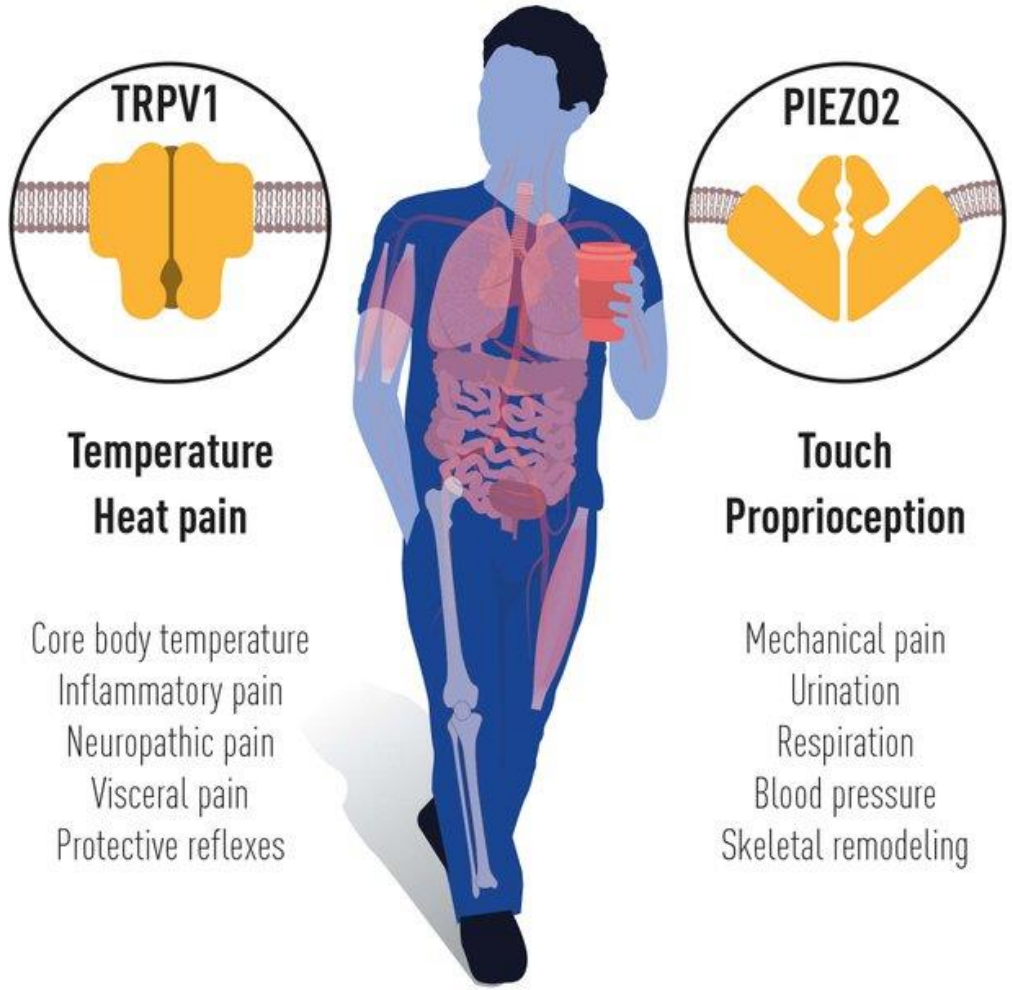



PIEZO1
PIEZO2
TRPV1
Touch
Proprioception
Temperature
Heat pain
© The Nobel Committee for Physiology or Medicine. Illustration: Mattias Karlén


TRPV1
PIEZO2
Temperature
Heat pain
Core body temperature
Inflammatory pain
Neuropathic pain
Visceral pain
Protective reflexes
Touch
Proprioception
Mechanical pain
Urination
Respiration
Blood pressure
Skeletal remodeling
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Monitorización del SNA perioperatoria

- La monitorización y el control de la analgesia intraoperatoria es de suma importancia para reducir el estrés quirúrgico que compromete el correcto funcionamiento de los sistemas:
  - Metabólico-endocrino
  - Homeostasis
  - Activación desmesurada del catabolismo celular
  - Sistema inmunitario.

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Monitorización del SNA perioperatoria

- Se estima que el **50% de los pacientes** sufren dolor de moderado a severo inmediatamente después de la cirugía.

PAIN MEDICINE

Pain Intensity on the First Day after Surgery

A Prospective Cohort Study Comparing 179 Surgical Procedures

Hans J. Gerbershagen, M.D., Ph.D.,* Sanjay Aduckathil, M.D.,† Albert J. M. van Wijck, M.D., Ph.D.,‡ Linda M. Peelen, Ph.D.,§ Cor J. Kalkman, M.D., Ph.D.,‖ Winfried Meissner, M.D., Ph.D.#

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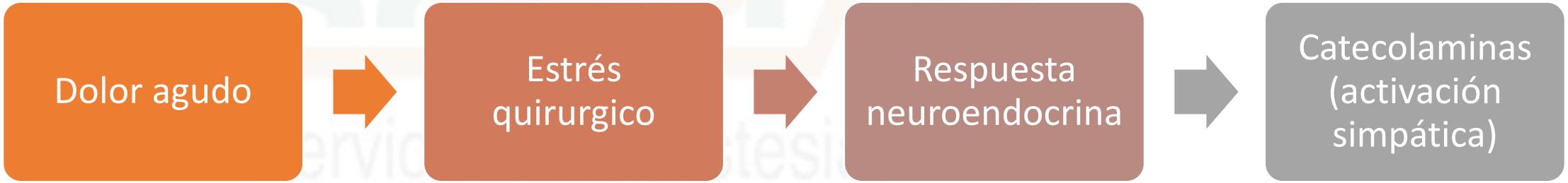
Monitorización del SNA perioperatoria

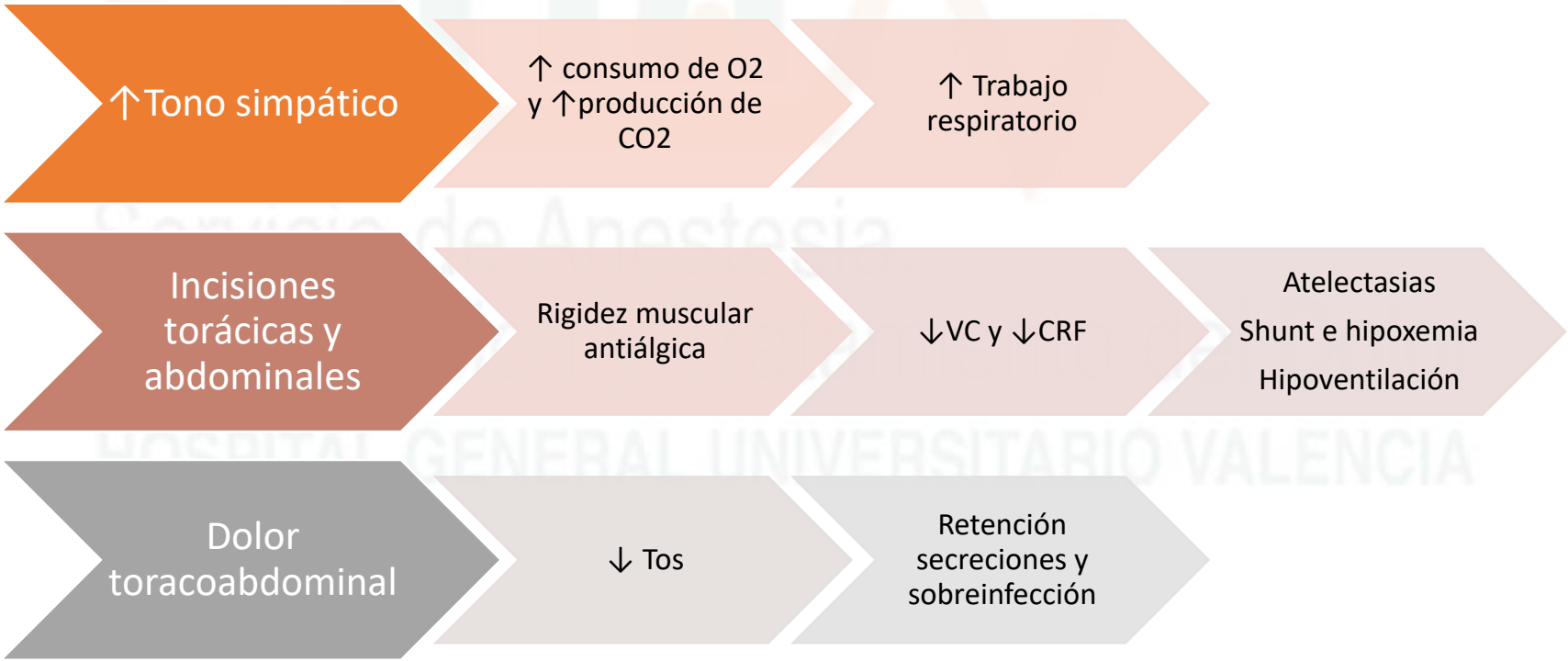


Monitorización del SNA perioperatoria

- Efectos cardiovasculares:
  - Irritabilidad miocárdica
  - Taquicardia
  - Incremento de resistencias vasculares periféricas
  - Incremento en la demanda de O2 (Riesgo de isquemia miocárdica)
  - Incremento del gasto cardiaco

Monitorización del SNA perioperatoria

- Efectos respiratorios:



Monitorización del SNA perioperatoria

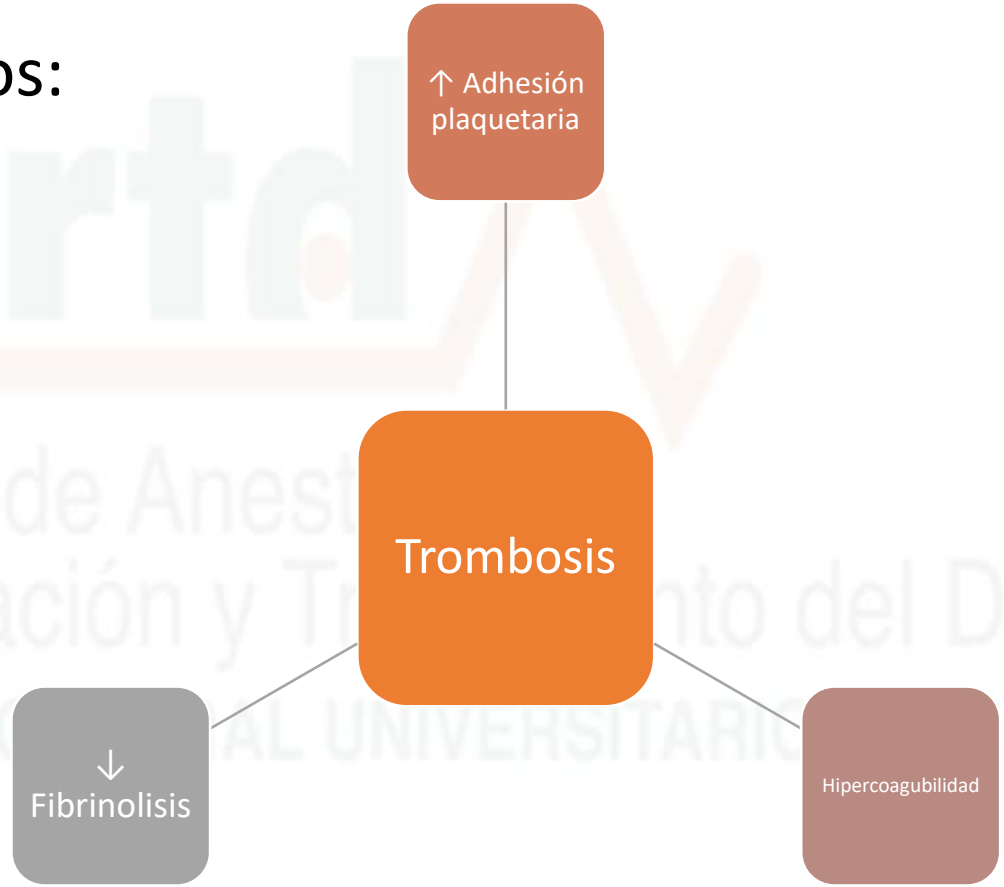
- Efectos gastrointestinales:

Monitorización del SNA perioperatoria

- Efectos en sistema endocrino:
  - ↑ en hormonas catabólicas:
    - Catecolaminas
    - Glucagon
    - Cortisol
  - ↓ Hormonas anabólicas:
    - Insulina
    - Testosterona

Monitorización del SNA perioperatoria

- Efectos hematológicos:



Monitorización del SNA perioperatoria

- Efectos inmunitarios:
  - Leucocitosis
  - Depresión del sistema retículo endotelial → Inmunosupresión
  - Riesgo incrementado de crecimiento tumoral y metástasis

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Monitorización del SNA perioperatoria

- Efectos psicológicos:
  - Ansiedad
  - Trastornos del sueño
  - Depresión
  - Ira
  - Frustración

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Monitorización del SNA perioperatoria

- No obstante, el exceso de analgesia también tiene efectos nocivos:
  - Sedación prolongada.
  - Insuficiencia respiratoria persistente.
  - NVPO
  - Hiperalgesia postoperatoria

British Journal of Anaesthesia 109 (5): 742–53 (2012)
Advance Access publication 3 October 2012 · doi:10.1093/bja/aes276

BJA

Evidence-based analysis of risk factors for postoperative nausea and vomiting†

C. C. Apfel[1*‡], F. M. Heidrich[2‡], S. Jukar-Rao[1], L. Jalota[3], C. Hornuss[4], R. P. Whelan[1], K. Zhang[5] and O. S. Cakmakkaya[6]

[1] Perioperative Clinical Research Core, Department of Anaesthesia and Perioperative Care, University of California—San Francisco, UCSF Medical Centre at Mt Zion, 1600 Divisadero, C-447, San Francisco, CA 94115, USA
[2] Department of Cardiology and Internal Medicine, Dresden University of Technology—Heart Centre, Fetscherstr. 76, 01309 Dresden, Germany
[3] Reading Hospital and Medical Centre, PO Box 16052, Reading, PA 19612-6052, USA
[4] Department of Anaesthesiology, Klinikum der Universität München, Marchioninistrasse 15, 81377 Munich, Germany
[5] Department of Cardiology and Angiology, Charité—Universitätsmedizin Berlin, Campus Charité Mitte, Berlin, Germany
[6] Department of Medical Education, University of Istanbul, Cerrahpasa Medical School, Istanbul, Turkey
* Corresponding author. E-mail: capfel@ponv.org, apfelc@anesthesia.ucsf.edu

Anaesth Intensive Care 2011; 39: 545-558

Reviews

Opioids, ventilation and acute pain management

P. E. MACINTYRE*, J. A. LOADSMAN†, D. A. SCOTT‡

Acute Pain Service, Department of Anaesthesia, Pain Medicine and Hyperbaric Medicine, Royal Adelaide Hospital and Discipline of Acute Care Medicine, University of Adelaide, Adelaide, South Australia; Sydney Medical School, University of Sydney and Department of Anaesthetics, Royal Prince Alfred Hospital, Sydney, New South Wales; and Department of Anaesthesia, St Vincent's Hospital and Faculty of Medicine Dentistry and Health Sciences, University of Melbourne, Melbourne, Victoria, Australia

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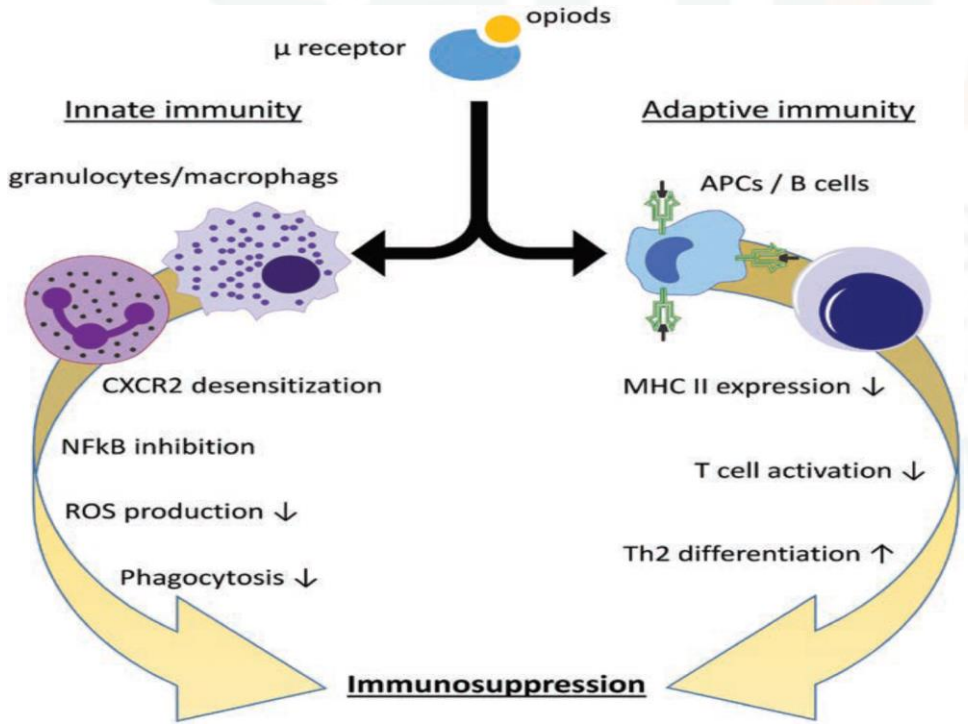
Monitorización del SNA perioperatoria

- Los opioides son bien conocidos por su capacidad de modular el sistema inmune, tanto el INNATO como el ADAPTATIVO.



REVIEW

CURRENT OPINION

Anesthesia-induced immune modulation

Jan Rossaint and Alexander Zarbock

Hindawi Publishing Corporation
BioMed Research International
Volume 2015, Article ID 161508, 8 pages
http://dx.doi.org/10.1155/2015/161508

Research Article

Morphine Promotes Tumor Angiogenesis and Increases Breast Cancer Progression

Sabrina Bimonte, Antonio Barbieri, Domenica Rea, Giuseppe Palma, Antonio Luciano, Arturo Cuomo, Claudio Arra, and Francesco Izzo

Istituto Nazionale per lo Studio e la Cura dei Tumori "Fondazione G. Pascale", IRCCS, Via Mariano Semmola, 80131 Naples, Italy

Research Paper

PAIN®

Morphine does not facilitate breast cancer progression in two preclinical mouse models for human invasive lobular and HER2$^+$ breast cancer

Chris W. Doornebal[a,b], Kim Vrijland[a], Cheei-Sing Hau[a], Seth B. Coffelt[a], Metamia Ciampricotti[a], Jos Jonkers[c], Karin E. de Visser[a,*], Markus W. Hollmann[b]

Inaugural Review Series
Translational Pain Research

OPEN

PAIN REPORTS®

The dark side of opioids in pain management: basic science explains clinical observation

Cyril Rivat[a], Jane Ballantyne[b,*]

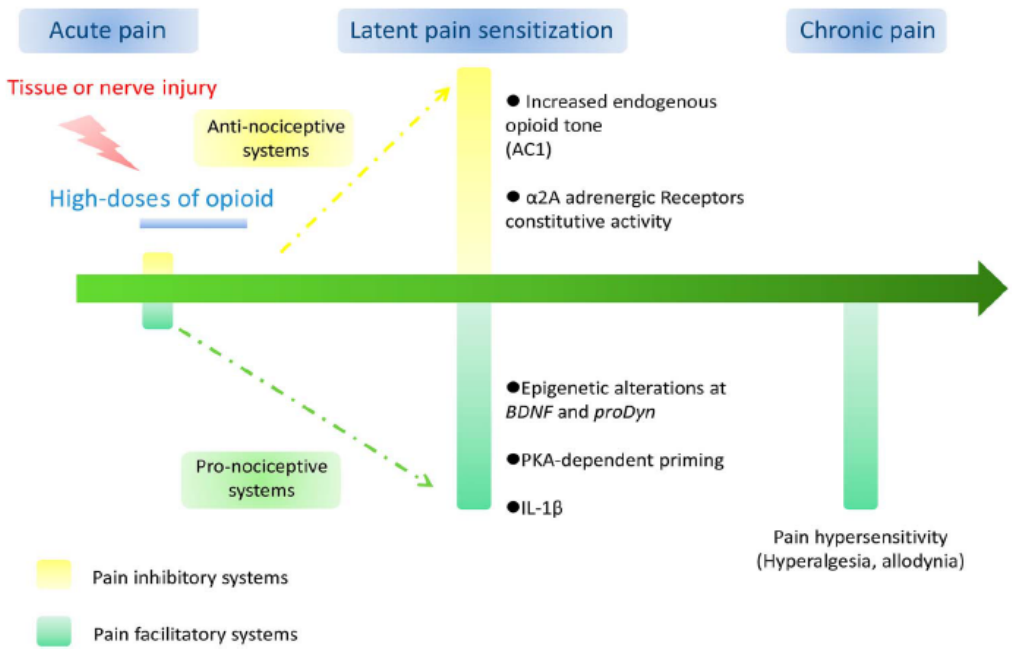
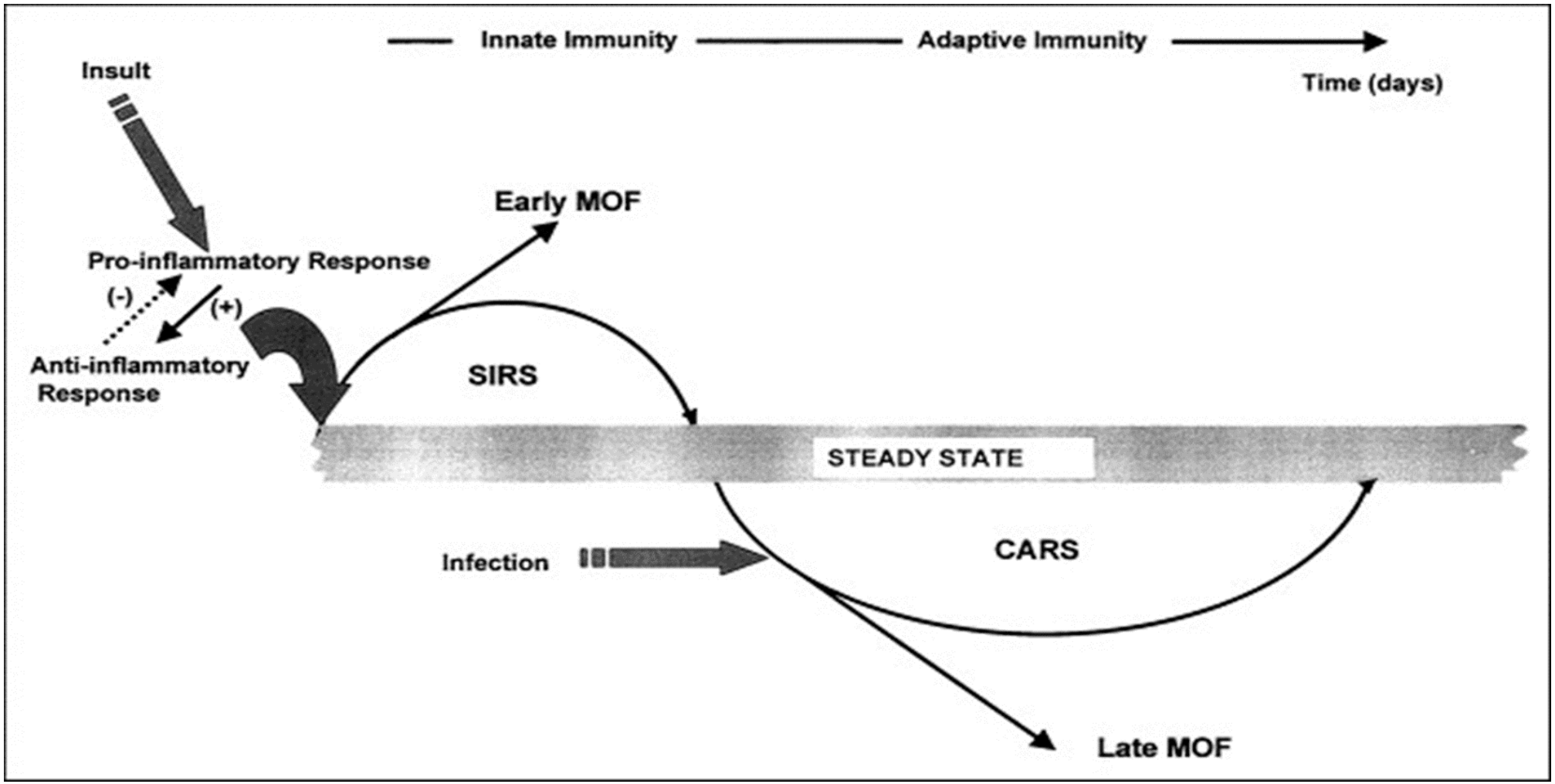


Figure 2. Hypothesis on the transition from acute to chronic facilitate by opioid administration. Acute tissue or nerve injury produces an increased activity in pain facilitatory systems that can be exaggerated by treatment with high doses of opioid. After remission and cessation of opioid administration, increased endogenous pain inhibition through opioid and α2A adrenergic receptors constitutive activity suppress sustained hyperalgesia that may depend on epigenetic alterations at *BDNF* and *proDyn gene* expression, protein kinase-A in primary afferent neurons and increased expression of the pro-inflammatory cytokines IL-1β. This results in the development of latent pain sensitization that may be associated with long-term pain vulnerability that could facilitate the development of chronic pain.


Innate Immunity
Adaptive Immunity
Time (days)
Insult
Early MOF
Pro-inflammatory Response
(-)
(+)
Anti-inflammatory Response
SIRS
STEADY STATE
Infection
CARS
Late MOF

Monitorización del SNA perioperatoria

- Tanto el EXCESO como la FALTA de analgesia se asocian a efectos deletéreos tanto en el intraoperatorio como en el postoperatorio.

Monitorización del SNA perioperatoria

- Clásicamente, la monitorización de la respuesta al estímulo nociceptivo en el paciente anestesiado se obtenía por variaciones en:
  - Presión arterial
  - Frecuencia cardiaca
  - Lagrimeo
  - Sudoración…
- No obstante, estas estimaciones son IMPRECISAS.
- Sujetas a muchas variables (cirugía, enfermedades, posición, medicación…).

Monitorización del SNA perioperatoria

- En los últimos años se han desarrollado diferentes métodos para cuantificar la intensidad del estímulo nociceptivo en los pacientes anestesiados.
- Emplean diferentes variables fisiológicas para interpretar la nocicepción en una variable tangible.
- Las más frecuentes se basan en el análisis de la variación de la frecuencia cardiaca.

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Dispositivos disponibles

- Uniparamétricos:
  - ANI: Variabilidad de la FC, interpretando la actividad del SNA
  - Conductancia de la piel: Picos de la actividad simpática.
  - Pupilometría: Variación pupilar. Equilibrio simpatico-vagal
  - Umbral NFR: reflejo de abstinencia espinal tras activación de receptores aferentes nociceptivos

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Dispositivos disponibles

- Biparamétricos:
  - SPI: Evalúa el tono periférico y cardiaco, valorando VC y análisis de la onda de pulso.
  - qNOX: EEF y EMG.
- Multiparamétricos:
  - NOL

BJA

British Journal of Anaesthesia, 123 (2): e312–e321 (2019)

doi: 10.1016/j.bja.2019.03.024
Advance Access Publication Date: 30 April 2019
Review Article

PERIOPERATIVE PAIN ASSESSMENT AND MANAGEMENT

Objective monitoring of nociception: a review of current commercial solutions

Thomas Ledowski[1,2,*]

[1]Anaesthesiology Unit, School of Medicine, University of Western Australia, Perth, Australia and [2]Dept. of Anaesthesia and Pain Medicine, Royal Perth Hospital, Perth, Australia

E-mail: Thomas.ledowski@health.wa.gov.au

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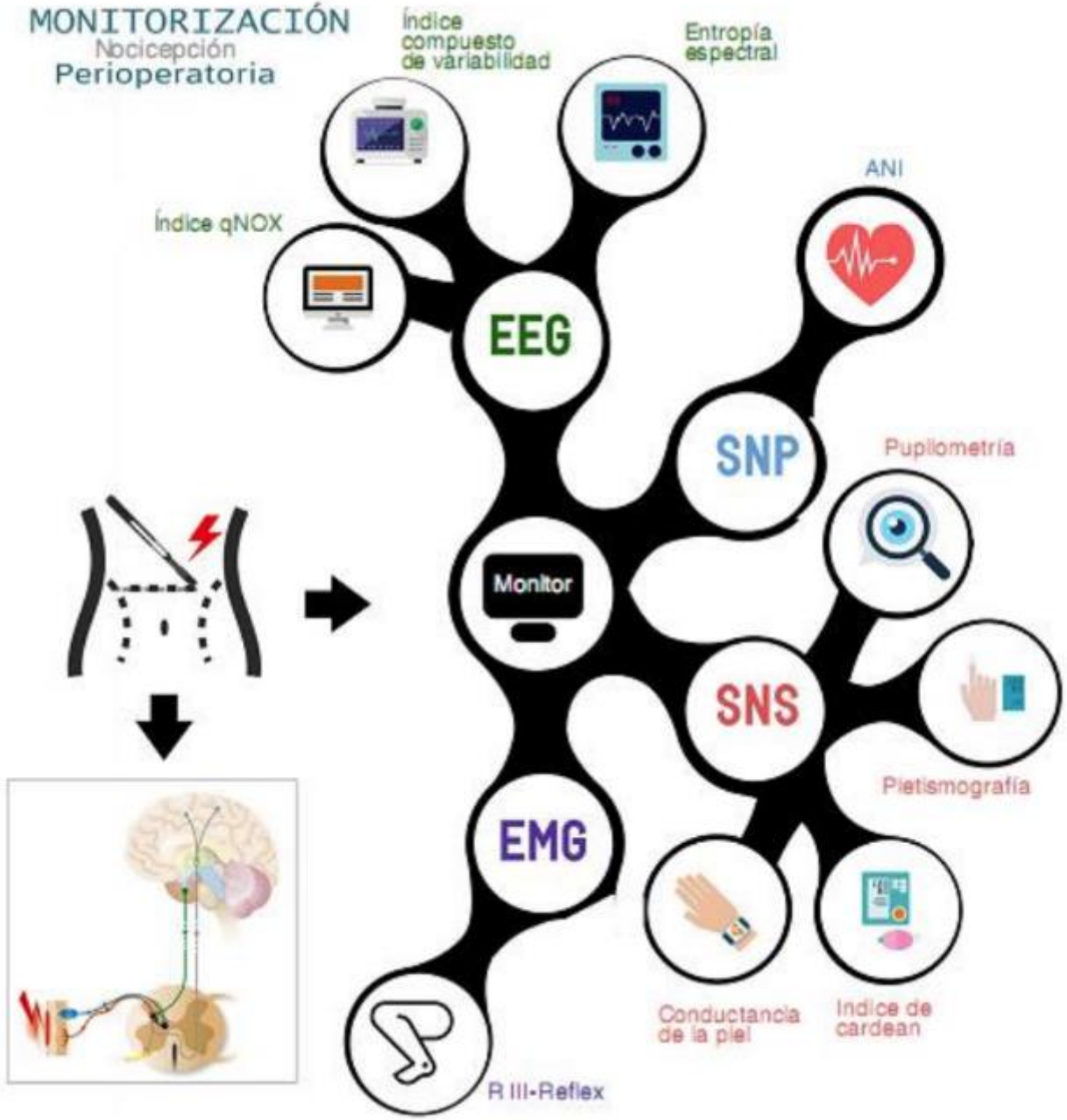

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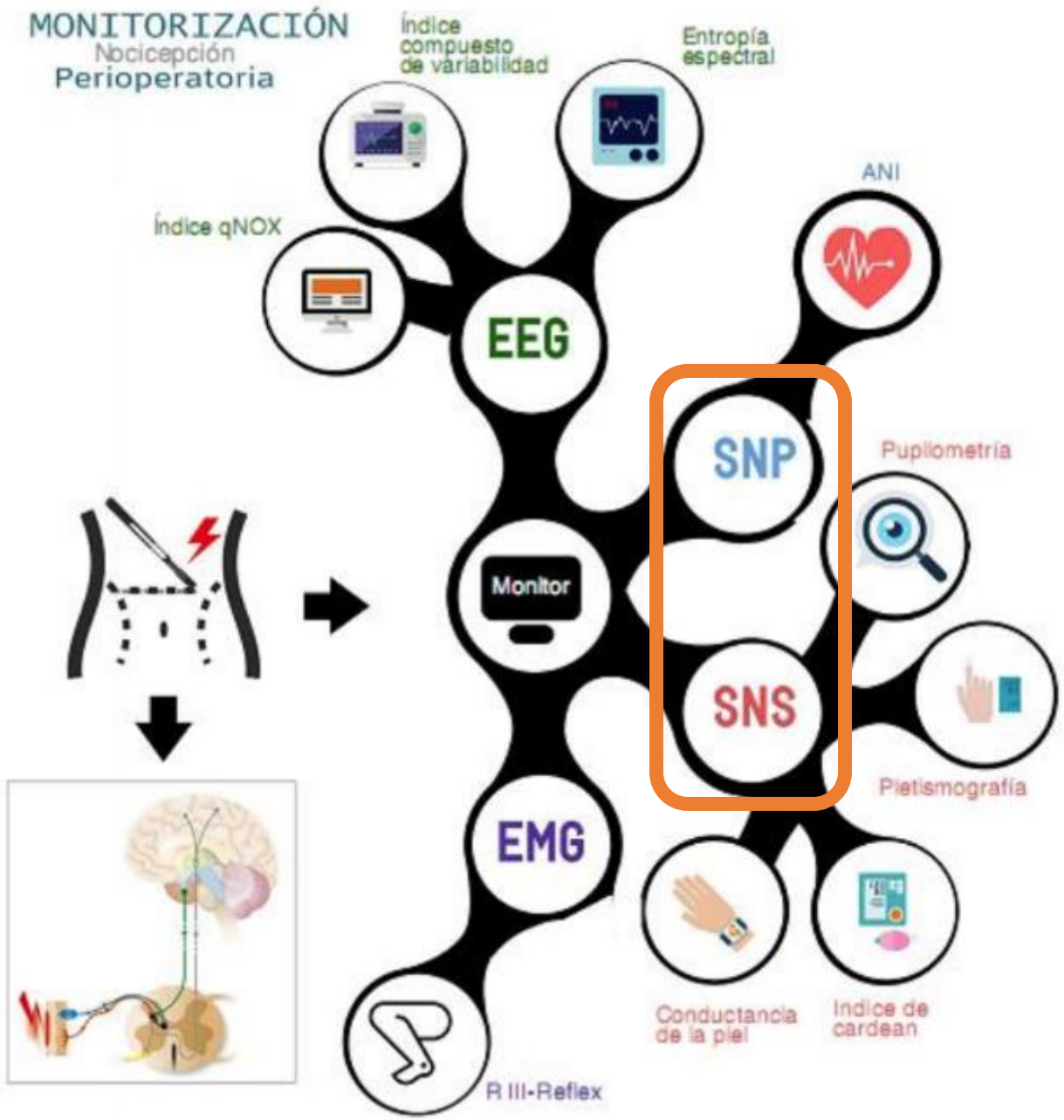

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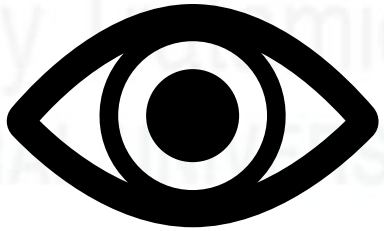
Variación del diámetro pupilar

- Fenómeno natural reconocido y cuantificable mediante un pupilómetro.
- Útil para la monitorización de la nocicepción intraoperatoria e incluso en el periodo postoperatorio
- Método más invasivo



Rev Esp Anestesiol Reanim. 2016;63(5):253–260

Revista Española de Anestesiología y Reanimación

www.elsevier.es/redar

ORIGINAL

Utilización de la monitorización analgésica intraoperatoria mediante pupilometría en el consumo de analgésicos durante las primeras 12 horas del postoperatorio

A. Abad Torrent[a,*], V. Rodríguez Bustamante[a], N. Carrasco Fons[b], F.J. Roca Tutusaus[c], D. Blanco Vargas[a] y C. González García[d]

[a] Servicio de Anestesia, Hospital de Viladecans, Viladecans, Barcelona, España
[b] Servicio de Farmacología, Hospital de Viladecans, Viladecans, Barcelona, España
[c] Subdirecció General de Drogodependències, Departament de Salut, Barcelona, España
[d] Servicio de Ginecología, Hospital de Viladecans, Viladecans, Barcelona, España

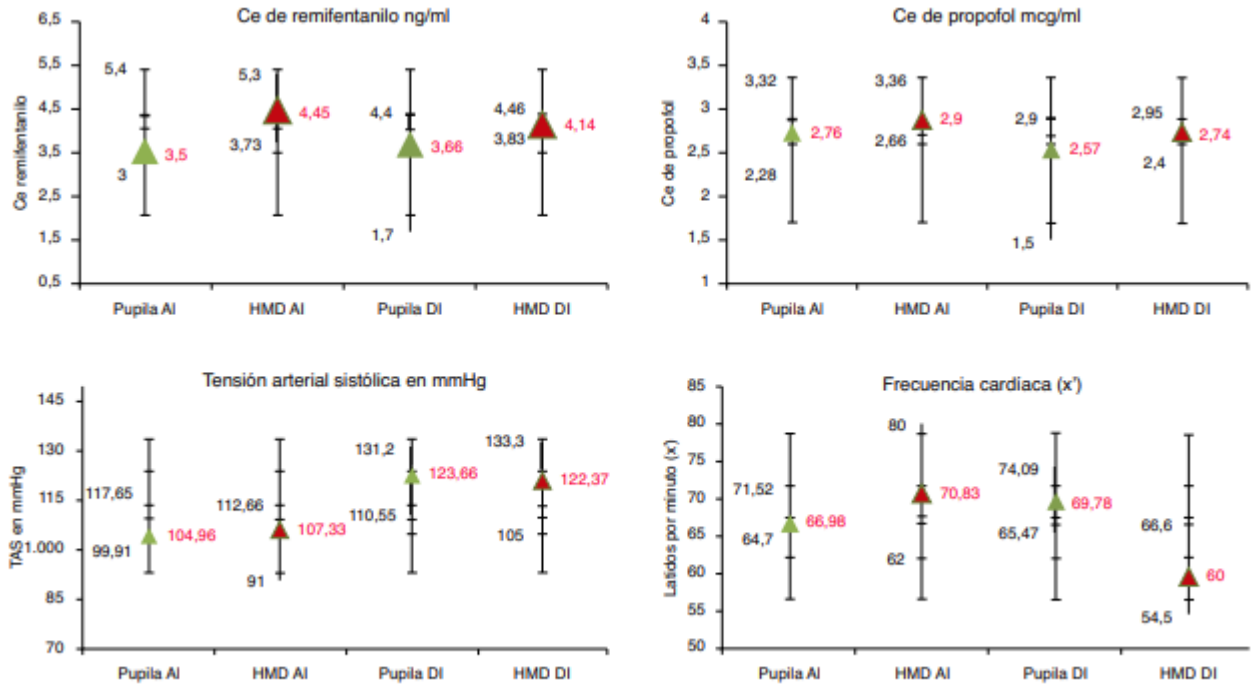


Figura 2 Monitorización intraoperatoria de los parámetros farmacológicos y hemodinámicos.

Rev Esp Anestesiol Reanim. 2016;63(5):253–260

Revista Española de Anestesiología y Reanimación

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ORIGINAL

Utilización de la monitorización analgésica intraoperatoria mediante pupilometría en el consumo de analgésicos durante las primeras 12 horas del postoperatorio

A. Abad Torrent[a,*], V. Rodríguez Bustamante[a], N. Carrasco Fons[b], F.J. Roca Tutusaus[c], D. Blanco Vargas[a] y C. González García[d]

[a] Servicio de Anestesia, Hospital de Viladecans, Viladecans, Barcelona, España
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[c] Subdirecció General de Drogodependències, Departament de Salut, Barcelona, España
[d] Servicio de Ginecología, Hospital de Viladecans, Viladecans, Barcelona, España

Tabla 2 Resultados

	Grupo pupilometría (n = 30) Mediana (IC 95%)	Grupo hemodinámica (n = 29) Mediana (IC 95%)
EVA 3 h	2 (1,29-2,11)	3 (2,36-3,71)
EVA 8 h	1 (0,61-1,39)	2 (1,53-2,54)
EVA 12 h	1 (0,62-1,31)	2 (1,39-2,34)

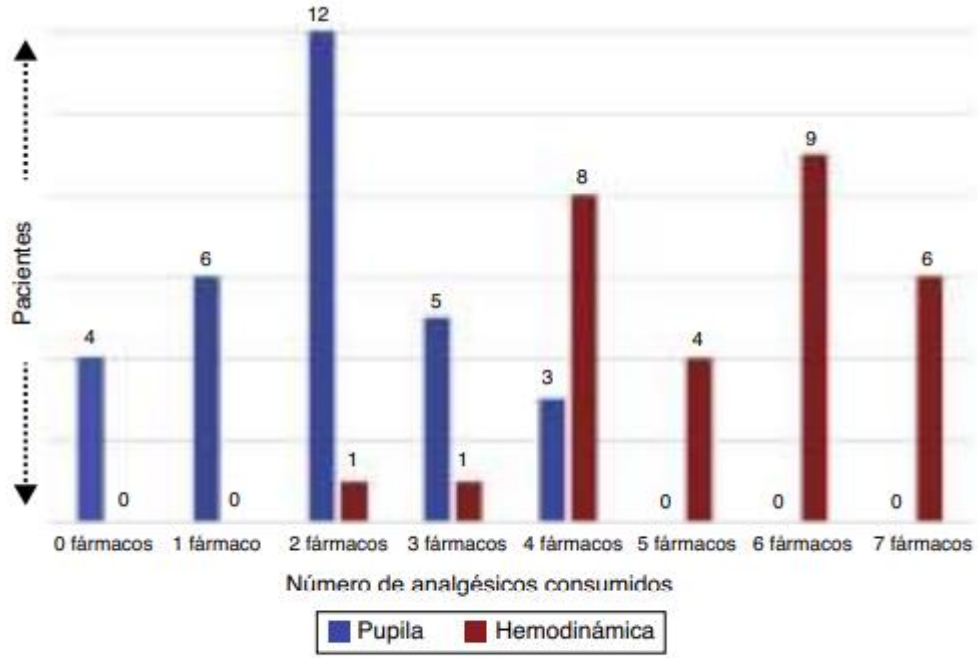

Figura 3 Consumo de analgésicos en las primeras 12 h en planta.

Rev Esp Anestesiol Reanim. 2016;63(5):253-260

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Utilización de la monitorización analgésica intraoperatoria mediante pupilometría en el consumo de analgésicos durante las primeras 12 horas del postoperatorio

A. Abad Torrent[a,*], V. Rodríguez Bustamante[a], N. Carrasco Fons[b], F.J. Roca Tutusaus[c], D. Blanco Vargas[a] y C. González García[d]

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[d] Servicio de Ginecología, Hospital de Viladecans, Viladecans, Barcelona, España

La monitorización de la analgesia intraoperatoria mediante pupilometría resultó un método simple y fiable que consiguió reducir la intensidad del dolor y el consumo de analgésicos en planta las primeras 12 h del postoperatorio tras cirugía mayor ginecológica

Research Article

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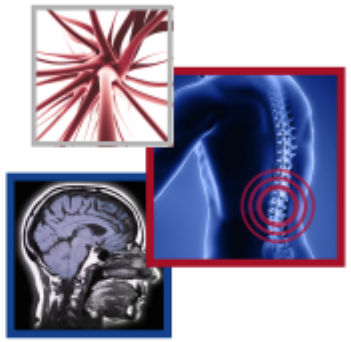
Pain Management



Pupillary reflex dilation and pain index evaluation during general anesthesia using sufentanil: a double-blind randomized controlled trial

Diederik Van Vlaenderen*[,1], Guy Hans[2], Vera Saldien[1] & Davina Wildemeersch[1,2]

[1]Department of Anesthesia, Antwerp University Hospital (UZA), Drie Eikenstraat 655, 2650 Edegem, Belgium

[2]Multidisciplinary Pain Centre, Antwerp University Hospital (UZA), Drie Eikenstraat 655, 2650 Edegem, Belgium

*Author for correspondence: van.vlaenderen@telenet.be

Summary points

- Nociception is a possible way to titrate opioids in unconscious patients.
- Seven devices are available to measure nociception during anesthesia.
- A pupillometer measures pupil pain reflex during increasing stimulation.
- To our knowledge, this is the first study using bolus sufentanil in combination with pupillometer and pupillometry pain index score.
- The wanted pupillometry pain index score of 1 or 2 was reached only in 31% of the intervention group patients and 26% of the control group patients.
- There was no effect on well-being between the study and the control group.
- The study group received a higher amount of sufentanil.
- Further study is needed; a new protocol could be made in addition with the pupil baseline diameter and/or other sufentanil dosage.

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SARTD-CHGUV Sesión de formación continuada
Valencia, 20 de Diciembre de 2022

Pupillometry pain index decreases intraoperative sufentanyl administration in cardiac surgery: a prospective randomized study

Vivien Berthoud[1], Maxime Nguyen[1,2], Anouck Appriou[1], Omar Ellouze[1], Mohamed Radhouani[1], Tiberiu Constandache[1], Sandrine Grosjean[1], Bastien Durand[1], Isabelle Gounot[1], Pierre-Alain Bahr[1], Audrey Martin[1], Nicolas Nowobilski[1], Belaid Bouhemad[1,2] & Pierre-Grégoire Guinot[1,2]✉

During the postoperative course, the cumulative doses of morphine (mg) were not significantly different between groups (23 mg [15-53] vs 24 mg [17-46]; p = 0.95). We found no significant differences in chronic pain at 3 months between the 2 groups (0 (0%) vs 2 (9.5%) p = 0.49). Overall, the algorithm based on the pupillometry pain index decreased the dose of sufentanyl infused during cardiac surgery.

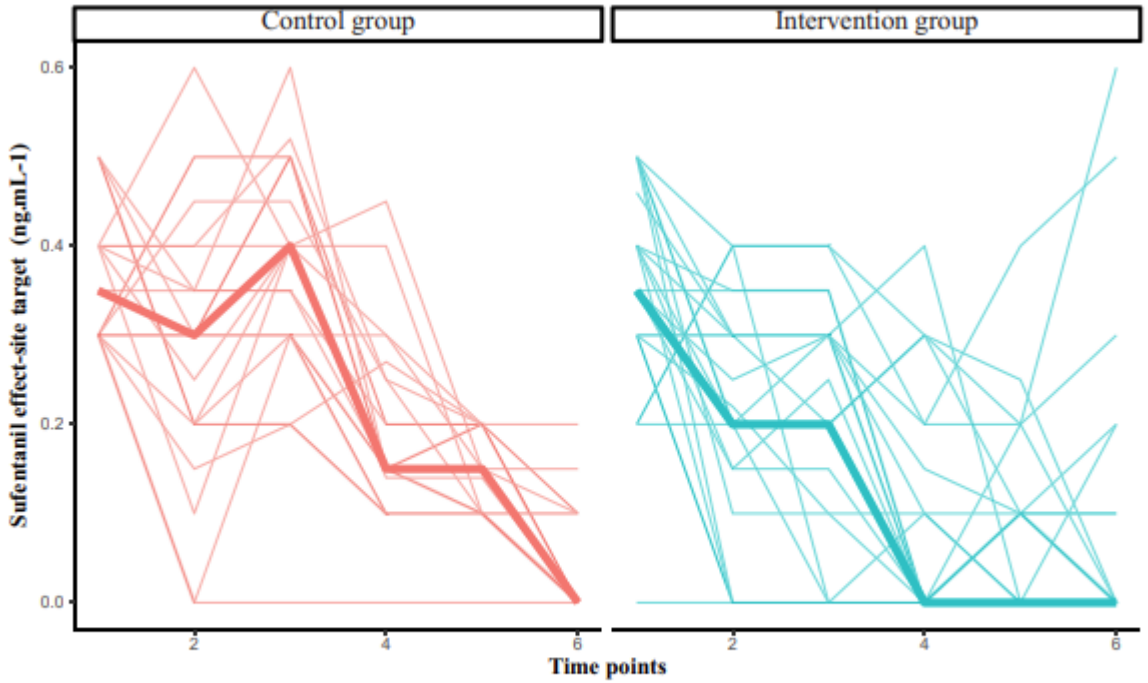

Figure 3. Evolution of sufentanyl site target. Time points: 2 min before orotracheal intubation (T1) 2 min before skin incision (T2); after sternotomy (T3); at the start of the CPB (T4); at CPB weaning (T5); at skin closure (T6).

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ANI (ANALGESIA NOCICEPTION INDEX®)

- Sistema Mdoloris.
- Variación entre las distancias de cada onda R del electrocardiograma o variación de la frecuencia cardiaca.
- Controlado por el sistema nervioso autónomo (SNA).
- Esta variación mostrará la actividad de los sistemas nerviosos simpatico y parasimático.

ANI (ANALGESIA NOCICEPTION INDEX®)

- Los valores del ANI nos mostraran la actividad del sistema nervioso autónomo del paciente.
- Durante la anestesia general se buscará un rango entre 50 y 70, el cual se relaciona con analgesia adecuada.

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ANI (ANALGESIA NOCICEPTION INDEX®)

- >70: Posibilidad de reducir la administración de opioides, predominio del sistema nervioso parasimpático.

ELSEVIER

Anaesthesia Critical Care & Pain Medicine

Volume 36, Issue 4, August 2017, Pages 229-232

Original Article

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

Georges Daccache [a, b], Edouard Caspersen [a], Michel Pegoix [a], Kelly Monthé-Sagan [a], Ludovic Berger [a, b], Dominique Fletcher [c], Jean-Luc Hanouz [a, b]

This prospective study demonstrated that the ANI can be used to adequately guide intraoperative remifentanil administration during vascular surgery. Such guidance resulted in **low remifentanil consumption**, **low postoperative pain rates** and **low opioid rescue** analgesia.

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ANI (ANALGESIA NOCICEPTION INDEX®)

- >70: Posibilidad de reducir la administración de opioides, predominio del sistema nervioso parasimpático.

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

Nurseda Dundar ✉, Alparslan Kus, Yavuz Gurkan, Kamil Toker & Mine Solak

Journal of Clinical Monitoring and Computing **32**, 481–486 (2018) | Cite this article

Sin diferencias en los tiempos de recuperación post anestesia ni el uso de analgesia de rescate.
Menor consumo total de remifentanilo en el grupo monitorizado con ANI.

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ANI (ANALGESIA NOCICEPTION INDEX®)

- <50: excesivo estimulo nociceptivo. Predominio del sistema nervioso simpático: probabilidad alta de reacción hemodinámica al estimulo en los próximos 10 minutos.

Validation of Innovative Techniques for Monitoring Nociception during General Anesthesia

A Clinical Study Using Tetanic and Intracutaneou Stimulation

Sandra Funcke, M.D., Sven Sauerlaender, Hans O. Pinnschmidt, Ph.D., Bernd Kai Bremer, C.R.N.A., Daniel A. Reuter, M.D., Rainer Nitzschke, M.D.

British Journal of Anaesthesia **110** (6): 1024–30 (2013)
Advance Access publication 6 March 2013 · doi:10.1093/bja/aet019

BJA

Influence of nociceptive stimulation on analgesia nociception index (ANI) during propofol–remifentanil anaesthesia

M. Gruenewald*, C. Ilies, J. Herz, T. Schoenherr, A. Fudickar, J. Höcker and B. Bein

Department of Anaesthesiology and Intensive Care Medicine, University Hospital Schleswig Holstein Campus Kiel, Schwanenweg 21, D-24105 Kiel, Germany

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ANI (ANALGESIA NOCICEPTION INDEX®)

- <50: excesivo estimulo nociceptivo. Predominio del sistema nervioso simpático: probabilidad alta de reacción hemodinámica al estimulo en los próximos 10 minutos.

Original Research | Published: 07 November 2015

Prediction of hemodynamic reactivity using dynamic variat Analgesia/Nociception Index (ΔANI)

E. Boselli, R. Logier, L. Bouvet & B. Allaouchiche

Journal of Clinical Monitoring and Computing **30**, 977–984 (2016) | Cite this article

Observational Study > Minerva Anestesiol. 2015 Mar;81(3):288-97. Epub 2014 Jul 11.

Prediction of hemodynamic reactivity during total intravenous anesthesia for suspension laryngoscopy using Analgesia/Nociception Index (ANI): a prospective observational study

E Boselli [1], L Bouvet, G Bégou, S Torkmani, Bernard Allaouchiche

Affiliations + expand

PMID: 25014481

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British Journal of Anaesthesia **112** (4): 715–21 (2014)
Advance Access publication 8 December 2013 · doi:10.1093/bja/aet407

BJA

PAIN

Prediction of immediate postoperative pain using the analgesia/nociception index: a prospective observational study

E. Boselli[1,2*], L. Bouvet[1], G. Bégou[1], R. Dabouz[1], J. Davidson[1], J.-Y. Deloste[1], N. Rahali[1], A. Zadam[1] and B. Allaouchiche[1,2]

[1] Department of Anaesthesiology and Intensive Care, Édouard Herriot Hospital, HCL, Lyon, France
[2] Claude Bernard Lyon I University, University of Lyon, Lyon, France

* Corresponding author: Hôpital Édouard Herriot, Service d'anesthésie-réanimation, 5 place d'Arsonval, 69003 Lyon, France.
E-mail: emmanuel.boselli@chu-lyon.fr

The measurement of ANI immediately before extubation after inhalation-remifentanil anaesthesia was significantly associated with pain intensity on arrival in PACU. The performance of ANI for the prediction of immediate postoperative pain is good and may assist physicians in optimizing acute pain management.

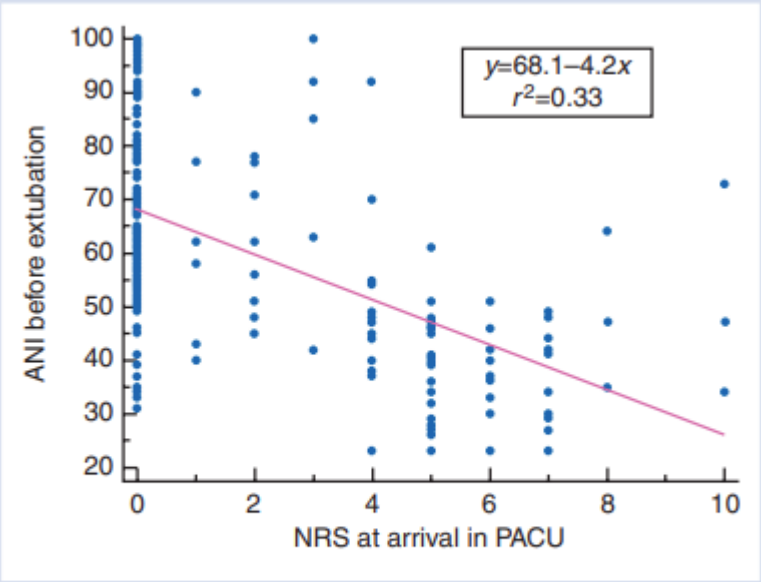

Fig 2 Negative linear relationship between ANI and NRS. ANI, analgesia/nociception index; NRS, numerical rating scale.

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Tecnología del dolor NOL®

- Sistema Medtronic.
- Basa su análisis en la integración de datos procedentes de diferentes mediciones.
- El parámetro obtenido es un valor entre el 0 y el 100.
- 0: ausencia total de nocicepción.
- 100: respuesta nociceptiva extrema.

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NOL > 25 durante más de 1-2 minutos (no como respuesta a drogas simpaticomiméticas) sugiere una **elevada respuesta nociceptiva**. Considerar analgésicos adicionales.

NOL < 10 durante más de 1-2 minutos durante la estimulación quirúrgica puede indicar una excesiva **antinocicepción**. Valorar reducir el uso de analgésicos.
Si técnica locorregional combinada, NOL <10 es lo esperado.

10 < NOL< 25 representa un buen **equilibrio** nocicepción/antinocicepción. La analgesia es adecuada.

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Ability of the Nociception Level, a Multiparameter Composite of Autonomic Signals, to Detect Noxious Stimuli during Propofol–Remifentanil Anesthesia

Chris H. Martini, M.D., Martijn Boon, M.D., Suzanne J. L. Broens, M.D., Evelien F. Hekkelman, M.D., Lisanne A. Oudhoff, M.D., Anna Willemijn Buddeke, M.D., Albert Dahan, M.D., Ph.D.

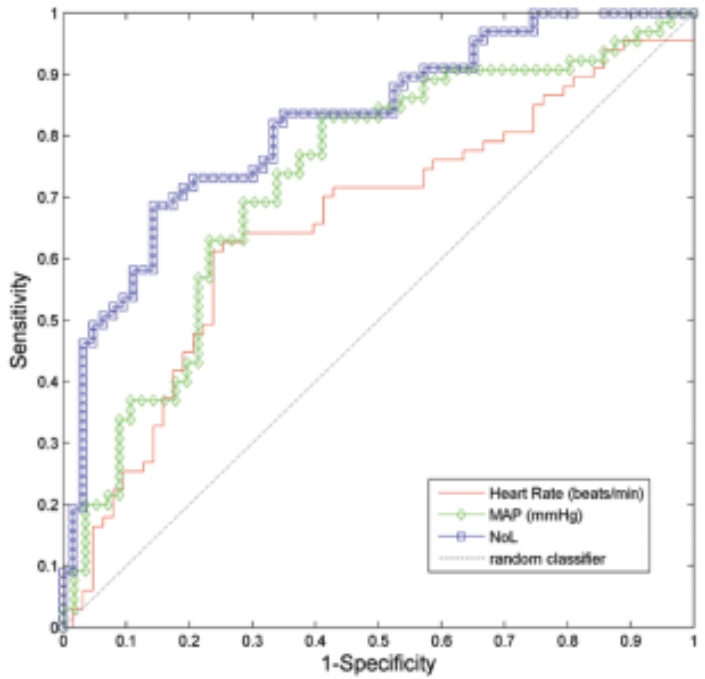

Fig. 2. Discrimination between nociceptive (incision and intubation) and nonnociceptive stimuli: receiver operating curves of heart rate, mean arterial pressure (MAP), and the composite parameter, the nociception level (NoL).

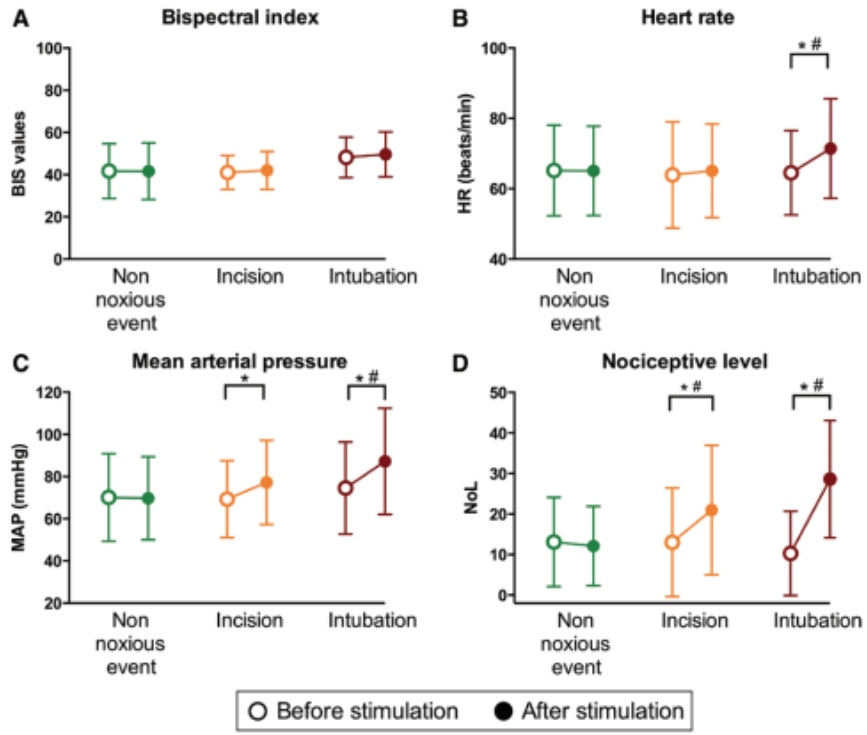

Fig. 1. Bispectral index (BIS) (*A*), heart rate (HR) (*B*), mean arterial pressure (MAP) (*C*), and nociceptive level (NoL) (*D*) before and after noxious stimulation for nonnociceptive conditions, incision, and intubation. *Paired *t* test, $P < 0.001$; #unpaired *t* test, $P < 0.001$. *Open symbol* = before stimulation; *closed symbol* = after stimulation.

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Preliminary Intraoperative Validation of the Nociception Level Index

A Noninvasive Nociception Monitor

Ruth Edry, M.D., Vasile Recea, M.D., Yuri Dikust, M.D., Daniel I. Sessler, M.D.

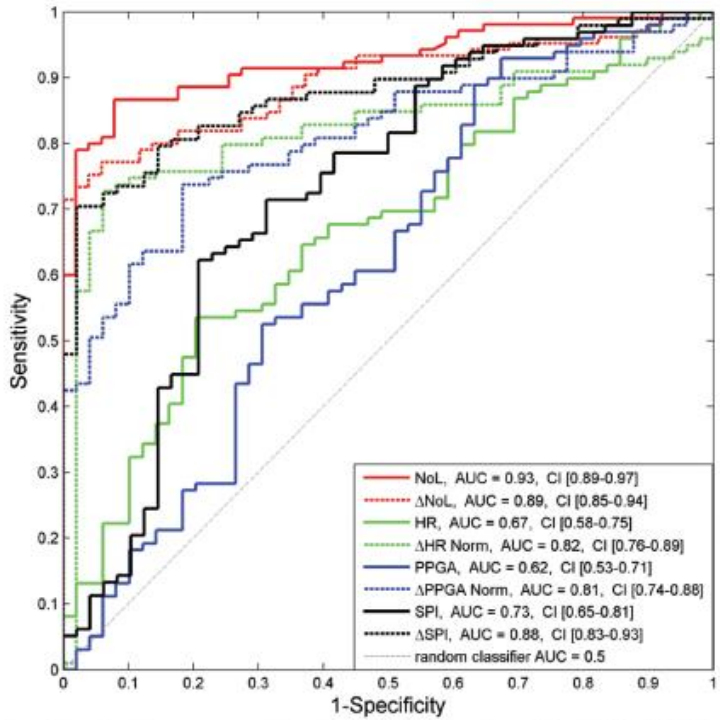

Fig. 4. Receiver operating characteristics curve analysis: discrimination of noxious stimuli (TP1 + TP2) from nonnoxious period. Nociception level (NoL) and ΔNoL outperformed all other measures. *Dashed lines* for reaction (Δ) values; *Solid lines* for post-values. Heart rate (HR) and pulse plethysmograph amplitude (PPGA) reaction values are normalized (norm). AUC = area under the curve; SPI = surgical pleth index; TP1 = intubation; TP2 = skin incision/first trocar insertion.

What We Already Know about This Topic

- Objective assessment of nociception in anesthetized patients remains challenging
- Excessive nociception may promote postoperative pain, whereas excessive antinociceptive medications may result in overdosing and related complications

What This Article Tells Us That Is New

- The nociception level index, based on an algorithmic combination of multiple physiologic measures, was compared with its underlying measures in anesthetized surgical patients
- Compared to its individual underlying measures, the multiparametric nociception level index was better able to distinguish nonnoxious and graded noxious stimuli, as well as the response to opioids

Table 3. Sensitivity for Detecting Noxious Events at 84% Specificity

Parameter/Index	Sensitivity (%)	95% CI
NoL	87	77–92%
HR	37	28–47%
PPGA	21	14–30%
SPI	43	33–53%
ΔNoL	80	71–87%
ΔHR	76	66–84%
ΔPPGA	64	54–73%
ΔSPI	80	71–87%

Nociception level (NoL) achieved the highest sensitivity both in absolute values and reaction (Δ) values.

HR = heart rate; PPGA = pulse plethysmograph amplitude; SPI = surgical pleth index.

ANESTHESIOLOGY

Nociception-guided *versus* Standard Care during Remifentanil–Propofol Anesthesia

A Randomized Controlled Trial

Fleur S. Meijer, M.D., Chris H. Martini, M.D., Ph.D., Suzanne Broens, M.D., Martijn Boon, M.D., Marieke Niesters, M.D., Ph.D., Leon Aarts, M.D., Ph.D., Erik Olofsen, Ph.D., Monique van Velzen, Ph.D., Albert Dahan, M.D., Ph.D.

ANESTHESIOLOGY 2019; 130:745–55

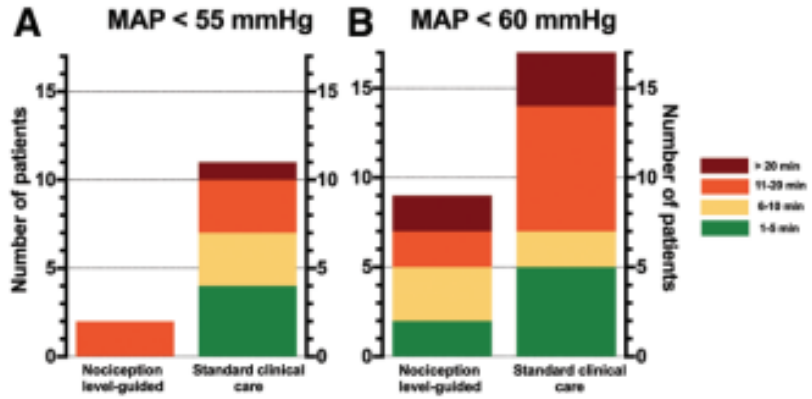

Fig. 3. Number of patients and duration of hypotensive events in standard clinical practice and nociception level–guided patients with a mean arterial pressure (MAP) cutoff of 55 mm Hg (*A*; $P = 0.006$) and 60 mm Hg (*B*; $P = 0.055$).

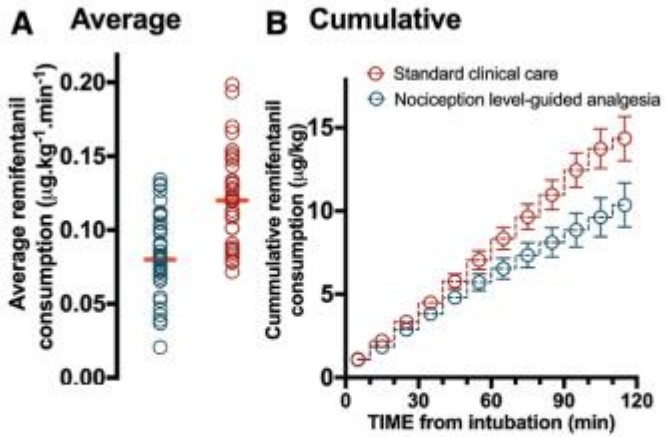

Fig. 2. (*A*) Individual remifentanil doses (in µg · kg^{-1} · min^{-1}) and mean values (*orange bars*) in the two treatment groups ($P < 0.001$). (*B*) Cumulative remifentanil consumption (µg/kg) during the first 2 h of anesthesia. *Red symbols*, standard clinical care; *dark green symbols*, nociception level–guided analgesia.

ANESTHESIOLOGY

Nociception-guided *versus* Standard Care during Remifentanil–Propofol Anesthesia

A Randomized Controlled Trial

Fleur S. Meijer, M.D., Chris H. Martini, M.D., Ph.D., Suzanne Broens, M.D., Martijn Boon, M.D., Marieke Niesters, M.D., Ph.D., Leon Aarts, M.D., Ph.D., Erik Olofsen, Ph.D., Monique van Velzen, Ph.D., Albert Dahan, M.D., Ph.D.

ANESTHESIOLOGY 2019; 130:745–55

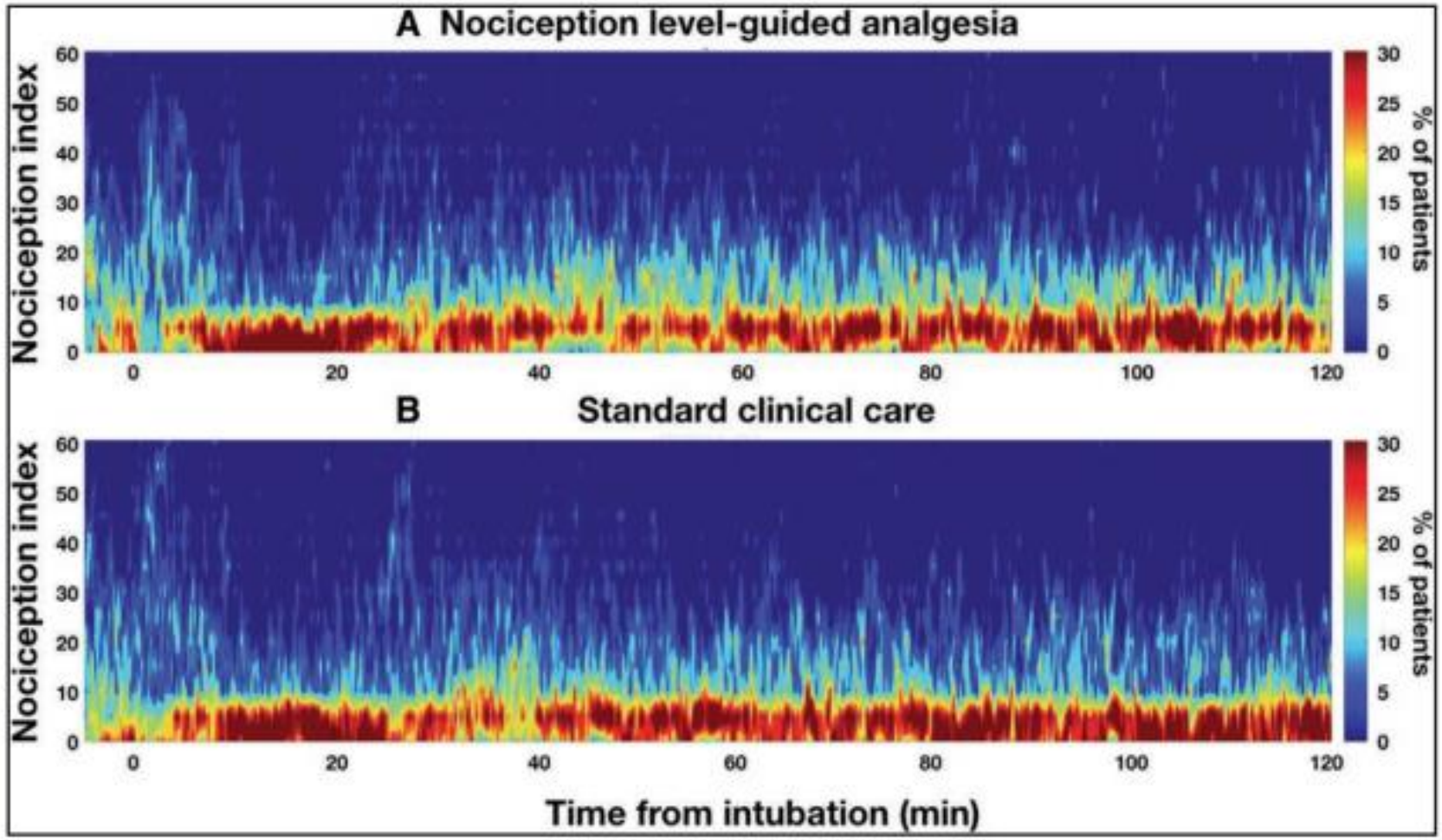

Fig. 4. Distribution of nociception level values during nociception level–guided analgesia (*A*) and during standard clinical care (*B*). The colors represent the percentage of patients ranging from dark blue (0%) to dark red (30%); see legend bars. The data are the 5-s outputs of the nociception level device. The data are aligned at intubation ($t = 0$ min). In the nociception level–guided group more patients fall in the designated limits of nociception level 10 to 25 as apparent by more light blue to yellow color; the equal amounts of dark blue and dark red are the manifestation of no difference between groups in nociception level values less than 10 and greater than 25.

Original Contribution

"Impact of Nociception Level (NOL) index intraoperative guidance of fentanyl administration on opioid consumption, postoperative pain scores and recovery in patients undergoing gynecological laparoscopic surgery. A randomized controlled trial"

Fabien Espitalier MD, PhD, DESAR [a, d], Moulay Idrissi BEng, MSc [a], Annik Fortier MSc [b], Marie-Ève Bélanger MD, PGdip(ed), FRCPC [a], Lucie Carrara MD, DESAR [a], Sarah Dakhlallah MD, Chantal Rivard MD, FRCSC [c], Véronique Brulotte MD, MSc, FRCPC [a], Valérie Zaphiratos MD, MSc, FRCPC [a], Christian Loubert MD, FRCPC [a], Nadia Godin RN, Research Coordinator [a], Louis-Philippe Fortier MD, MSc, FRCPC [a], Olivier Verdonck MD, MSc, DESAR [a], Philippe Richebé MD, PhD, DESAR [a]

Highlights

- NOL index is a recently developped index to better assess intraoperative nociception level
- NOL-guided intraoperative antinociception allows for rationalized and personalized management of opioids
- In hysterectomies it resulted in a significant reduction of intraoperative doses of fentanyl per hour of surgery
- No significant difference was seen on postoperative pain scores and analgesics' consumption
- Larger studies must be proposed in the future, powered on these postoperative outcomes.

Reduced postoperative pain using Nociception Level-guided fentanyl dosing during sevoflurane anaesthesia: a randomised controlled trial

Fleur Meijer[1], Maarten Honing[1], Tessa Roor[1,2], Samantha Toet[1,2], Paul Calis[2], Erik Olofsen[1], Chris Martini[1], Monique van Velzen[1], Leon Aarts[1], Marieke Niesters[1], Martijn Boon[1] and Albert Dahan[1,*]

[1]Department of Anesthesiology, Leiden University Medical Center, Leiden, Netherlands and [2]Department of Anesthesiology, Alrijne Hospital, Leiderdorp, Netherlands

*Corresponding author. E-mail: a.dahan@lumc.nl

Editor's key points

- There are recognised challenges in optimising intra-operative analgesia with no direct measure of pain in anaesthetised patients.
- Integrating a wide range of relevant factors into an algorithm, as is used in the Nociception Level index, has shown some promise in guiding analgesia.
- Despite similar levels of opioid use and depth of anaesthesia, use of the NOL index to guide intra-operative fentanyl dosing resulted in reduced post-operative pain scores and a smaller increase in stress hormones (adrenocorticotropic hormone [ACTH] and cortisol) compared with standard care.
- These promising results require further study to understand the mechanisms of improved analgesia.

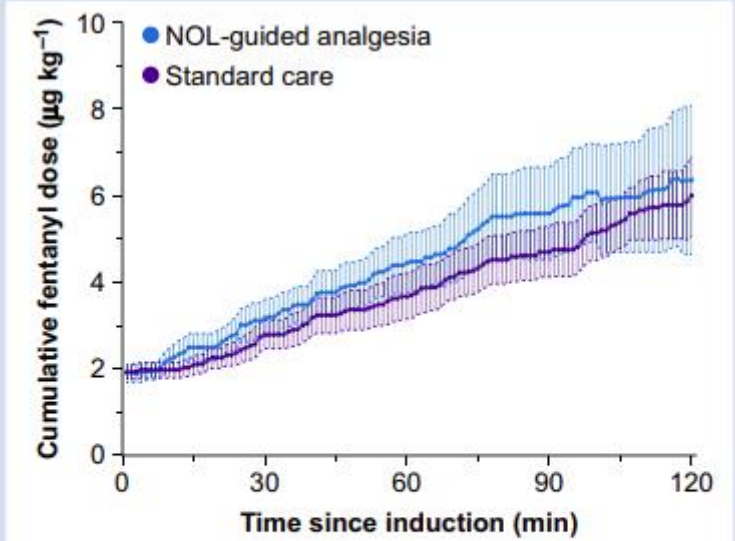

Fig. 3. Cumulative fentanyl dosing in Nociception Level (NOL)-guided patients (red symbols) and patients receiving standard clinical care (blue symbols). Data are 1-min averages (95% confidence intervals).

PAIN

Reduced postoperative pain using Nociception Level-guided fentanyl dosing during sevoflurane anaesthesia: a randomised controlled trial

Fleur Meijer[1], Maarten Honing[1], Tessa Roor[1,2], Samantha Toet[1,2], Paul Calis[2], Erik Olofsen[1], Chris Martini[1], Monique van Velzen[1], Leon Aarts[1], Marieke Niesters[1], Martijn Boon[1] and Albert Dahan[1,*]

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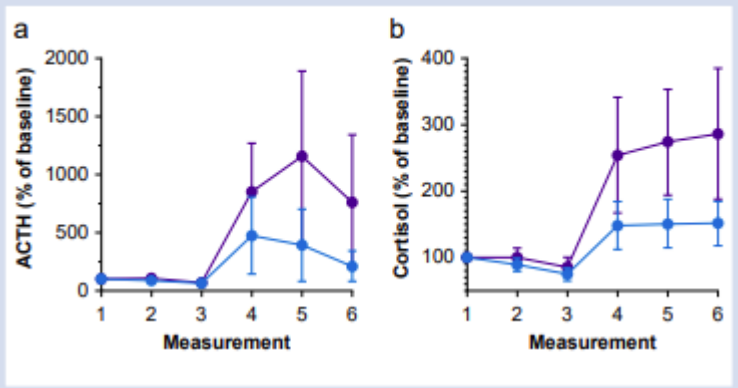


Fig. 4. Adrenocorticotropic hormone (ACTH) (a) and cortisol (b) concentrations from induction on until discharge from the PACU in subjects receiving standard clinical care (red symbols) and subjects receiving fentanyl dosing based on the Nociception Level index (blue symbols). Measurements were (1) 10–30 min before induction, (2) 1–2 min after intubation, (3) 1–2 min after incision, (4) at skin closure, (5) 15 min into the PACU, and (6) at discharge from the PACU. Data are mean values relative to baseline (1) (95% confidence interval).

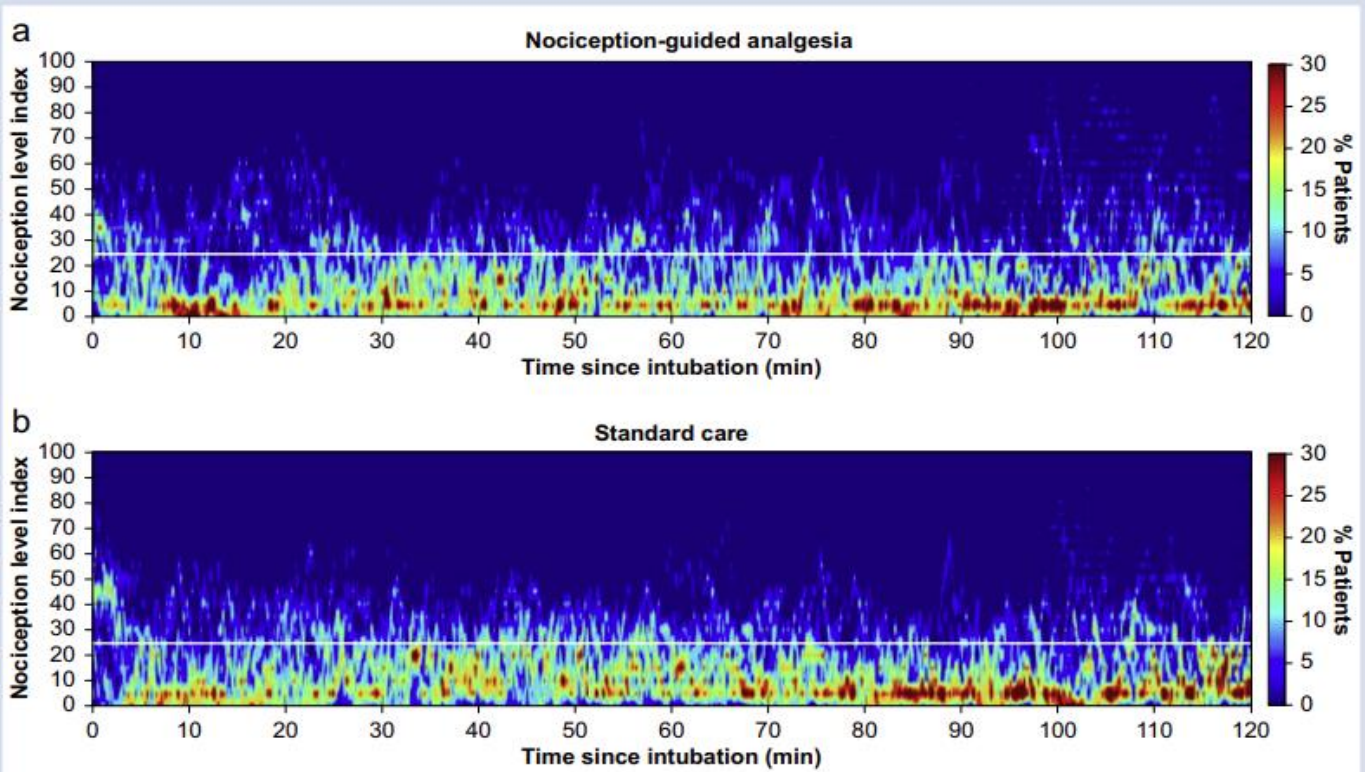


Fig. 2. Fire plots of the Nociception Level (NOL) index values during anaesthesia in NOL-guided analgesia (a) and during standard care (b) patients. To guide the eye, one horizontal line is added to the graph representing a NOL index value of 25. The colours reflect the percentage of subjects at any 5-s time point and range from 0% (dark blue) to 30% (dark red).

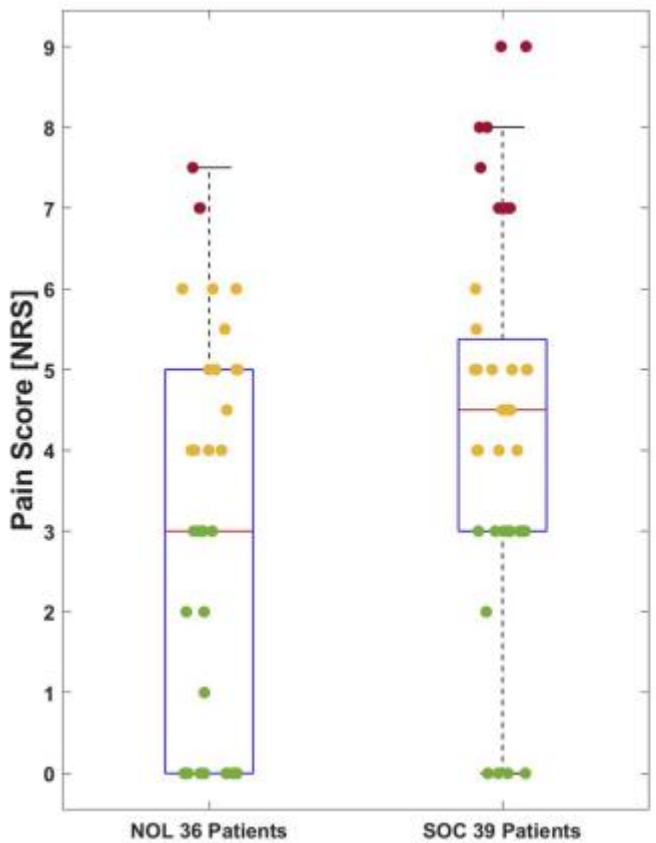
Journal of Clinical Monitoring and Computing
https://doi.org/10.1007/s10877-022-00906-1

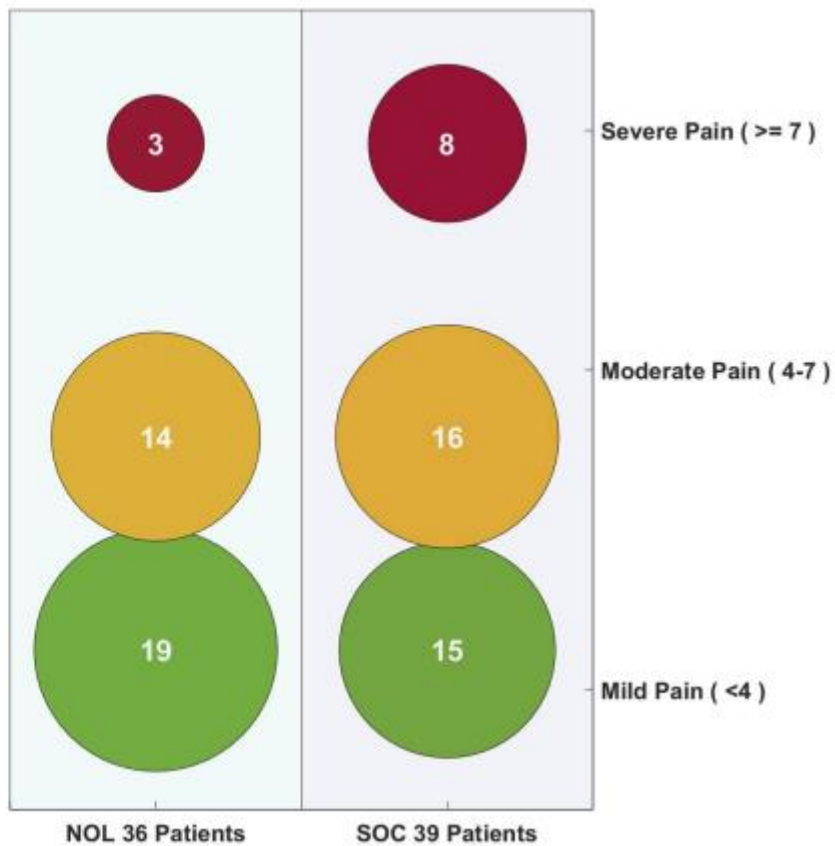
ORIGINAL RESEARCH

Reduced postoperative pain in patients receiving nociception monitor guided analgesia during elective major abdominal surgery: a randomized, controlled trial

Rivka Fuica[1] · Carlos Krochek[1] · Rachel Weissbrod[2] · Dimitri Greenman[1] · Andres Freundlich[1] · Yaacov Gozal[1]

Received: 30 March 2022 / Accepted: 28 July 2022





Journal of Clinical Monitoring and Computing
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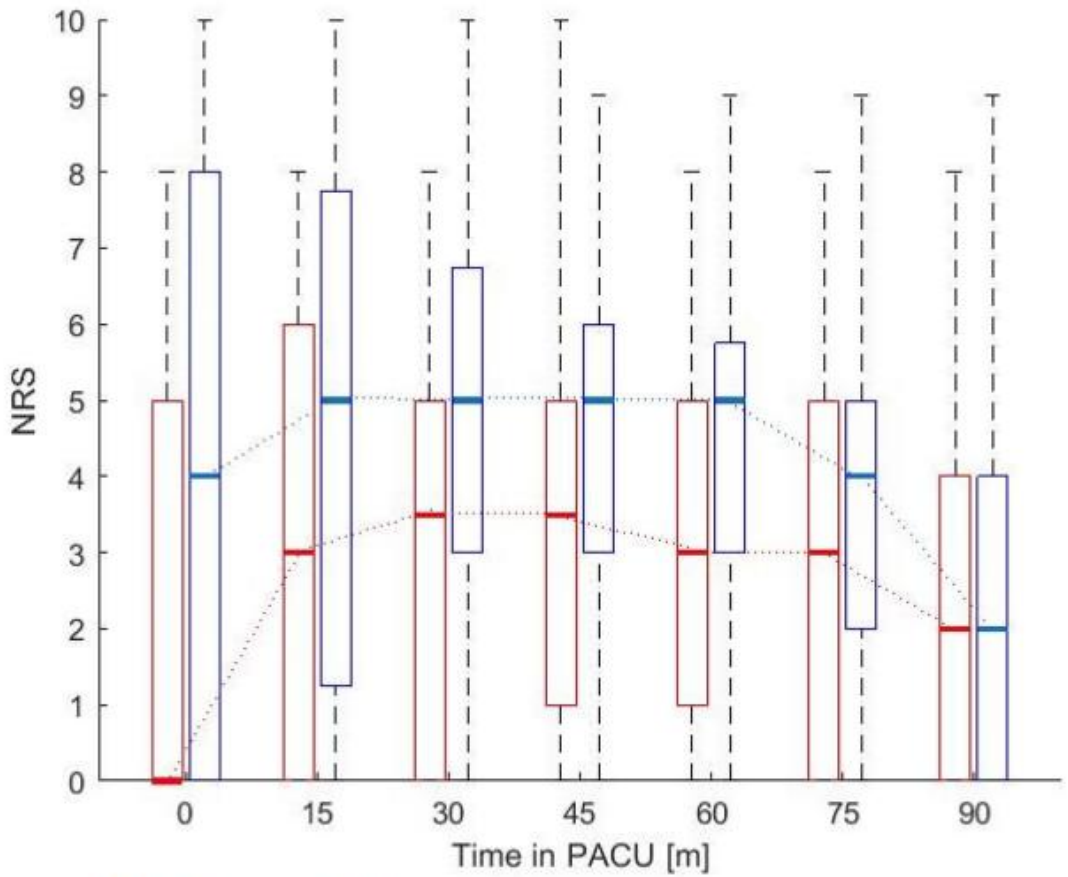
ORIGINAL RESEARCH

Reduced postoperative pain in patients receiving nociception monitor guided analgesia during elective major abdominal surgery: a randomized, controlled trial

Rivka Fuica[1] · Carlos Krochek[1] · Rachel Weissbrod[2] · Dimitri Greenman[1] · Andres Freundlich[1] · Yaacov Gozal[1]

Received: 30 March 2022 / Accepted: 28 July 2022

Fig. 4 PACU pain score trajectories in the NOL guided and SOC groups



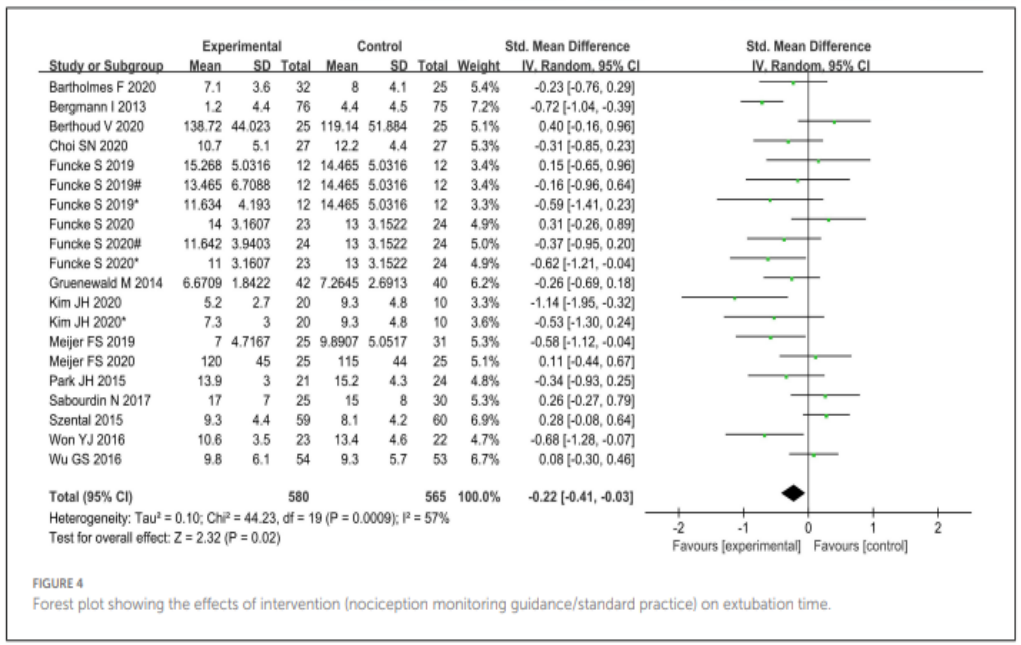
SOC pain scores in blue

NOL guided pain scores in red

Nociception monitors vs. standard practice for titration of opioid administration in general anesthesia: A meta-analysis of randomized controlled trials

Dandan Ma[1,2†], Jiahui Ma[3†], Huayong Chen[2], Dongliang Mu[3], Hao Kong[3] and Lingzhi Yu[1*]

[1]Department of Pain Management, Jinan Central Hospital, Shandong University, Jinan, China, [2]Department of Anesthesiology, Yidu Central Hospital Affiliated to Weifang Medical University, Weifang, China, [3]Department of Anesthesiology, Peking University First Hospital, Beijing, China



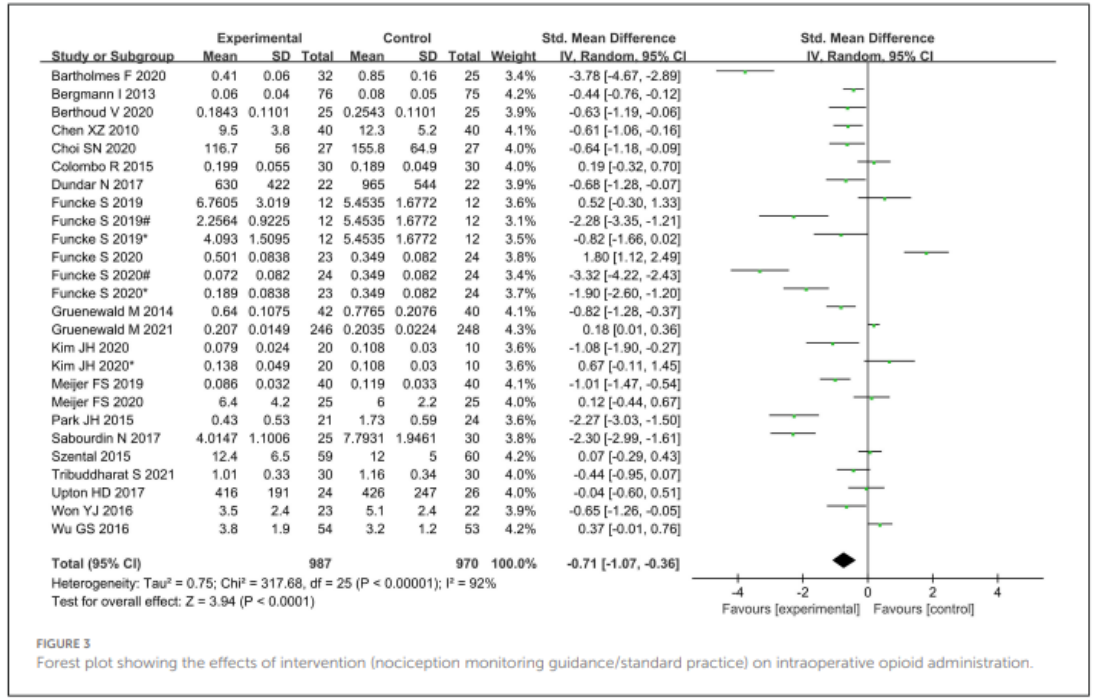
Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Bartholmes F 2020	7.1	3.6	32	8	4.1	25	5.4%	-0.23 [-0.76, 0.29]
Bergmann I 2013	1.2	4.4	76	4.4	4.5	75	7.2%	-0.72 [-1.04, -0.39]
Berthoud V 2020	138.72	44.023	25	119.14	51.884	25	5.1%	0.40 [-0.16, 0.96]
Choi SN 2020	10.7	5.1	27	12.2	4.4	27	5.3%	-0.31 [-0.85, 0.23]
Funcke S 2019	15.268	5.0316	12	14.465	5.0316	12	3.4%	0.15 [-0.65, 0.96]
Funcke S 2019#	13.465	6.7088	12	14.465	5.0316	12	3.4%	-0.16 [-0.96, 0.64]
Funcke S 2019*	11.634	4.193	12	14.465	5.0316	12	3.3%	-0.59 [-1.41, 0.23]
Funcke S 2020	14	3.1607	23	13	3.1522	24	4.9%	0.31 [-0.26, 0.89]
Funcke S 2020#	11.642	3.9403	24	13	3.1522	24	5.0%	-0.37 [-0.95, 0.20]
Funcke S 2020*	11	3.1607	23	13	3.1522	24	4.9%	-0.62 [-1.21, -0.04]
Gruenewald M 2014	6.6709	1.8422	42	7.2645	2.6913	40	6.2%	-0.26 [-0.69, 0.18]
Kim JH 2020	5.2	2.7	20	9.3	4.8	10	3.3%	-1.14 [-1.95, -0.32]
Kim JH 2020*	7.3	3	20	9.3	4.8	10	3.6%	-0.53 [-1.30, 0.24]
Meijer FS 2019	7	4.7167	25	9.8907	5.0517	31	5.3%	-0.58 [-1.12, -0.04]
Meijer FS 2020	120	45	25	115	44	25	5.1%	0.11 [-0.44, 0.67]
Park JH 2015	13.9	3	21	15.2	4.3	24	4.8%	-0.34 [-0.93, 0.25]
Sabourdin N 2017	17	7	25	15	8	30	5.3%	0.26 [-0.27, 0.79]
Szental 2015	9.3	4.4	59	8.1	4.2	60	6.9%	0.28 [-0.08, 0.64]
Won YJ 2016	10.6	3.5	23	13.4	4.6	22	4.7%	-0.68 [-1.28, -0.07]
Wu GS 2016	9.8	6.1	54	9.3	5.7	53	6.7%	0.08 [-0.30, 0.46]
Total (95% CI)			**580**			**565**	**100.0%**	**-0.22 [-0.41, -0.03]**

Heterogeneity: Tau² = 0.10; Chi² = 44.23, df = 19 (P = 0.0009); I² = 57%
Test for overall effect: Z = 2.32 (P = 0.02)

Std. Mean Difference IV, Random, 95% CI

-2 -1 0 1 2
Favours [experimental] Favours [control]

FIGURE 4
Forest plot showing the effects of intervention (nociception monitoring guidance/standard practice) on extubation time.



Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Bartholmes F 2020	0.41	0.06	32	0.85	0.16	25	3.4%	-3.78 [-4.67, -2.89]
Bergmann I 2013	0.06	0.04	76	0.08	0.05	75	4.2%	-0.44 [-0.76, -0.12]
Berthoud V 2020	0.1843	0.1101	25	0.2543	0.1101	25	3.9%	-0.63 [-1.19, -0.06]
Chen XZ 2010	9.5	3.8	40	12.3	5.2	40	4.1%	-0.61 [-1.06, -0.16]
Choi SN 2020	116.7	56	27	155.8	64.9	27	4.0%	-0.64 [-1.18, -0.09]
Colombo R 2015	0.199	0.055	30	0.189	0.049	30	4.0%	0.19 [-0.32, 0.70]
Dundar N 2017	630	422	22	965	544	22	3.9%	-0.68 [-1.28, -0.07]
Funcke S 2019	6.7605	3.019	12	5.4535	1.6772	12	3.6%	0.52 [-0.30, 1.33]
Funcke S 2019#	2.2564	0.9225	12	5.4535	1.6772	12	3.1%	-2.28 [-3.35, -1.21]
Funcke S 2019*	4.093	1.5095	12	5.4535	1.6772	12	3.5%	-0.82 [-1.66, 0.02]
Funcke S 2020	0.501	0.0838	23	0.349	0.082	24	3.8%	1.80 [1.12, 2.49]
Funcke S 2020#	0.072	0.082	24	0.349	0.082	24	3.4%	-3.32 [-4.22, -2.43]
Funcke S 2020*	0.189	0.0838	23	0.349	0.082	24	3.7%	-1.90 [-2.60, -1.20]
Gruenewald M 2014	0.64	0.1075	42	0.7765	0.2076	40	4.1%	-0.82 [-1.28, -0.37]
Gruenewald M 2021	0.207	0.0149	246	0.2035	0.0224	248	4.3%	0.18 [0.01, 0.36]
Kim JH 2020	0.079	0.024	20	0.108	0.03	10	3.6%	-1.08 [-1.90, -0.27]
Kim JH 2020*	0.138	0.049	20	0.108	0.03	10	3.6%	0.67 [-0.11, 1.45]
Meijer FS 2019	0.086	0.032	40	0.119	0.033	40	4.1%	-1.01 [-1.47, -0.54]
Meijer FS 2020	6.4	4.2	25	6	2.2	25	4.0%	0.12 [-0.44, 0.67]
Park JH 2015	0.43	0.53	21	1.73	0.59	24	3.6%	-2.27 [-3.03, -1.50]
Sabourdin N 2017	4.0147	1.1006	25	7.7931	1.9461	30	3.8%	-2.30 [-2.99, -1.61]
Szental 2015	12.4	6.5	59	12	5	60	4.2%	0.07 [-0.29, 0.43]
Tribuddharat S 2021	1.01	0.33	30	1.16	0.34	30	4.0%	-0.44 [-0.95, 0.07]
Upton HD 2017	416	191	24	426	247	26	4.0%	-0.04 [-0.60, 0.51]
Won YJ 2016	3.5	2.4	23	5.1	2.4	22	3.9%	-0.65 [-1.26, -0.05]
Wu GS 2016	3.8	1.9	54	3.2	1.2	53	4.2%	0.37 [-0.01, 0.76]
Total (95% CI)			**987**			**970**	**100.0%**	**-0.71 [-1.07, -0.36]**

Heterogeneity: Tau² = 0.75; Chi² = 317.68, df = 25 (P < 0.00001); I² = 92%
Test for overall effect: Z = 3.94 (P < 0.0001)

Std. Mean Difference IV, Random, 95% CI

-4 -2 0 2 4
Favours [experimental] Favours [control]

FIGURE 3
Forest plot showing the effects of intervention (nociception monitoring guidance/standard practice) on intraoperative opioid administration.

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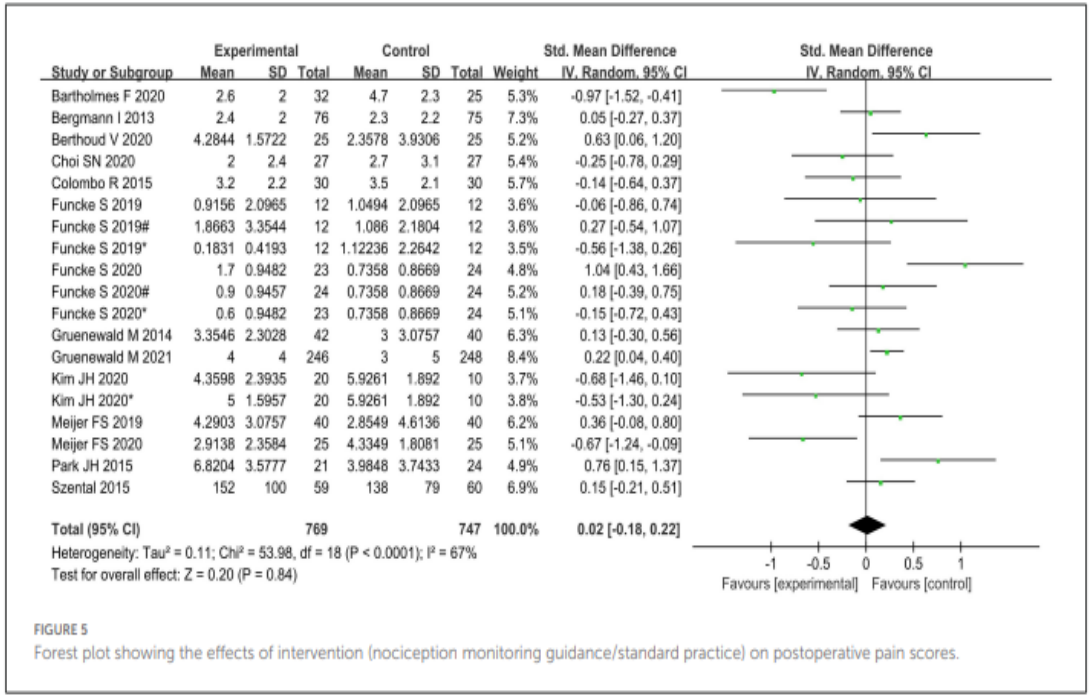
SARTD-CHGUV Sesión de formación continuada
Valencia, 20 de Diciembre de 2022

Nociception monitors vs. standard practice for titration of opioid administration in general anesthesia: A meta-analysis of randomized controlled trials

Dandan Ma[1,2†], Jiahui Ma[3†], Huayong Chen[2], Dongliang Mu[3], Hao Kong[3] and Lingzhi Yu[1*]

[1]Department of Pain Management, Jinan Central Hospital, Shandong University, Jinan, China, [2]Department of Anesthesiology, Yidu Central Hospital Affiliated to Weifang Medical University, Weifang, China, [3]Department of Anesthesiology, Peking University First Hospital, Beijing, China



Study or Subgroup	Experimental Mean	SD	Total	Control Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI
Bartholmes F 2020	2.6	2	32	4.7	2.3	25	5.3%	-0.97 [-1.52, -0.41]
Bergmann I 2013	2.4	2	76	2.3	2.2	75	7.3%	0.05 [-0.27, 0.37]
Berthoud V 2020	4.2844	1.5722	25	2.3578	3.9306	25	5.2%	0.63 [0.06, 1.20]
Choi SN 2020	2	2.4	27	2.7	3.1	27	5.4%	-0.25 [-0.78, 0.29]
Colombo R 2015	3.2	2.2	30	3.5	2.1	30	5.7%	-0.14 [-0.64, 0.37]
Funcke S 2019	0.9156	2.0965	12	1.0494	2.0965	12	3.6%	-0.06 [-0.86, 0.74]
Funcke S 2019#	1.8663	3.3544	12	1.086	2.1804	12	3.6%	0.27 [-0.54, 1.07]
Funcke S 2019*	0.1831	0.4193	12	1.12236	2.2642	12	3.5%	-0.56 [-1.38, 0.26]
Funcke S 2020	1.7	0.9482	23	0.7358	0.8669	24	4.8%	1.04 [0.43, 1.66]
Funcke S 2020#	0.9	0.9457	24	0.7358	0.8669	24	5.2%	0.18 [-0.39, 0.75]
Funcke S 2020*	0.6	0.9482	23	0.7358	0.8669	24	5.1%	-0.15 [-0.72, 0.43]
Gruenewald M 2014	3.3546	2.3028	42	3	3.0757	40	6.3%	0.13 [-0.30, 0.56]
Gruenewald M 2021	4	4	246	3	5	248	8.4%	0.22 [0.04, 0.40]
Kim JH 2020	4.3598	2.3935	20	5.9261	1.892	10	3.7%	-0.68 [-1.46, 0.10]
Kim JH 2020*	5	1.5957	20	5.9261	1.892	10	3.8%	-0.53 [-1.30, 0.24]
Meijer FS 2019	4.2903	3.0757	40	2.8549	4.6136	40	6.2%	0.36 [-0.08, 0.80]
Meijer FS 2020	2.9138	2.3584	25	4.3349	1.8081	25	5.1%	-0.67 [-1.24, -0.09]
Park JH 2015	6.8204	3.5777	21	3.9848	3.7433	24	4.9%	0.76 [0.15, 1.37]
Szental 2015	152	100	59	138	79	60	6.9%	0.15 [-0.21, 0.51]
Total (95% CI)			**769**			**747**	**100.0%**	**0.02 [-0.18, 0.22]**

Heterogeneity: Tau² = 0.11; Chi² = 53.98, df = 18 (P < 0.0001); I² = 67%
Test for overall effect: Z = 0.20 (P = 0.84)

FIGURE 5
Forest plot showing the effects of intervention (nociception monitoring guidance/standard practice) on postoperative pain scores.

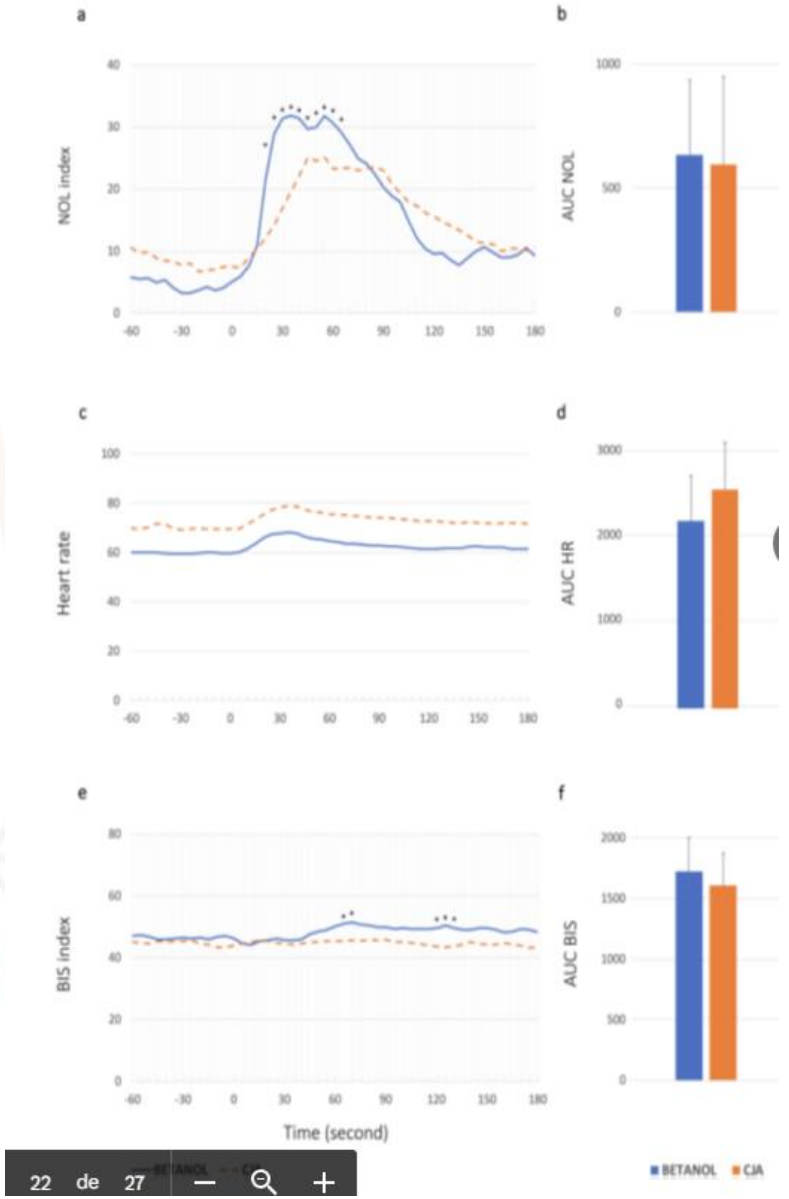
En los pacientes sometidos a AG la analgesia guiada por monitores de nocicepción ayuda a reducir la administración de opioides, acortar el tiempo de exIOT, reducir incidencia de NVPO sin incrementar el grado de dolor postop ni consumo de opioides.

Journal of Clinical Monitoring and Computing
https://doi.org/10.1007/s10877-020-00626-4

ORIGINAL RESEARCH

Impact of chronic treatment by β1-adrenergic antagonists on Nociceptive-Level (NOL) index variation after a standardized noxious stimulus under general anesthesia: a cohort study

Catherine Bergeron[2] · Véronique Brulotte[1] · Felix Pelen[1] · Ariane Clairoux[1] · Marie-Eve Bélanger[1] · Rami Issa[1] · Robert Urbanowicz[1] · Issam Tanoubi[1] · Pierre Drolet[1] · Louis-Philippe Fortier[1] · Olivier Verdonck[1] · Annik Fortier[3] · Fabien Espitalier[1] · Philippe Richebé[1,2]



- NOL resulta fiable en pacientes en tratamiento con Betabloqueantes.
- Sensibilidad mayor que el BIS en estos pacientes.
- Valores similares en ambos grupos

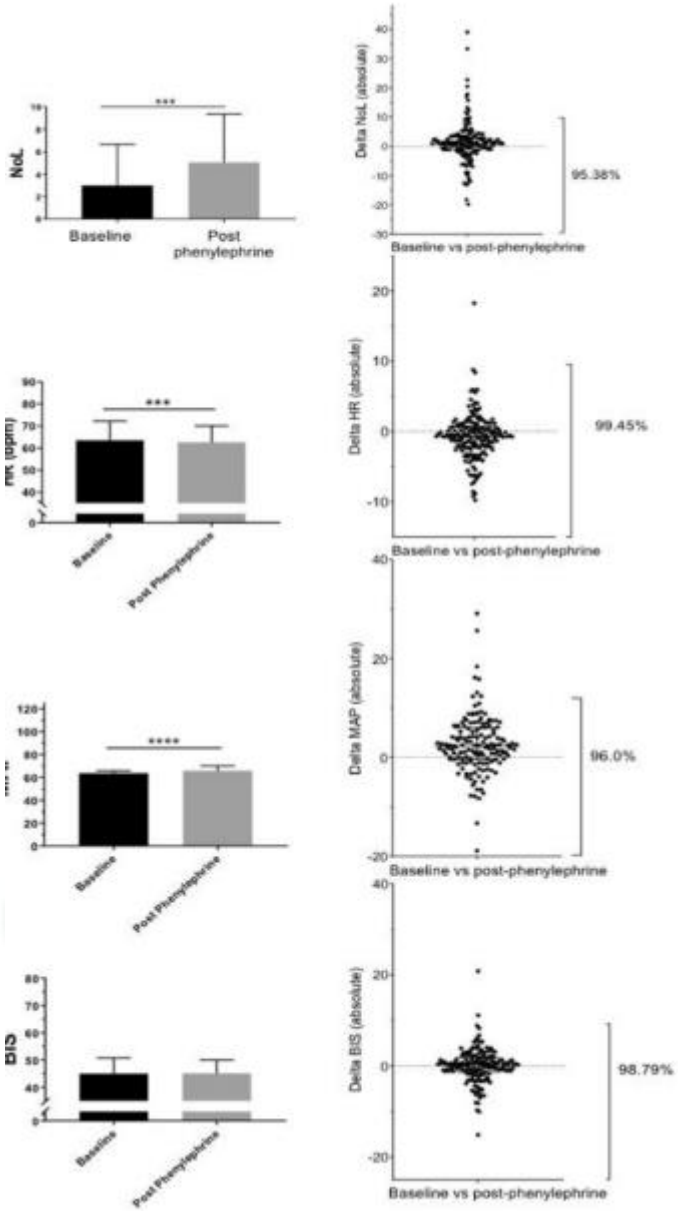
Journal of Clinical Monitoring and Computing
https://doi.org/10.1007/s10877-019-00393-x

ORIGINAL RESEARCH

Impact of intravenous phenylephrine bolus administration on the nociceptive level index (NOL)

Julien Raft[1,2] · Marie-Andrée Coulombe[3] · Etienne Renaud-Roy[3] · Issam Tanoubi[1] · Olivier Verdonck[1] · Louis-Philippe Fortier[1] · Fabien Espitalier[1] · Philippe Richebe[1]

Bolus de fenilefrina inducen un aumento estadísticamente significativo en el NOL, pero no altera su valor de manera relevante



medicina

MDPI

Article

Nociception Level Index-Directed Erector Spinae Plane Block in Open Heart Surgery: A Randomized Controlled Clinical Trial

Cosmin Balan [1,2,*], Dana R. Tomescu [2,3], Liana Valeanu [1,2], Bianca Morosanu [1,2], Iulia Stanculea [1], Antonia Coman [1], Anca Stoian [1] and Serban I. Bubenek-Turconi [1,2]

1 Cardiac Anesthesiology and Intensive Care Department I, Prof. Dr. C.C. Iliescu Emergency Institute for Cardiovascular Diseases, 022328 Bucharest, Romania
2 Anesthesiology and Intensive Care Department, Carol Davila University of Medicine and Pharmacy, 050474 Bucharest, Romania
3 3rd Department of Anesthesiology and Intensive Care, Fundeni Clinical Institute, 022328 Bucharest, Romania
* Correspondence: cosmin13mara@yahoo.com

- Conclusiones, beneficio de ESPB en:
  - Menor uso de fentanilo intraoperatorio,
  - Menos morfina acumulada 48h,
  - Más rápida extubación,
  - Suspensión más temprana de NA
  - Mejor calidad analgésica.

- Limitación de NOL , no es medible en CEC por falta de fotopletismografía.

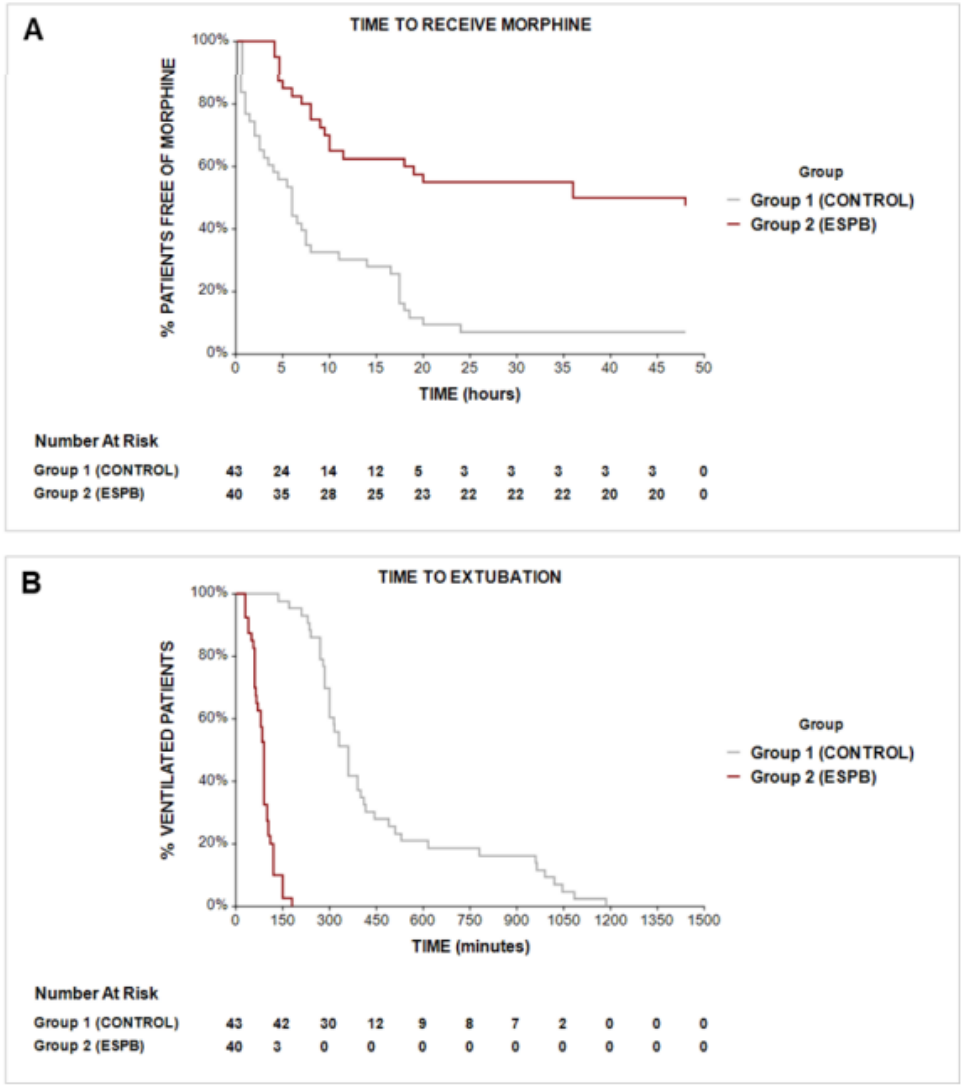


Figure 4. Kaplan–Meier curve to compare the time required to receive morphine after ICU admission (**A**) and the time required to extubate the patient (**B**). The Cox proportional hazard ratio for postoperative morphine in the ESPB-to-Control group was 0.3 (HR: 0.30; 95% CI: 0.18–0.50; $p < 0.001$). The Cox proportional hazard ratio for extubation in the ESPB-to-Control group was 5.24 (HR: 5.24; 95% CI: 2.87–9.57; $p < 0.001$). Abbreviations: ESPB, erector spinae plane block.

Beeinflusst NoL-Monitoring den Opioidbedarf bei Da-Vinci-Prostatektomien?

F. Niebhagen[1] · C. Golde[1] · T. Koch[1] · M. Hübler[2]

[1] Klinik und Poliklinik für Anästhesiologie und Intensivtherapie, Universitätsklinikum Carl Gustav Carus, TU Dresden, Dresden, Deutschland

[2] Klinik für Anästhesiologie, Intensivmedizin und Schmerztherapie, Krankenhaus St. Joseph-Stift Dresden (Lehrkrankenhaus der TU Dresden), Dresden, Deutschland

Diferencias estadísticamente NO significativas pero si una tendencia a la baja en los scores de dolor postoperatorio

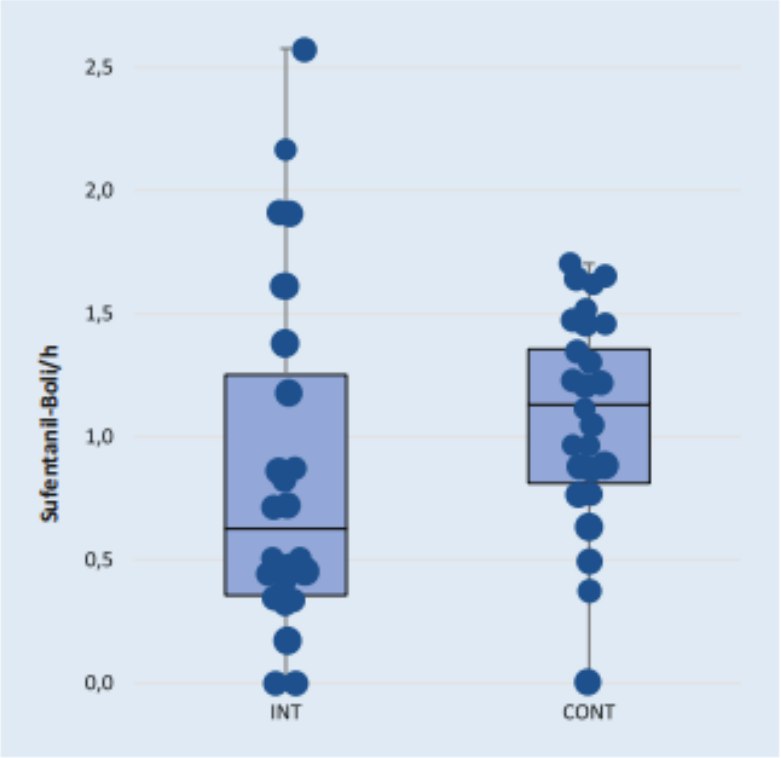


Abb. 2 ◀ Im Boxplot wird die unterschiedliche Verteilung der Sufentanilboli, auf die Operationszeit normalisiert, dargestellt. In der Interventionsgruppe(*INT*)-Gruppe fällt ein deutlich breiteres Verteilungsmuster mit größerem Interquartilsabstand von 0,9 als in der Kontrollgruppe(*CONT*)-Gruppe mit 0,6 auf

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Tecnología del dolor NOL®

- LIMITACIONES:
  - Alteraciones en la perfusión distal
  - Arritmias (ACxFA)
  - Cambios bruscos de volemia (hipoperfusión)
  - Fármacos que modifican el tono simpático
  - No validado en el paciente consciente
  - No evalúa el dolor postoperatorio

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SARTD-CHGUV Sesión de formación continuada
Valencia, 20 de Diciembre de 2022

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Índice

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2. Nocicepción ≠ Dolor
3. Monitorización perioperatoria del SNA
4. Dispositivos disponibles
    1. Pupilometría
    2. ANI
    3. NOL
5. Monitorización del SNA en críticos
6. Conclusiones

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Monitorización del SNA en críticos

- Muchos de nuestros pacientes requieren ventilación mecánica y sedación.
- Una correcta analgesia es clave para ayudar a la adaptación a VM y evitar asincronías.

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Analgesia en el paciente crítico

Introduction

Analgesia and sedation in the intensive care unit: an overview of the issues

Curtis N Sessler[1,2] and Wolfram Wilhelm[3]

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[2]Medical Director of Critical Care, Medical College of Virginia Hospitals, Richmond, Virginia 23298, USA
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This article is online at http://ccforum.com/content/12/S3/S1

Critical Care 2008, **12(Suppl 3)**:S1 (doi:10.1186/cc6147)

Solamente el 68% de los pacientes que reciben ventilación mecánica se les pauta analgesia.

sartd
Servicio de Anestesia, Reanimación y Tratamiento del Dolor
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Analgesia en el paciente crítico

Published in final edited form as:
Anesth Analg. 2016 October ; 123(4): 903–909. doi:10.1213/ANE.0000000000001393.

Impact of an Analgesia-Based Sedation Protocol on Mechanically Ventilated Patients in a Medical Intensive Care Unit

Andrew C. Faust, PharmD, BCPS[*], **Pearl Rajan, PharmD, BCPS**[*,†], **Lyndsay A. Sheperd, PharmD, BCPS**[*], **Carlos A. Alvarez, PharmD, MSc, MSCS, BCPS**[†], **Phyllis McCorstin, APRN, CNS**[‡], and **Rebecca L. Doebele, MD**[‡,§]

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The benefits of an analgosedation protocol

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

Implementation of an analgosedation protocol was associated with an overall lighter level of sedation, shorter mean ventilator duration, and a reduced use of continuous infusion sedatives

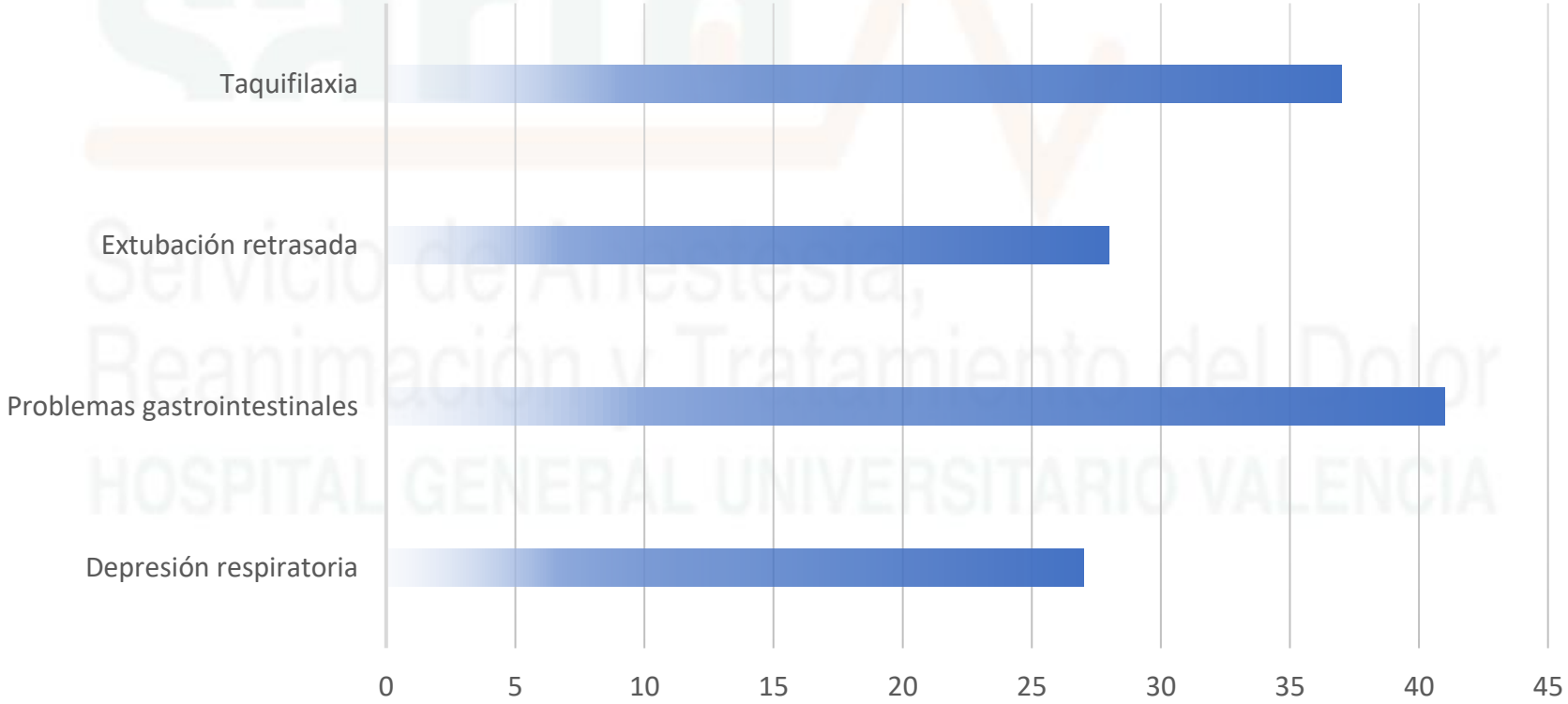
Intensive Care Med (1999) 25: 186–191

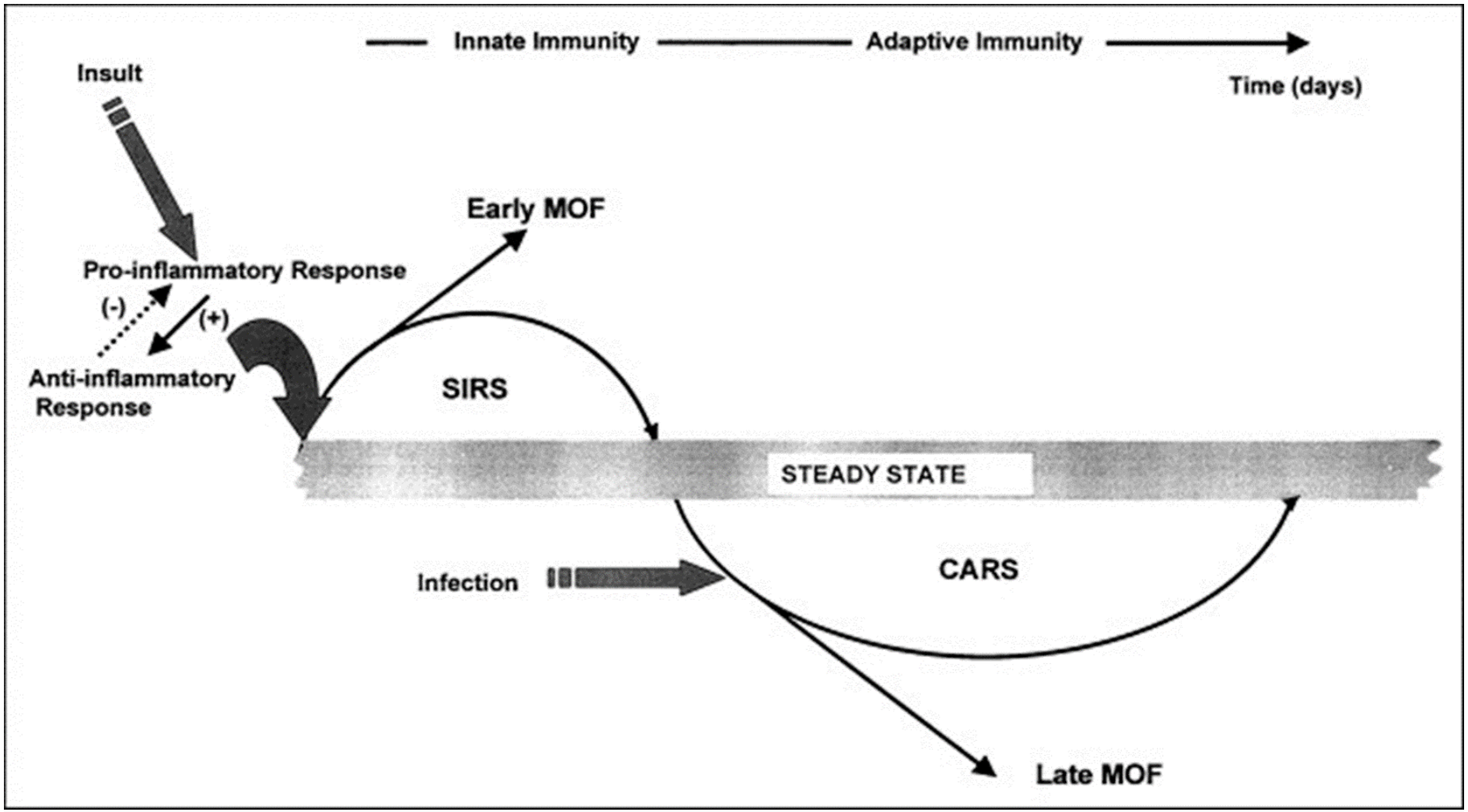
ORIGINAL

B.V. Christensen
L.P. Thunedborg

Use of sedatives, analgesics and neuromuscular blocking agents in Danish ICUs 1996/97

A national survey




Innate Immunity
Adaptive Immunity
Time (days)
Insult
Early MOF
Pro-inflammatory Response
(-)
(+)
Anti-inflammatory Response
SIRS
STEADY STATE
Infection
CARS
Late MOF

Dysfunction of the Autonomic Nervous System and Its Role in the Pathogenesis of Septic Critical Illness (Review)

DOI: 10.17691/stm2020.12.4.12
Received October 25, 2019

© **Y.Y. Kiryachkov,** MD, DSc, Head of the Department of Surgical and Resuscitation Technologies[1];
S.A. Bosenko, Anesthesiologist[1];
B.G. Muslimov, Deputy Chief Physician for Anesthesiology and Intensive Care[2];
M.V. Petrova, MD, DSc, Professor, Deputy Director[1]

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Dysfunction of the autonomic nervous system in the brain during sepsis largely determines lethality and severity of systemic inflammation [99–104]. However, there are still no specific approaches to assessing the ANS dysfunction and developing specific therapies for its correction.

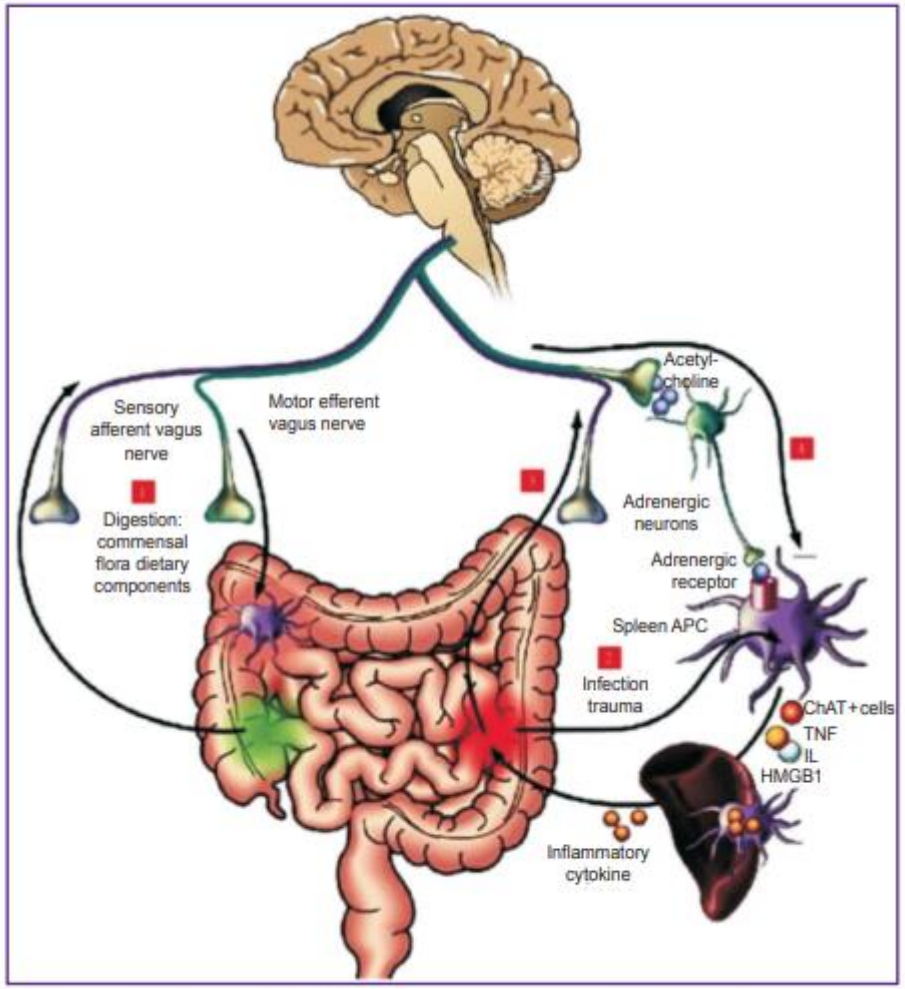

Figure 2. The interaction of the autonomic nervous system and the immune system of the gastrointestinal tract [30]

REVIEWS

Dysfunction of the Autonomic Nervous System and Its Role in the Pathogenesis of Septic Critical Illness (Review)

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The sympathetic part of the ANS also modifies the activity of macrophages and lymphocytes via β2-adrenergic receptors, stimulating the synthesis of β2AR-IL-10 cytokines.

The parasympathetic arm of the ANS is able to simulate inflammation through cholinergic receptors of internal organs, macrophages, and lymphocytes

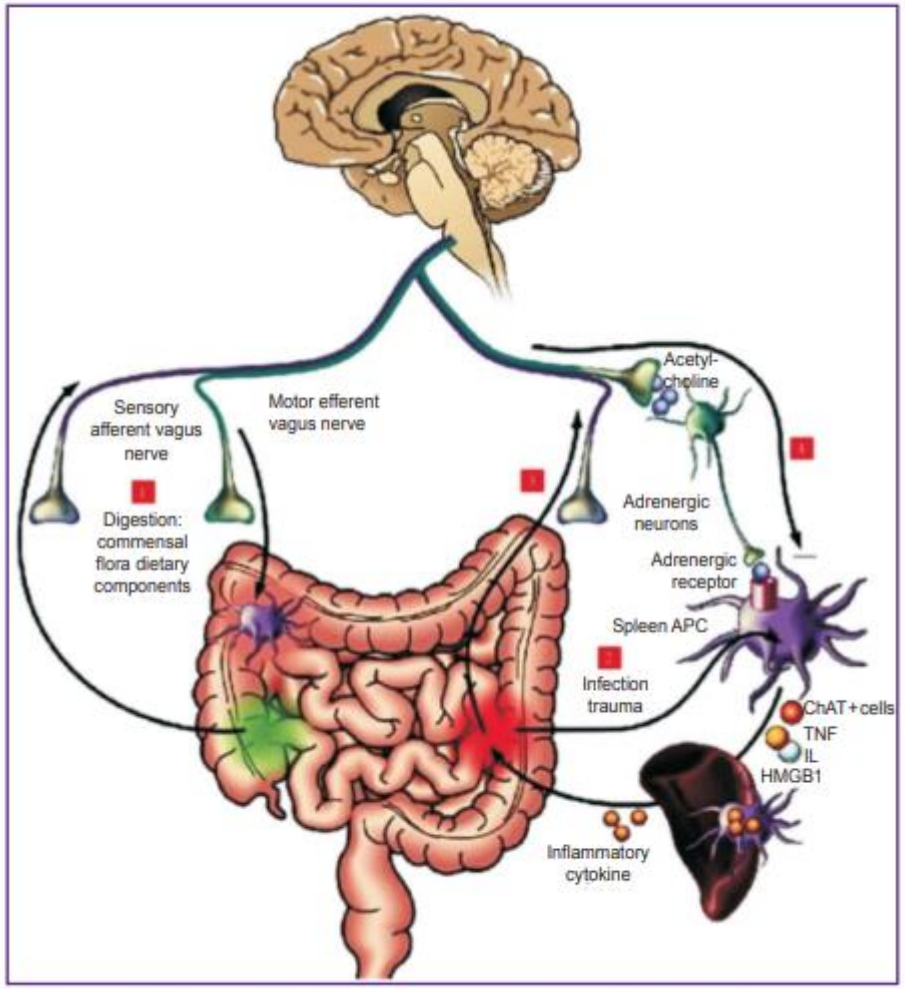

Figure 2. The interaction of the autonomic nervous system and the immune system of the gastrointestinal tract [30]

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Review article

jics

Journal of the Intensive Care Society
2020, Vol. 21(2) 148–157

DOI: 10.1177/1751143719853744
journals.sagepub.com/home/jics
SAGE

Heart rate variability: Measurement and emerging use in critical care medicine

Brian W Johnston[1,*], Richard Barrett-Jolley[1,*], Anton Krige[2] and Ingeborg D Welters[1,*]

The inclusion of HRV measures into current early warning scoring systems such as NEWS could potentially lead to a new generation of physiomarkers that can predict deterioration earlier and help target those patients at greatest risk of mortality

SHOCK, Vol. 28, No. 5, pp. 549–553, 2007

DEPRESSED HEART RATE VARIABILITY IS ASSOCIATED WITH HIGH IL-6 BLOOD LEVEL AND DECLINE IN THE BLOOD PRESSURE IN SEPTIC PATIENTS

Yoshihisa Tateishi,* Shigeto Oda,* Masataka Nakamura,* Keisuke Watanabe,* Tomoyuki Kuwaki,† Takeshi Moriguchi,‡ and Hiroyuki Hirasawa*

*Departments of *Emergency and Critical Care Medicine; and †Autonomic Physiology, Graduate School of Medicine, Chiba University, Chiba; and ‡Department of Emergency and Critical Care Medicine, Yamanashi University, Yamanashi, Japan*

Received 27 Nov 2006; first review completed 7 Jan 2007; accepted in final form 5 Mar 2007

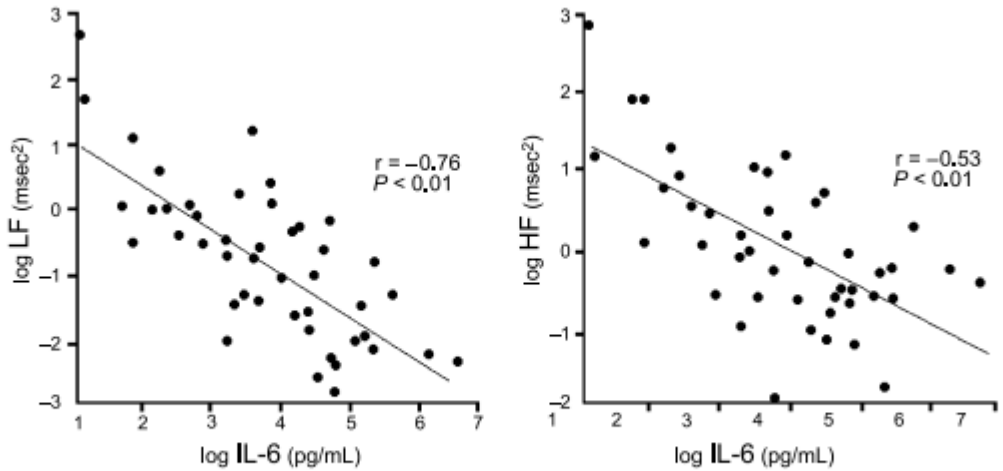

FIG. 1. **Correlations between the HRV indices and IL-6 blood level on ICU admission.** Analysis with Pearson correlation analysis revealed significant negative correlations between IL-6 blood level and both LF and HF.

Journal of Critical Care
Volume 24, Issue 4, December 2009, Pages 625.e1-625.e7

Relation of heart rate variability to serum levels of C-reactive protein, interleukin 6, and 10 in patients with sepsis and septic shock

Vasilios E. Papaioannou MD, PhD, Christos Dragoumanis MD, PhD, Vasiliki Theodorou MD, Christos Gargaretas MD, Ioannis Pneumatikos MD, PhD

Our data suggest that low HRV and sympathovagal balance during septic shock are associated with both an increased hyperinflammatory and antiinflammatory response.

Monitorización del SNA en críticos

- Valor pronóstico y ayuda a identificar a aquellos pacientes con más riesgo de mala evolución
- No existen por el momento terapias que hayan demostrado mejorar la disfunción del SNA.
- Dexmedetomedina, galantamina, fisiostigmina…

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Índice

1. Sistema Nervioso Autónomo
2. Nocicepción ≠ Dolor
3. Monitorización perioperatoria del SNA
4. Dispositivos disponibles
    1. Pupilometría
    2. ANI
    3. NOL
5. Monitorización del SNA en críticos
6. Conclusiones

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Conclusiones

- En el paciente bajo anestesia general, el término dolor debería sustituirse por estrés nociceptivo.
- El inadecuado manejo estimulo nociceptivo, tanto excesiva como falta de analgesia repercute de manera negativa en el paciente.
- Los métodos tradicionales para determinar la intensidad del estímulo nociceptivo son imprecisos y pueden conducir a error.

Conclusiones

- Diferentes tecnologías basadas en el análisis de la variabilidad de la frecuencia cardiaca han demostrado reflejar de una manera fiable la intensidad del estimulo nociceptivo
- El uso de estos sistemas podría ayudarnos a reducir dosis de fármacos y optimizar el manejo del paciente.
- El empleo de protocolos y monitores de analgesia en UCI puede resultar beneficioso para nuestros pacientes.

Conclusiones

- La desregulación del sistema nervioso autónomo juega un papel importante en la fisiopatología de diferentes enfermedades como la sepsis.
- La monitorización del mismo puede ayudarnos a identificar a aquellos pacientes con mayor riesgo de mala evolución
- No obstante, se trata de una tecnología relativamente nueva y son necesarios más estudios acerca de este campo

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MUCHAS GRACIAS!!