

Clinical Implications of Monitor Alarms: A Comparative Study on SpO₂, EtCO₂ and Respiratory Volume Monitoring in Perioperative Settings

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Introduction/Identification of problem: Physiologic monitors are to improve patient safety, but can also produce excessive nuisance alarms, leading to alarm fatigue. Our goal was to identify the respiratory status monitors that contribute most to alarm fatigue and provide alternatives while maintaining patient safety. We compared the alarm rate of three continuous respiratory status monitors: capnography (EtCO₂), pulse oximetry (SpO₂) and respiratory volume monitoring (RVM).

Purpose of the Study: Nuisance alarms is the leading cause of alarm fatigue, which decreases awareness of patient safety. Alarm fatigue was identified as a major safety issue, and the goal is to minimize nuisance alarms.

Methodology: This study was conducted in four Kaiser-Permanente hospitals. Standard data for RVM (ExSpirom 1Xi, Waltham, MA), oximetry (Philips IntelliVue MP 50), capnography and oximetry (Philips SureSigns VM8) were collected post-operatively, either in post anesthesia care unite (PACU) or general hospital floor (GHF). Device-specific alarms were recorded electronically and later categorized into physiological (actionable) and technical (nuisance) alarms. Alarm rates were calculated and compared across devices. A total of 247 patients were monitored by RVM from a broad population (104 males)

Result: In one site, bedside monitor reported continuous EtCO₂ and SpO₂ for 7 patients with an average of 12.9 alarm/hr, 72.8% of which were technical alarms. The RVM only had 0.25 alarm/hr (4% technical) for the same group. Furthermore, simultaneous EtCO₂/SpO₂ monitoring were conducted for only 51 of 127 available hours due to fear of nuisance alarms, whereas RVM completed all 127 hours. Among 7 patients that received only SpO₂ and RVM monitoring, RVM had lower alarm rates (1.5 vs 0.36 alarm/hr, 67% vs 8% technical). At another site 15 patients were monitored with SpO₂ telemetry, with an average of 3.31 alarm/hr (19% technical), compared to 0.25 alarm/hr (4% technical) for RVM.

Conclusion: Alarm fatigue due to nuisance alarms is a challenge in perioperative settings regardless of the potential clinical value of monitoring. Among the three respiratory monitoring technologies, RVM had the highest rate of compliance (100%) and the lowest rate of technical alarms. In contrast, EtCO₂/SpO₂ combination monitoring was not used for >50% of available time, raising questions on overall patient safety.