The Effects of Ethrane

To the Editor:—In a recent article,[1] Drs. Shimosato, Sugai, Iwatsuki and Etsten, using a papillary muscle preparation, demonstrated that a greater concentration of Ethrane than of either halothane or methoxyflurane is required to depress several parameters of myocardial contractility (table 1). They state that "therefore, Ethrane was less depressant to myocardial contractility than methoxyflurane or halothane."

Although, on a milligram-for-milligram basis, the above statement is accurate, it is, in a way, quite misleading, in that it ignores the relative narcotic effects of the three agents. If, for example, drug A and drug B depress the heart equally at equal concentrations and this same concentration represents a far greater anesthetic depth for drug A than for drug B, then in terms of cardiac depression per level of anesthetic depression, drug B is more depressing to the heart than drug A.

TABLE 1. Concentrations of Ethrane, Methoxyflurane and Halothane to Produce 50 Per Cent Reductions of Parameters of Myocardial Mechanics[1]

	Concentration (mg/100 ml)		
	Ethrane	Methoxyflurane	Halothane
V_{max}	20	17	6
F_m	16	12	7
Maximal power	11	4	3
Maximal work	9	6	3
Maximal dF/dt	13	9	5

TABLE 2. Multiples of MAC for Ethrane, Methoxyflurane and Halothane Required to Produce 50 Per Cent Reductions of of Parameters of Myocardial Mechanics

	Ethrane*	Methoxyflurane**	Halothane***
V_{max}	2.2	3.4	1.3
F_m	1.8	2.4	1.5
Maximal power	1.2	0.81	0.64
Maximal work	1.0	1.2	0.64
Maximal dF/dt	1.4	1.8	1.07

* Ethrane MAC estimated to be 1.45 per cent from MAC x oil/gas partition coefficient = 143.[2]
** MAC for methoxyflurane = 0.16 per cent.[2]
*** MAC for halothane = 0.77 per cent.[2]

I have restated the data presented by the authors in terms of multiples of Minimum Alveolar Concentration (MAC),[2] a standard of potency that can be used to compare relative cardiovascular or respiratory effects of anesthetic agents.[3] The data now show that equal reductions of myocardial mechanics are produced by *lighter* levels of Ethrane than methoxyflurane for all parameters measured except maximum power (table 2). If this relationship holds true *in vivo*, one could they say that Ethrane was *more* rather than less depressing to the heart than methoxyflurane.

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REFERENCES

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3. Munson, E. S., Larson, C. P., Jr., Babad, A. A., Regan, M. J., Buechel, D. R., and Eger, E. I., II: The effects of halothane, fluroxene, and cyclopropane on ventilation: A comparative study in man, ANESTHESIOLOGY 27: 716, 1966.

To the Editor:—The importance of considering the relative narcotic effects of anesthetic agents, as pointed out by Dr. Saidman's letter, is well taken. However, it should be pointed out that it is more appropriate to determine the percentage depression in myocardial mechanics at an equipotent level of anesthesia. A comparison of the degree of depression produced by three anesthetics: halothane, methoxyflurane and Ethrane, at a given MAC is more discerning than attempting to determine changes in multiples of MAC related to

a given degree of depression of myocardial mechanics. Data provided by Dr. Saidman to describe the comparative effects of the anesthetics assume that the concentration of the anesthetics is a linear function of MAC. This has not been demonstrated. Dr. Saidman's interpretation of our data by using multiples of MAC, therefore, gives erroneous information. He used the MAC obtained in man for analysis of cat papillary heart muscle, which may not be justified.

Note, we have taken into account the relative narcotic effect by means of the MAC-1 level, and the concentrations of the anesthetics at a MAC-1 level for animals as described by Eger *et al.* (ANESTHESIOLOGY 30: 129, 1969). The percentage decreases in the components of myocardial mechanics of the isolated cat papillary muscle induced by three agents are shown in table 1.

TABLE 1. Δ Decreases in Myocardial Mechanics at MAC-1 (%)

	V_{max}	F_m	Max. Power	Max. Work	Max. dF/dt
Ethrane	12	36	44	50	37
Methoxyflurane	31	40	55	51	43
Halothane	39	35	51	52	45

The percentage decreases in V_{max}, F_m, maximal power, maximal work and maximal dF/dt were calculated for a given MAC-1 level of each agent, expressed in mg/100 ml using linear regression equations derived for each component. Our data show that percentage decrements in all components of mechanics of contraction of the heart muscle exposed to Ethrane at the MAC-1 level are less than those in muscles exposed to either halothane or methoxyflurane. Evidently, these findings corroborate our previous findings which showed that Ethrane is less depressant to myocardial contractility than methoxyflurane or halothane (ANESTHESIOLOGY 30: 513, 1969).

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Drugs

NEW ANALGESIC Phenoperidine, a new analgesic, was given to 100 patients of various ages in a dose of one mg/30 kg body weight prior to induction of anesthesia. Sleep was not induced with this drug, but the patients became drowsy within five minutes. The dose of thiopental required for induction of anesthesia was reduced considerably. Respiratory depression was considerable; apnea occurred in 36 patients, most of whom were elderly. Anesthesia was maintained with nitrous oxide–oxygen and fractional doses of phenoperidine, using the respiratory rate as an indicator of the need for more drug (about every 30 minutes when the respiratory rate was faster than 10 beats/min). Tracheobronchial reflexes were also depressed, and the endotracheal tube was well tolerated. The cardiovascular system remained stable. (*Viars, P., and Gaveau, T.: Report on the Use of Phenoperidine, Anesth. Analg. 25: 163 (March) 1968.*)