

Title: DOES ATROPINE IMPROVE MYOCARDIAL PERFORMANCE DURING HALOTHANE AND ISOFLURANE ANESTHESIA IN INFANTS?  
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**Introduction.** In infants, atropine administered prior to anesthesia induction is believed to attenuate the cardiovascular depression that occurs during halothane anesthesia.<sup>1</sup> Whether the improved cardiac output following atropine results from merely increasing heart rate or by improving other myocardial determinants is unclear from prior studies.<sup>2</sup> Using precordial two-dimensional and pulsed Doppler echocardiography in infants, we measured the cardiovascular changes produced by intravenous atropine during equipotent halothane and isoflurane anesthesia.

**Method.** After informed written parental consent was obtained, 31 unpremedicated ASA physical status I infants who required elective surgery had non-invasive cardiovascular measurements recorded prior to anesthesia induction. Two-dimensional and pulsed Doppler echocardiographic measures included left ventricular short axis area and length, pulmonary artery diameter as well as pulsed Doppler measures of mean pulmonary artery velocity. Blood pressure by automated oscillometry and heart rate (HR) by EKG were also recorded.

Infants were alternately assigned to a mask inhalation induction with halothane (n = 15) or isoflurane (n = 16). During the study period, ventilation was controlled and inspired and expired levels of halothane or isoflurane were measured and recorded using a Perkin-Elmer mass spectrometer. With end-expired levels of halothane or isoflurane maintained at 1.5 MAC, a second set of cardiovascular data was collected (approximately 20 minutes following induction). Atropine 0.02 mg.kg<sup>-1</sup> IV was administered and a third set of cardiovascular data was collected two minutes later with anesthesia maintained at 1.5 MAC. Measurements were completed prior to intubation and the start of elective surgery.

Results were analyzed by a multi-variate repeated measures design and are expressed as mean ± SEM.

**Results.** The mean age (11.7 ± 2.3 mos, 8.9 ± 1.7 mos) and weights (8.8 ± 0.7 kg, 7.3 ± 0.6 kg) of the infants were similar in the halothane and isoflurane groups, respectively.

Mean blood pressure (MBP) decreased similarly from awake values during 1.5 MAC halothane and isoflurane. HR decreased during 1.5 MAC halothane, but did not change significantly from awake values in the isoflurane group.

Following atropine, HR increased by 31 ± 3% during halothane anesthesia and by 18 ± 4% during isoflurane anesthesia (Table 1). Cardiac output (CO) decreased significantly during 1.5 MAC halothane and isoflurane anesthesia but returned to awake levels following atropine (Table 1). Stroke volume (SV) and ejection fraction (EF) also decreased significantly during halothane and

isoflurane anesthesia (Figures 1 and 2). Following atropine, while CO increased in both groups, SV and EF remained unchanged from values measured prior to atropine (Figures 1 and 2). Halothane decreased ejection fraction (32 ± 5%) significantly more than isoflurane (18 ± 7%).

**Discussion.** Following atropine, cardiac output increased to values similar to awake values as a result of increases in HR alone. Atropine is a useful to increase HR and to prevent the more frequent vagal responses that occur in infants during anesthesia and surgery, but intravenous atropine did not attenuate the myocardial depression produced by halothane and isoflurane as EF and SV remained unchanged.

**References.**

1. Miller BR, Friesen RH: Anesth Analg 67:180, 1988
2. Barash PG et al: Anesthesiology 49:79, 1978

Table 1  
Cardiovascular Data

	Awake	1.5 MAC	1.5 MAC + Atropine
Heart Rate (beats.min <sup>-1</sup> )			
Halothane	127 ± 5.5	115 ± 6.0 <sup>*,†</sup>	151 ± 4.0 <sup>b</sup>
Isoflurane	141 ± 5.0	140 ± 1.5	168 ± 3.0 <sup>b</sup>
Mean Blood Pressure (mmHg)			
Halothane	74.3 ± 1.9	55.4 ± 1.5 <sup>*</sup>	62.5 ± 2.7 <sup>*,†b</sup>
Isoflurane	73.5 ± 2.4	57.8 ± 2.6 <sup>*</sup>	59.4 ± 3.1
Cardiac Output (l.min <sup>-1</sup> )			
Halothane	1.15 ± 0.11	0.84 ± 0.10 <sup>*</sup>	1.08 ± 0.14 <sup>b</sup>
Isoflurane	1.14 ± 0.12	1.03 ± 0.11 <sup>*</sup>	1.19 ± 0.13 <sup>b</sup>

Results are expressed as mean ± SEM. \* p < 0.05 from awake measurement.

<sup>b</sup> p < 0.05 from prior to administration of atropine.

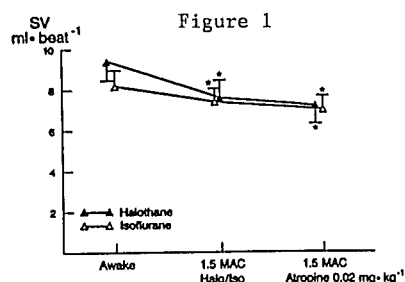


Figure 1. Stroke volume (SV) (\* p < 0.05 from awake). Values are expressed as mean ± SEM.

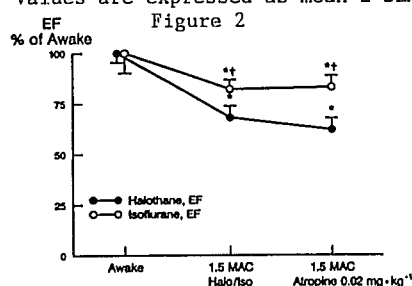


Figure 2. % of awake Ejection Fraction (EF) (\* p < 0.05 from awake, † p < 0.05 from halothane). Values are expressed as mean ± SEM.