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Spontaneous Breathing During General Anesthesia Prevents Ventral Redistribution Of Ventilation Detected By Electronic Impedance Tomography Eit

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Rationale

Atelectasis formation is a common phenomenon during general anaesthesia, occurring in almost 90% of patients¹. Spontaneous breathing during mechanical ventilation has been shown to reduce atelectasis formation in presence of lung injury². We hypothesize that compared with pressure controlled ventilation (PCV), spontaneous breathing (SB) and pressure support ventilation (PSV) during general anaesthesia reduce the extent of redistribution of ventilation as detected by Electrical impedance tomography (EIT) during and after the procedure³.

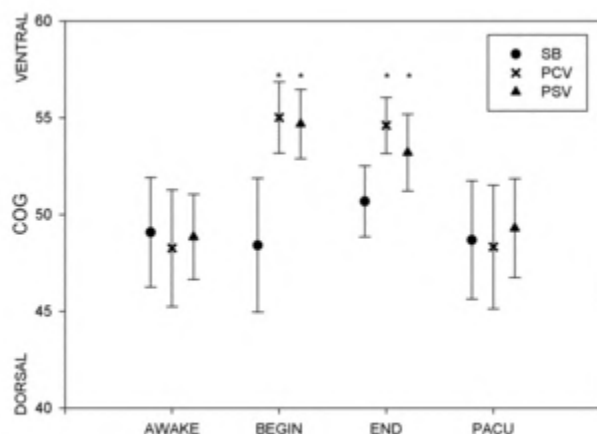
Methods

The design of the study was a randomized, controlled clinical trial. With approval by the local ethics committee, 30 patients scheduled for elective knee, foot or ankle surgery were enrolled in the study after obtaining written informed consent. All procedures were performed under general anesthesia with a laryngeal mask airway and a standardized anesthetic regimen (Sufentanil, Propofol, Sevoflurane). Patients were randomized to either SB, PCV or PSV. EIT was used to assess the distribution of ventilation. Center of gravity (COG) and fraction of total ventilation in the ventral 25% region of interest (ROI) were calculated at pre-defined time points: baseline before induction of anesthesia ("awake"), 10 minutes after placement of LMA ("begin"), before end of anesthesia ("end") and after arrival in the post anesthesia care unit ("PACU").

Results

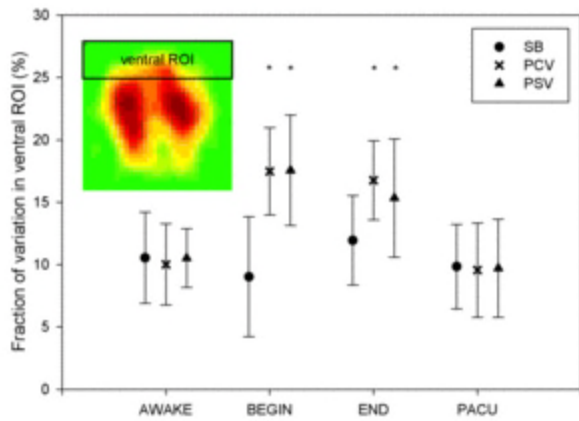
Patient characteristics were not different among the three groups. COG and ROI during anesthesia (time points "begin" and "end") were significantly higher in both PCV and PSV groups, while values in group SB remained at baseline levels. In the PACU, COG and ROI had returned to baseline values in all groups.

Changes in Center of Gravity



Center of Gravity (COG), given as mean \pm 95% confidence interval. * indicates $p < 0.05$ versus "AWAKE" (paired student's T-test).

Changes in ventral ROI variation



Ventral ROI variation, given as mean \pm 95% confidence interval. * indicates $p < 0.05$ versus "AWAKE" (paired student's T-test)

Conclusion

PCV causes a significant redistribution of ventilation towards the ventral region as detectable by EIT. Spontaneous breathing instead of PCV prevents this redistribution. PSV causes redistribution by the same magnitude as PCV.

In our sample of healthy patients, the redistribution of ventilation receded after the end of anesthesia. We did not observe differences in postoperative oxygen saturation or peak flow between the three groups. Nevertheless, spontaneous ventilation could be advantageous for patients with high risk of atelectasis and pulmonary complications, for instance obese patients.

References

- 1 Acta Radiol 1995;36:626-32.
- 2 Am J Respir Crit Care Med 1999;159:1241-8.
- 3 Crit Care Med 2009;37:713-24.

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