

**TITLE:** A VAPORIZER FOR INHALATION ANESTHETICS DURING HIGH FREQUENCY JET VENTILATION  
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**INTRODUCTION** During high-frequency jet ventilation (HFJV) only balanced anesthesia has been used<sup>1</sup> because there is no vaporizer available for inhalation anesthetic during this method of ventilation. We have designed a simple vaporizer on the principle of airblast atomization,<sup>2</sup> which causes instant vaporization of enflurane during HFJV (fig. 1). The 14-gauge needle is attached to a VS600 HFJ ventilator, and the 20-gauge needle is connected to an infusion pump, which controls the amount of liquid anesthetic. We tested the vaporizer to see whether: 1- a predictable concentration of anesthetic within the clinical range can be achieved, 2- sufficient uptake of anesthetic occurs to keep animal anesthetized.

**METHODS** For bench tests we used the system shown in figure 2 with a 3-liter bag attached to the endotracheal tube. Ventilator settings were: rate = 150, I:E = 0.43, O<sub>2</sub> = 100%. Driving pressure was adjusted to 20-30 psi, to control minute volume at 15, 20, and 25 l/min. A Sigma infusion pump was used to infuse liquid enflurane at rates of .5, 1.5, 2, 2.5, and 3 ml/min. Concentrations of vaporized anesthetic were recorded by a Perkin-Elmer mass spectrometer at the side-port of the Hi-Lo tube. Each setting of minute volume and flow rate was tested four times and the mean (+ SE) vapor concentration was recorded. In animal experiment the tests were repeated in seven dogs, weighing 18-22 kg. Anesthesia was induced by 10 mg/kg thiopental IV and 100 mg/kg of pancuronium. ECG leads were applied, and femoral arterial and venous catheters were inserted. Ventilator settings were as above. Minute volume was adjusted to maintain normocarbida. Enflurane infusion was adjusted to produce 2.2% vapor concentration. Arterial and venous plasma levels of enflurane were measured by gas liquid chromatography (Varidan 3700) at 5 min, 15 min, and then every 30 min. for 120 min. Vital signs and arterial blood gas tensions were checked every 15 min.

**RESULTS** In figure 3, the horizontal axis shows increments of infusion rate, and the vertical axis illustrates concentration of vaporized anesthetic. The nomogram represents mean (+ SE) of concentration against infusion rate. Figure 4 shows mean (+ SE) of arterial and venous levels of enflurane. Blood levels of anesthetic rose quickly to about 20 mg% in first 30 min., then leveled off at 20-30 mg% thereafter. Vital signs and arterial blood gas tensions were within the normal range. The animals showed clinical signs of anesthesia and woke up within several minutes after termination of anesthetic.

**DISCUSSION** We conclude that this vaporizer can vaporize enflurane to concentrations within the clinical range during HFJV. The concentration is directly proportional to infusion rate and inversely related to minute volume. A nomogram provides a guide to estimating concentrations other minute volumes and infusion rates between those used in this study. Blood levels of enflurane indicate that normal uptake of anesthetic occurs and represent laboratory evidence of anesthesia.

**REFERENCES**

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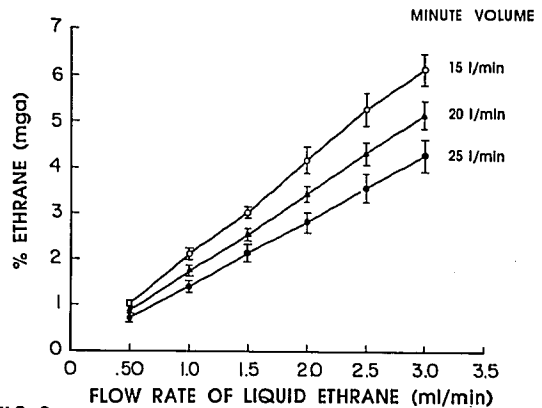
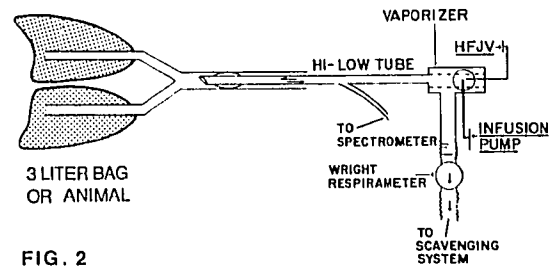
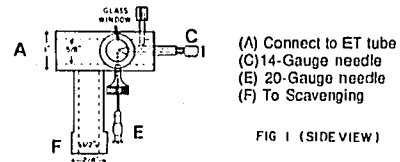


FIG 3

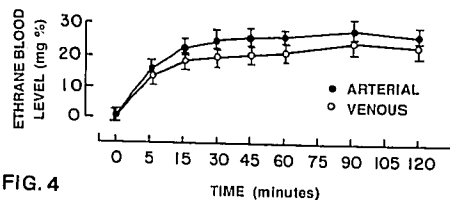


FIG 4

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