Title: EFFECTS OF INDUCTION OF ANESTHESIA WITH HALOTHANE ON RESPIRATORY MECHANICS IN INFANTS

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Introduction: Induction of anesthesia results in a decrease in respiratory compliance (Crs) in adult subjects.[1] However, the effects of induction of anesthesia on respiratory mechanics in infants have not been studied. We applied two non-invasive techniques for measuring Crs[2,3] to healthy infants before and following induction of anesthesia with halothane in order to quantitate the changes in respiratory mechanics caused by this anesthetic technique.

Methods: Eight infants between 2.5 and 14 months of age (height 57-80 cm), who were scheduled to undergo general anesthesia for elective surgery, were studied. They were all ASA physical status I, were delivered at full-term and had no cardiopulmonary illness. The protocol received approval from the Human Subject Review Committee of the hospital and informed consent was obtained from the parents of each child prior to the study.

All infants were premedicated with chloral hydrate 50 mg/kg body weight rectally or triclofos 70 mg/kg orally one hour prior to induction. In the operating room, anesthesia was induced and maintained with halothane in oxygen and nitrous oxide via a Jackson-Rees modified Ayre's t-piece. Following completion of the studies of respiratory mechanics, the surgical procedure began.

Each child was studied while sedated preoperatively and then during maintenance halothane anesthesia while breathing spontaneously. The apparatus consisted of a Rendall Baker mask, sealed to the face with soft silicon putty, with a port for measuring mask pressure (P). A pneumotachograph was connected to the mask and its output was connected to a pressure transducer whose signal was amplified and integrated. The flow, volume (V) and P signals were displayed on an oscilloscope and recorded on magnetic tape. At end-inspiration the pneumotachograph was briefly occluded until P plateaued and then the occlusion was released. The passive expiratory time constant (τ) was calculated by the method of Lesouef et al[3] from at least four end-inspiratory occlusion maneuvers. In four children, comprising the first group, total respiratory compliance (Crs) was calculated by the method of Lesouef et al.[3] In the second group of four children, a unidirectional valve was placed on the exit port of the pneumotachograph. When the expiratory port of this valve was occluded, the child progressively recruited volume during 4 or 5 inspirations, but was occluded during expiration.[3] During each occluded expiration, the respiratory muscles relaxed and the P signal plateaued. This plateau P with the corresponding V constituted one data point on the P-V curve. Four or five data points were obtainable from each maneuver. The data from 5 or more such maneuvers was used to construct a V-P curve, and Crs was the slope of the linear regression of this curve. Total respiratory system resistance (Rrs) was calculated as τ/Crs for all subjects.

Comparison of anthopometric data and baseline studies between groups was by the Mann-Whitney U-test. τ, Crs and Rrs in each sedated infant were compared with the results for that subject during halothane anesthesia by the paired t-test. $P < 0.05$ was accepted as a significant difference.

Results: There were no differences in the weight, age, or baseline τ, Crs or Rrs measurements between the two groups of children. Therefore the results from all 8 infants were analyzed together. For all subjects, τ decreased by 45% following induction of anesthesia, and Crs decreased by 36% (Table). Rrs did not change significantly following induction of anesthesia.

Discussion: Using two techniques to measure respiratory mechanics, we have shown that τ and Crs decreased immediately following halothane induction, but Rrs was not affected. The decrease in Crs is probably due to a decrease in functional residual capacity (FRC) from collapse of alveoli in the dependent regions of the lung. Rrs did not decrease as might be expected following a decrease in FRC, perhaps due to the bronchodilating properties of halothane. The 36% decrease in Crs was similar to the estimated increase in lung elastance in adults when anesthetized with halothane.[1]

References:
1. Behrakis PK, Higgs BD, Bevan DR, Milic-Emili J. Partitioning of respiratory mechanics in halothane-anesthetized humans. J Appl Physiol 58:285-289, 1985
2. Grunstein MM, Springer C, Godfrey S, et al. Expiratory volume clamping (EVC) a new method to assess respiratory mechanics in sedated infants. J Appl Physiol 62:2107-2112, 1987
3. Lesouef PN, England SJ, Bryan AC. Passive respiratory mechanics in newborns and children. Am Rev Respir Dis 129:552-556, 1984

TABLE

Respiratory mechanics in 8 infants (mean ± sd)

	Preanesthesia	Anesthesia
τ (s)	0.62 ±0.23	0.34* ±0.10
C_{rs} (ml/cm$H_2$0)	12.6 ±3.7	8.1* ±3.0
R_{rs}(cm$H_2$0·l^{-1}·s^{-1})	49.7 ±10.6	43.8 ±10.1

*significant difference as compared to preanesthesia