Quantification of abdominal expiratory motion via correlation of respiratory inductance plethysmography and spirometry

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Introduction: Spontaneous ventilation (SV) during general anesthesia is associated with phasic contraction of expiratory muscles; this activity is decreased by pressure support ventilation (PSV)¹, and can be measured via EMG, intraabdominal pressure, and optical scanning of the abdominal wall², but this is not always practical. We describe a method that employs correlation of spirometry and respiratory inductance plethysmography (RIP), and demonstrate its application during transitions in PSV.

Methods: With IRB approval and informed consent, 12 patients undergoing cystoscopy under inhalational anesthesia with LMA were enrolled. Transitions from PSV to SV were performed during maintenance anesthesia. RIP and spirometry were recorded at 120 Hz. Spirometry signals were analyzed to determine breath boundaries, and trapezoidal integration used to determine tidal volume. RIP signals were differentiated and correlated with spirometry data, as suggested by³ and depicted graphically in figure 1.

Results: Tidal volume (TV), respiratory period, and correlation from a typical patient are presented in figure 2. A clear drop in TV is seen following discontinuation of PSV, accompanied by a drop in correlation coefficient. While TV recovers to near baseline, the lack of correlation persists, but is restored by resuming PSV. This pattern was seen in 9 of 12 patients.

Discussion: The role of abdominal expiratory activity during anesthesia is not well understood, but may decrease FRC with attendant atelectasis. Rapid assessment of this effect has been lacking. Correlation of RIP and spirometry may provide such a tool.

References