

Changes in pulmonary ventilation distribution assessed by Electrical Impedance Tomography in healthy children under general anesthesia; a pilot study comparing facial mask spontaneous breathing and laryngeal mask spontaneous breathing with and without support.

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Objective: The aim of this study was to evaluate the development of atelectasis and ventilation distribution during general anesthesia in pediatric patients undergoing short-duration surgery.

Background: The specific ventilatory mechanics in pediatric patients increase the risk of developing peri-operative atelectasis, which is further influenced by the ventilatory technique used¹. Pulmonary Electrical Impedance Tomography (EIT) enables regional ventilation evaluation at patient's bedside and has been validated in the pediatric population^{2,3}.

Methods: After written parental informed consent, 49 ASA I pediatric patients (1-6 years, >10kg) undergoing circumcision were included in this prospective interventional study and randomized in three groups: 17 spontaneously breathing with facial mask (FM), 15 spontaneously breathing with laryngeal mask (LM), and 17 spontaneously breathing with laryngeal mask and inspiratory support (LMIS) aiming for a tidal volume of 6 to 10 ml/kg. EIT measurements were performed at 4 procedural time-points: before induction (T1), before surgical incision (T2), end of surgery (T3), before hospital discharge (T4). Dorso-ventral regions were defined and ventilated surface areas, surrogating the evolution of atelectasis (Δ Surf % compared to the T1 basal situation), were collected at each time-point. Center of Ventilation (CoV) and Global Inhomogeneity index (GI) were calculated at those time-points.

Results:

Δ Surf (%)

Group	Before surgical incision (T2)	End of surgery (T3)	Hospital discharge (T4)
Facial Mask (FM)	-6.98 ± 10.61	-6.95 ± 10.71	0.53 ± 11.58
Laryngeal Mask (LM)	1.27 ± 8.27	0,57 ± 9.14	3.99 ± 12.76
Laryngeal Mask with Inspiratory Support (LMIS)	5.99 ± 15.67*	4.04 ± 13.43*	-2.20 ± 14.19

All values are reported as % variation compared to T1 (before induction); values are mean ± SD.

* P<0.05 compared to FM

Inspiratory support (LMIS) is the only group allowing pulmonary recruitment (reducing atelectasis) during anesthesia as the ventilated surfaces increased over the time, which returned to basal state after emergence, compared to standard procedure with facial mask (FM) (P<0.001). CoV indicates an evolution towards dorsal ventilation in the FM group (P=0.002) compared to the LMIS group which shifts towards ventral ventilation during anesthesia (P<0.001). During general anesthesia, GI tends to increase in the FM group suggesting a more inhomogeneous ventilation compared to LMIS (P=0.026). No significant CoV or GI variation was observed in the LM group (P=0.59). No respiratory complications were observed.

Conclusions: Inspiratory support (LMIS) increases the recruitment of pulmonary alveoli and improves ventilation distribution in children during general anesthesia compared to spontaneous breathing.

Number of words in the abstract: 395

ANNEX

References:

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The study was conducted in accordance with the ICH-GCP guidelines.

All authors approved the publication of the aforementioned study.



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