



ANESTHESIOLOGY NEWS

Technology

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Monitor Detects Patients' Pain During Surgery

The Nociception Level Index

Israeli researchers have devised a multivariable index that appears to accurately reflect patients' experience of pain during surgery.

"The primary significance of our findings is that we have proved that it is possible to accurately and objectively assess patients' nociceptive state—or "pain"—based on an algorithmic combination of multiple physiological parameters, creating the NoL [nociception level] index," Ruth Edry, MD, told *Anesthesiology News*. Results of a trial of the NoL index were reported in *Anesthesiology* (2016;125:193-203).

"We were able to identify—in anesthetized, noncommunicating, surgical patients—a patient's response to noxious stimuli and the effect of analgesic administration, as well as grade the patient's response to noxious stimuli of varied levels and distinguish different doses of analgesia during a similar noxious stimulus."

Dr. Edry is the lead author of this study and senior physician anesthesiologist at Rambam Medical Center in Haifa, Israel, where the research was conducted.

"Using a nociception monitor ... and NoL index may enable the anesthesiologist, or any other interventionist managing patients during invasive procedures, to optimize the intraoperative administration of analgesics, keeping the patient more hemodynamically stable during the procedure," Dr. Edry explained.

The NoL index operates within a clinical device that evaluates a nonlinear combination of the following variables in order to provide clinicians with an objective pain measurement:

- heart rate
- heart rate variability
- plethysmographic pulse wave amplitude
- skin conductance

- skin conductance fluctuations
- the time derivatives of these measures



The Trial

In this study, the authors examined the correlation between the results of the NoL index and other measures of nociception. The objective was to discern the ability of the NoL index to discriminate between painful and nonpainful stimuli, to respond to graded stimuli and to respond to the effects of opioid administration on patients' somatic experience of noxious stimuli. The NoL index was run on the PMD-100, a nociception monitor manufactured by Medasense Biometrics.

The study included 58 patients undergoing a variety of surgical procedures, including laparoscopic and open abdominal surgeries with intubation. The researchers found that "the NoL index responded progressively to increased stimulus intensity and remained unchanged in response to nonnoxious stimuli."

Compared with other accepted measures of nociception, the NoL index better discriminated noxious from nonnoxious stimuli with an area under the curve of 0.93 (95% CI, 0.89-0.97). The NoL index/PMD-100 had a sensitivity of 87% at a specificity of 84%. "The NoL index was the only measure that reliably reflected two different analgesic concentrations of remifentanyl [Ultiva, Mylan] during initial skin incision or trocar insertion," the authors noted.

This multicenter trial included researchers in the Department of Outcomes Research at the Cleveland Clinic, which is chaired by Daniel I. Sessler, MD, and who is the Michael Cudahy Professor of Anesthesiology in the Department of Anesthesiology at the Cleveland Clinic. Of note, Drs. Edry and Sessler have financial interests in the device.

Dr. Sessler told *Anesthesiology News* that this new device is “important.”

He explained: “Anesthesia is necessary because surgery causes intense nociceptive stimulation, which is not consciously recognized, but can stress the body and worsen pain after surgery,” he said. “Because patients cannot describe pain during general anesthesia, it is hard for physicians to evaluate.

“Typically, anesthesiologists use opioids to moderate nociception during anesthesia. The difficulty is that too little promotes postoperative pain, whereas excessive doses can cause complications including nausea and vomiting, respiratory complications, constipation and hyperalgesia.

“Our study shows that NoL ... is an intensity-sensitive measure that is blocked by opioid administration. Titrating to NoL may thus guide clinicians and help them give patient-specific optimal amounts of intraoperative opioid,” Dr. Sessler explained.

Another Toy?

Paul White, MD, PhD, was not as impressed by the findings. “This appears to be a well-conducted clinical study with predictable results. Previous studies have reported that each of these variables have some predictive value, so the combination would be expected to be stronger than any one alone,” he told *Anesthesiology News*.

Dr. White is a consultant at Cedars-Sinai Medical Center, in Los Angeles, and the Rizzoli Institute at the University of Bologna, in Italy. In addition to being on the advisory board of *Anesthesiology News*, he is a retired professor and former holder of the Margaret Milam McDermott Distinguished Chair in Anesthesiology at the University of Texas Southwestern Medical Center, in Dallas.

The accepted measures to which Dr. White was referring included heart rate, plethysmographic pulse wave amplitude, noninvasive blood pressure and the surgical pleth index around five specific stimuli: tetanic stimulation with and without fentanyl analgesia, intubation, first incision/trocar insertion and the nonnoxious period.

“The real question is whether the use of this device has any significant influence on measurable clinical outcomes (e.g., recovery times, side effects, adverse events [intraoperative recall], pharmacoeconomics, OR [operating room] efficiency, patient safety, etc.). Otherwise, it is just another expensive toy.”

—John Henry Dreyfuss

Drs. Sessler and Edry reported personal financial interests in the new device.