Correlation between RRetCO2 and Masimo RRA in Patients under Deep Sedation: A Pilot Assessment

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Background

Deep Sedation is an anesthesia technique largely used concomitant with regional or local anesthesia to provide patient comfort in the noise OR environment. The ability to independently maintain ventilatory function may be impaired. Patients may require assistance in maintaining a patent airway, and spontaneous ventilation may be inadequate. The ASA amended its Standards for Basic Anesthetic Monitoring to include mandatory exhaled end-tidal carbon dioxide (EtCO2) monitoring during both moderate and deep sedation1.

Methods

After IRB approval, this prospective, single-center study consented patients 18 years of age or older undergoing sedation with local or regional anesthesia. All patients received pre-medication consisting of midazolam and fentanyl administered intravenously (IV) at the discretion of the anesthesiologist or regional anesthesia team in the preoperative area before the local or regional block. Patients were transferred to the operating room, and received standard monitoring consisting of SpO2, noninvasive blood measurement, end-tidal CO2 (CapnoStream20, Oridion) using tubing with standard nasal cannula, skin temperature, and ECG monitoring. Oxygen was administered (4 to 10L/minute) continuously through a facial mask. Anesthesia and sedation were administered based on the standard of care protocol. For study purposes, a Rainbow Acoustic sensor (revision C) was placed on the subject's neck and connected to a Masimo Rad-87 monitor (Masimo Corporation, Irvine, CA; software v. 7805) providing acoustic respiration rate (RRa), oxygen saturation (SpO2), pulse rate (PR), perfusion index (PI). The Masimo Rad-87 monitor was blinded to the assessor. If the patient was intubated based on standard of care, the study with the Rad 87 would ceased to continue. The purpose of this study was to determine the accuracy of respiration rate monitored by CapnoStream (RRetCO2) and Rad 87 (RRa) in anesthetized patients under sedation.

Results

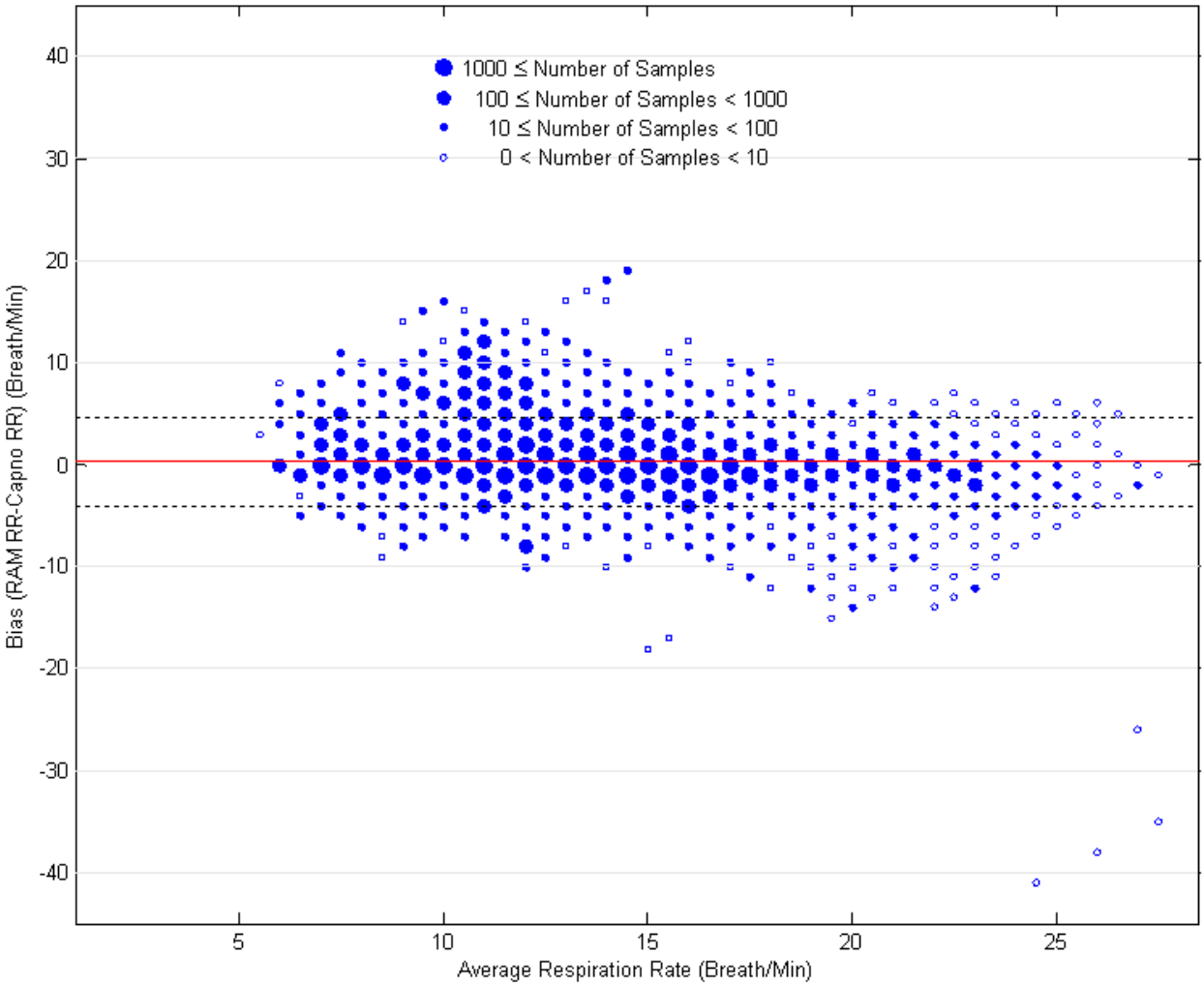
A total of 21 patients consented for the study, 15 female and 6 male, average age 60 years (range 32-87). Data and events were continuously recorded into Automatic Data Collection (ADC) program (Masimo Corporation). One patient was excluded from the study due to inability to perform spinal anesthesia. Three patients had an oral airway placed during the case, which caused early withdraw from the study and end of study data collection. The surgical procedures performed were: 18 patients for TKA, 1 tumor bone resection, and 1 wrist reduction. A total of 137,199 paired RRetCO2 and RRa values were collected over all 20 cases. The agreement between RRetco2 and RRa was analyzed by Bland-Altman plot with bias and limits of agreement [(0.2 g/dl +/- 2.3 sd * 1.96)Fig 1].

Discussion

To our knowledge this is the first study addressing the accuracy of measuring respiratory rate either by end-tidal CO2 or acoustic respiration rate in patients submitted to regional anesthesia and deep sedation. The RRa provided similar respiration rate values. Differences between the two methods could be the result of either RRetco2 or RRa deviations from the physiologic respiration rate. The accuracy of acoustic respiration rate has been validated in patients admitted to PACU after general anesthesia2. The use of RRa could be a good alternative for the perioperative period as most patients will have received sedation during surgery and need to be monitored in PACU and later on the patient wards.

References: 1. WeaverJ. Prog 2011;58:111-112. 2. Mimoz O, et al. Brit J Anaesth 2012; doi:10.1093/bja/aer510.

Figure 1.


1000 ≤ Number of Samples
100 ≤ Number of Samples < 1000
10 ≤ Number of Samples < 100
0 < Number of Samples < 10
Bias (RAM RR-Capno RR) (Breath/Min)
Average Respiration Rate (Breath/Min)
40
30
20
10
0
-10
-20
-30
-40
5
10
15
20
25