P-58

Spontaneous breathing during general anaesthesia prevents ventral redistribution of ventilation detected by electronic impedance tomography (EIT)

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Introduction. Spontaneous breathing during mechanical ventilation has been shown to reduce atelectasis formation in the presence of lung injury. We hypothesize that compared with pressure controlled ventilation (PCV), spontaneous breathing 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 procedure.

Method. 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 anaesthesia with a laryngeal mask airway. Patients were randomized to either spontaneous breathing (SB), pressure controlled ventilation (PCV) or pressure support ventilation (PSV). EIT was used to assess the distribution of ventilation. Centre of ventilation (COV) and fraction of total ventilation in the ventral 25% region of interest (ROI) were calculated at baseline before induction of anaesthesia, during anaesthesia, and after arrival in the post anaesthesia care unit (PACU).

Results. Patient characteristics were not different among the three groups. COV and ROI were significantly higher during anaesthesia in both PCV and PSV groups (Student's *t*-test with Bonferroni adjustment; $P<0.01$), while values in group SB remained at baseline levels. In the PACU, COV and ROI had returned to baseline values in all groups.

Discussion. PCV causes a significant redistribution of ventilation towards the ventral region as detectable by EIT. Spontaneous breathing instead of PCV prevents this redistribution. Surprisingly, PSV causes redistribution by the same magnitude as PCV. In our sample of healthy patients, the redistribution of ventilation receded completely after the end of anaesthesia.