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Does Halothane Protect Against Hypoxia?

To the Editor:—Hershenson *et al.*¹ confirmed a previous investigation² that halothane significantly reduces cardiac output and oxygen consumption in normoxic and hypoxic newborn lambs when compared to paralyzed, ventilated controls. They conclude that halothane reduces oxygen consumption and delivery, and may be protective in hypoxemic patients. One must exercise caution in interpreting these results because of two serious design flaws in this study. Hershenson *et al.*¹ used paralyzed newborn lambs that were anesthetized with fentanyl ($30 \mu\text{g} \cdot \text{kg}^{-1} \cdot \text{hr}^{-1}$) as their control animals. Fentanyl may not be an "anesthetic" in newborn lambs at ten to 100 times this dose.³ Indeed, the ability of fentanyl to anesthetize other species at this dose has been questioned as well.⁴ We wonder how this may have affected the author's conclusions. Were the decreases seen in oxygen consumption and delivery the result of halothane *per se*, or secondary to the reduction of an artificially elevated oxygen consumption and delivery caused by pain or immobilization stress?⁵ Perhaps any anesthetic agent would produce the same results.

Secondly, all animals were exposed to progressively lower levels of inspired oxygen (100%, 21%, 15%, 10%) in this study without either an intervening return to normoxia or randomization of the sequence of exposure. Were the decreases in oxygen consumption and

delivery at the 10% FI_{O_2} level unduly influenced or exaggerated by the immediately preceding hypoxic exposure?

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In Reply:—We welcome and appreciate Dr. Yaster's comments concerning experimental design. With regards to the use of fentanyl, we agree that fentanyl alone may not provide surgical anesthesia in the new-

born lamb. We have found that unparalyzed animals given fentanyl alone at $30 \mu\text{g} \cdot \text{kg}^{-1} \cdot \text{hr}^{-1}$, while able to lie on the operating table without restraint and appearing to have a blunted response to stimulation, continued