A469 - Assessing the effects of duration of apnea on adequacy of ventilation in the post-operative environment

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Introduction:
Maintaining respiratory sufficiency is a vital component of post-operative care, yet clinicians often rely on subjective assessments or secondary indicators. Patients with apneic episodes are often considered to have respiratory insufficiency regardless of whether these apneic episodes are compensated by large recovery breaths. We used a non-invasive respiratory volume monitor (RVM) to measure minute ventilation (MV) to assess ventilation in patients experiencing apnea in the PACU and general floor.

Methods:
We used an RVM (ExSpiron1Xi, Respiratory Motion, Inc.) to continuously monitor MV for 48h following elective abdominal surgery. MV was expressed as percent of predicted MV (MVPRED); Low MV was defined as MV<40%MVPRED. For each apnea (ie, respiratory pause >10 seconds), we calculated the patient’s corresponding MV over the 30, 60, 90, and 120s windows following the start of the apnea.

Results:
216 patients (110 males, BMI:26.7 (15.1-41.2)kg/m2) were monitored for 42.0±0.9 hours. 49985 apneas were identified ranging from 10-117s (Fig1A). Apneas were observed in 99% of patients, suggesting low predictability of respiratory insufficiency. The average MV was 73±2.4%MVPRED, as patients were often sleeping or mildly sedated. We assessed the effects of each apnea on the temporally associated MV (Fig1B). While apneas ranging in length from 10-18s decrease MV by as much as 30%, their effect over 1min is <10%. On a 2min time scale, even 60s apneas led to LowMV just 20% of the time(Fig1C).

Conclusion:
While apneas were ubiquitous, they seldom led to LowMV over clinically relevant time scales. Large compensatory breaths following an apnea generally restored MV to near pre-apnea levels. Nonetheless, some apneas can become dangerous when ignored, as when subsequent sedation decreases compensatory breath size. RVM data provide a better metric of respiratory competence, driving better assessment of patient risk and individualization of care.
The effect of apneas on respiratory status. (A) Distribution of apneas across a surgical population. Apneas >10sec were recorded in 99% (214 out of 216) patients in the post-operative period and 92% of the recorded apneas were <20s long. (B) Sustained MV over various time windows (30-sec – red, 60-sec – green, 90-sec – purple, 2-min – cyan) following the onset of apnea. Note that, an apnea of 30-sec will (by definition) drive MV over a 30-sec window down to 0, but will only decrease MV over a 60-sec window down to ~35% MVPRED and to less than 60% over a 2-min window. (C) Likelihood of an apnea of specific length to decrease MV below the Low MV cutoff over various time windows. Note that a single 10-sec apnea has just a 25% chance to decrease MV below 40% in a 30-sec window and less than 2% chance to decrease MV below the cutoff over a 2-min window. Even 60-sec apneas have just 20% chance of decreasing sustained MV over a 2-min window below the 40% MVPRED cutoff.