

Current Comment

S. G. HERSHEY, M.D., *Editor*

Flammability of Halothane, Methoxyflurane and Fluoroxene Under Hyperbaric Oxygen Conditions

SHELDON F. GOTTLIEB, PH.D.,* FRANK J. FEGAN, JOHN TIESLINK †

With the increasing use of hyperbaric oxygenation (HPOT) questions arise as to the potential fire hazard from various anesthetics.

This report concerns flammability studies of three anesthetics at two different oxygen tensions. The anesthetics used in this study are halothane, methoxyflurane and, for comparative purposes, fluoroxene.**

METHODS

Explosion and flame testing were performed in a "Bethlehem Multi-Purpose Explosion Chamber" †† constructed so as to meet all requirements set forth in military specifications E 5272C.

The three anesthetics were vaporized under vacuum. In individual experiments the vaporization was accomplished by carefully (to avoid air intake) introducing the calculated amount of liquid anesthetic from a side-arm tube into the evacuated test chamber. The total pressure was subsequently raised either to 760 mm. of mercury (1 ata) or 3,040 mm. of mercury (4 atmospheres absolute) with 100 per cent oxygen. The contents of the chamber were mixed by a fan prior to ignition. In addition to this procedure, a Fluotec was employed to fill the evacuated chamber with a halothane-oxygen mixture (76 mm. of mercury halothane

—752 mm. of mercury O₂). For hyperbaric oxygen conditions the total pressure was increased to 3,040 mm. of mercury with 100 per cent oxygen.

RESULTS

The results (table 1) show that halothane in the range of 7.6–49 mm. of mercury (1–6.5 per cent of 1 atmosphere), at a total pressure of 1 and 4 atmospheres did not explode nor did it show evidence of being flammable when the high voltage spark was generated and held for five seconds. Similar results were obtained with methoxyflurane (2 per cent of 1 atmosphere). Fluoroxene, in the range of 7–35 mm. of mercury, did not explode nor did it burn. At 73 mm. of mercury fluoroxene exploded and burned. The critical partial pressure for exploding and for burning fluoroxene is in the range of 35–73 mm. of mercury.

CONCLUSIONS

These data are interpreted to mean that from the point-of-view of safety, excluding physiological considerations, halothane and methoxyflurane can be used safely in conjunction with hyperbaric oxygenation.

TABLE 1. Flammability of Anesthetics

Anesthetic	(mg. Hg)	Oxygen (mm. Hg)	Explosion	Flame
Halothane	7.6–49	711–752.4	No	No
	7.6–49	2,991–3,032	No	No
Methoxyflurane	15.0	745	No	No
	15.0	3,025	No	No
Fluoroxene	7.0	753	No	No
	35.0	725	No	No
	73.0	687	Yes	Yes

* Departments of Physiology and Anesthesiology, Jefferson Medical College, Philadelphia, Pennsylvania.

† Hyperbaric Oxygen Therapy Division, The Bethlehem Corporation, Bethlehem, Pennsylvania.

** Fluoroxene was included as a check on the functioning of the explosion chamber.

†† The explosion chamber was on loan from the Hyperbaric Oxygen Therapy Division of the Bethlehem Corporation, Bethlehem, Pennsylvania.