Non-Invasive Respiratory Volume Monitoring to Develop a Risk Algorithm for the Safe use of Opioids

Christopher Voscopoulos, MD, Diane Ladd, DNP, Jordan Brayanov, PhD, Edward George, MD, PhD

Opioid-induced respiratory depression and post-operative apnea (POA) often lead to increased post-operative complications. Inadequate minute ventilation (MV) initiates the spiral of respiratory depression. MV monitoring can provide an early sign of respiratory decompensation. A novel, non-invasive Respiratory Volume Monitor (RVM) provides continuous, real-time respiratory volume traces and reports MV, tidal volume (TV) and respiratory rate (RR) in non-intubated patients. The utility of the RVM derived respiratory depression risk assessment algorithm to direct safe use of opioids, evaluate POA and improve PACU discharge decisions was evaluated.

RVM data were collected from 114 PACU patients following elective orthopedic surgery. 50/114 of the patient’s received opioids. “Predicted” MV (MV_TRUE) and “Percent Predicted” (MV_MEASURED /MV_TRUE x100%) was calculated for each patient using standard formulas. Prior to opioid administration patients were classified as: “Not-at-Risk”, MV≥80% MV_TRUE and “At-Risk”, MV<80% MV_TRUE. “Un-Safe” was defined as MV<40% MV_TRUE. Patients were analyzed post-hoc for POA. Patients were also assessed for “Un-Safe” status within 30 minutes prior to discharge from the PACU.

Within 30 minutes of opioid administration, 28% of patients (14 out of 50) became potentially “Un-Safe”. This fraction is higher (43%, 6 out of 14) in the group with POA and lower (22%, 8 out of 36) in the group without POA. 30 minutes prior to discharge, 14% of all patients (16 out of 114) were potentially “Un-Safe”. In the POA group this fraction was marginally increased (19%, 5 out of 26) and in the group without POA was essentially unchanged (13%, 11 out of 88). In the group that received opioids 18% of patients (9 out of 50) were potentially “Un-Safe”, whereas in the group without opioids this fraction was only 11% (7 out of 64).

RVM provides real-time MV measurements that can quantify respiratory depression, the effects of opioids and post-operative apnea. RVM may be used to create protocols for opioid administration and discharge criteria. RVM data will allow for better communication of the patients respiratory status and improve patient safety across the continuum of care.