SPECIAL SUPPLEMENT
Pain Management
in the ICU

Innovation

Protecting ward patients: the case for continuous monitoring, *F. Michard, T.J. Gan, R. Bellomo*

Innovations in ICU ventilation: the future delivered, *F. Gordo, A. Abella, B. Lobo-Valbuena*

Data-driven management for intensive care units, *F. J. da Silva Ramos, J. I. F. Salluh*

Technology innovations in delivering accurate nutrition: preventing malnutrition and enforcing nutritional guidelines, *P. Singer, L. Elia*

The business of research, *J. B. Ochoa Gautier*

PLUS

The role of disruptive and hybrid technologies in acute care, *T. Kyprianou*

Extravascular lung water as a target for intensive care, *M. Kirov, V. Kuzkov, L. Bjertnaes*

Managing delirium in the ICU with sleep guardians, *C. Irwin, S. Parkinson*

The establishment and provision of an acute kidney injury service at a tertiary renal centre, *S. Fray*

Communication myths of anaesthetists, *S. Watson*

The role of the Physician Assistant in critical care, *V. Bakshi*

The need to humanise the ICU, *S. East*

Noninvasive technologies for personalised haemodynamic monitoring: advanced haemodynamic monitoring methods, *B. Saugel*

NEWS

Sleep index, wakefulness can predict patient ability to breathe on their own

According to new research, critically ill patients can be more successfully weaned from a mechanical ventilator if they have higher levels of wakefulness and if both their right and left brains experience the same depth of sleep. The article titled "*Sleep and Pathological Wakefulness at Time of Liberation from Mechanical Ventilation*" is published in the American Journal of Respiratory and Critical Care Medicine.

Laurent Brochard, MD, PhD, and the co-authors of this study used polysomnography and a novel sleep index. The sleep index was developed by one of the co-authors, Magdy Younes, MD, PhD. The index has an odds ratio product (ORP) that provides a continuous digital score from 0 (very deep sleep) to 2.5 (full wakefulness). The objective was to determine whether the ORP was associated with the likelihood that a patient could be removed from mechanical ventilation.

Dr. Brochard, Director of the Critical Care Medicine Division at the University of Toronto and clinician-scientist at the Keenan Research Centre for Biomedical Science at St. Michael's Hospital in Toronto, Canada is the senior study author. He explains that patients who are under mechanical ventilation in intensive care units often suffer from severe sleep deprivation. As a result, they tend to exhibit abnormal patterns of sleep or wakefulness, which could also explain in part, the development of delirium.

Mechanical ventilation is life-saving, but it can also cause lung damage, infections, and other health problems. That is why it is important to take patients off the ventilator as soon as its medically possible. Physicians use a spontaneous breathing trial (SBT) during which a patient breathes on their own without the help of a ventilator. This is done to assess their readiness to breathe on their own. Dr. Brochard points out that in order to successfully separate the patient from the ventilator, it is necessary to get an adequate response from a number of physiological systems, which could potentially be impaired by sleep deprivation. He also notes that previous studies have linked pathological sleep with prolonged difficulties in being separated from the ventilator.

The purpose of this research was to assess whether a period of sleep and wakefulness in the hours before attempting separation from the ventilator could predict a greater level of success. To determine this, the researchers analysed data from 37 patients at three hospitals in Toronto, Canada. These patients were scheduled for an SBT and had already undergone polysomnography for 15 hours before the test. SBT was successful in 19 of the 37 patients while the breathing tube was removed in 11 others. In 8 patients, the breathing tube was not removed despite a successful SBT because other clinical factors suggested that they were not ready for extubation. The SBT was unsuccessful in 18 patients.

Study Findings

Overall, the results of the study show that:

- Classical sleep states determined by conventional sleep scoring guidelines were not associated with the success or failure of the SBT.
- Longer duration of full wakefulness was correlated with successful SBT and extubation.
- Poor correlation between sleep depth in the right and left-brain hemispheres predicts SBT failure.

ORP scores were associated with success or failure in weaning patients from the ventilator while sleep scores were not, thus suggest-

Wakefulness may predict if patients are able to breathe on their own.

Image Credit: ATS

ing that ORP scores have a better ability to distinguish different levels of sleep.

"Defining wakefulness or sleep classically necessitates detecting short-wave brain activity that typically characterises sleep and a decrease in higher frequencies that characterise wakefulness and comparing these results to clinical behaviour: does the patient look awake or asleep?" Dr. Brochard said.

Sleep deprivation produces a brainwave pattern similar to pathological wakefulness, and while the patient may appear to be clinically awake, they may, in fact, be obtunded or not fully awake. The authors of the study speculate that this state of pathological wakefulness may be the flip side of sleep deprivation.

It is thus important to understand the dissociation between the brain hemispheres. Clinicians in the ICU need to understand the cause of this dissociation, and they need to determine if the cause is sleep deprivation, the influence of sedative drugs or other medical conditions. By answering these questions, it may be possible to better manage mechanically ventilated patients in the ICU.

"We now have a monitoring tool of the brain that can help us address questions of major importance for the outcome of patients in the ICU," Dr. Brochard said. ■

References

Brochard L, Martin D, Magdy Y et al. (2019) Sleep and Pathological Wakefulness at Time of Liberation from Mechanical Ventilation (SLEEWE): A Prospective Multicenter Physiological Study. American Journal of Respiratory and Critical Care Medicine.

Acute pain estimation, postoperative pain resolution, opioid cessation, and recovery

Acute postoperative pain is associated with persistent postsurgical pain (PPSP). The incidence of PPSP ranges from 10 to 50% while severe, chronic pain after surgery is reported by 2 to 10% of patients. Both the severity and duration of postoperative pain are influenced by other factors including pre-existing pain.

A secondary analysis of the Stanford Accelerated Recovery Trial (START), a randomised, double-blind clinical trial, was conducted to assess the effect of perioperative use of gabapentin on postoperative pain resolution and opioid cessation. The researchers used data-mining algorithms to identify patient clusters based on the first 10 daily pain scores (reported as average, current and worst pain) after surgery. They also explored psychosocial characteristics that were associated with each cluster and determined which description best estimated the probability of 3 outcomes which included remote pain cessation, opioid cessation, and surgical recovery. The analysis was based on two hypotheses: that patient clusters predictive of poorer remote outcomes were associated with preoperative psychosocial characteristics, and that high-risk patient clusters were a superior predictor of outcomes over acute pain descriptors.

Results

A total of 371 participants (225 women and 146 men) scheduled for thoracotomy, video-assisted thoracoscopic surgery, total hip replacement, total knee replacement, mastectomy, breast lumpectomy, hand surgery, carpal tunnel surgery, knee arthroscopy, shoulder arthroplasty, or shoulder arthroscopy were included in the analysis. Of these 371 patients, 52% were partitioned into the low pain cluster, and 48% were partitioned into the high pain cluster.

Median pain duration in the high vs. low pain cluster was 92.0 vs. 40.0 days; opioid use was 39.0 vs. 12.0 days and time to patient-reported recovery was 89.0 vs. 49.0 days. Median time to pain cessation in the high vs. low-risk group was 92 days vs. 40 days. Median time to opioid cessation in the high vs. low-risk group was 39 days vs. 12 days. Median time to full recovery in the high vs. low-risk group was 89 days vs. 49 days.

Overall, the findings of this analysis show that patients categorised to each of the 3 high pain clusters had longer duration of pain and opioid use regardless of the procedure. Some preoperative characteristics that correlated with the assignment of these patients to the high-risk cluster included worse baseline pain at the future surgical site, a history of alcohol or drug abuse treatment, and randomisation to the placebo group. The analysis also showed a sex difference where women were found to be at an increased risk of categorisation to the high pain cluster.

Worst pain over the past 24 hours reported on postoperative day 10 (POD 10) was identified as a significant immediate postoperative predictor of remote pain resolution, opioid cessation, and complete surgical recovery. This measure was found to be a better predictor of all three outcomes. Its application to current clinical practice could facilitate early identification of patients requiring more-intensive, interdisciplinary, postoperative pain management as well as help decisions regarding the continuation or discontinuation of multimodal analgesia. The postoperative predictor can facilitate the identification and referral of high-risk patients through transitional pain services. ■

References

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