Anesthesiology

THE JOURNAL OF THE AMERICAN SOCIETY OF ANESTHESIOLOGISTS, INC.

VOL. 21 JANUARY–FEBRUARY 1960 NO. 1

HALOTHANE CONCENTRATIONS IN CLINICAL ANESTHESIA

R. H. Smith, M.D., and Perry P. Volpitto, M.D.

From a review of the literature, it would appear that 1–2 per cent concentrations of halothane (Fluothane) are commonly required for anesthesia.[1-4] We have had a clinical impression that we frequently used smaller concentrations. One hundred twenty-four anesthetic records were therefore reviewed for this study.

Method

The halothane vaporizer employed was calibrated from 0.1 to 4 per cent. It was standardized against a spectrophotometer using 228-millimicron light as recommended by MacKay and Kalow.[5] The anesthetic records of the 124 patients were analyzed for age, sex, physical status, operation and duration of anesthesia. The duration of flow of each concentration of halothane and the sum of the minutes each concentration was used were determined in each case. Alveolar concentrations of halothane were not determined.

Technique of Anesthesia. For premedication, atropine or scopolamine, with or without pentobarbital or meperidine, was given as indicated by the patient's condition. A dose of pentobarbital 100 mg. and meperidine 50 mg. was never exceeded in any patient. Anesthesia was induced with thiopental, thiamylal or hexobarbital. These drugs were used for induction only and averaged 185 mg. per patient. Oxygen, 4 l./minute, was then given by mask, succinylcholine chloride was injected to facilitate tracheal intubation, after which nitrous oxide, 2.5 l.–oxygen, 1.5 l., was given by controlled respiration until spontaneous respirations were adequate. Halothane was then added gradually. Anesthesia was maintained with nitrous oxide, 2.5 l.–oxygen, 1.5 l., and halothane as required for the procedure. Respirations were assisted or occasionally controlled. Ventilation, although not usually measured, was considered clinically adequate. Succinylcholine by intravenous drip was used in 11 patients, 500 mg. was not exceeded in any case. In 7, the succinylcholine used was under a 90 mg. per hour rate. An endotracheal tube was used in 118 patients.

Accepted for publication August 10, 1959. The authors are in the Department of Anesthesiology, Medical College of Georgia and the Eugene Talmadge Memorial Hospital, Augusta, Georgia.

Results

The age distribution and physical status of the 124 patients are shown in table 1. There were 67 males and 57 females. Operations were as follows: intra-abdominal, 16; kidney, 4; perineal, 6; extremities, 5; surface, 18; brain, 34; back, 33; neck, 4; thyroid, 4. The shortest operation was 20 minutes, the longest 450 minutes, average 157 minutes.

The halothane vaporizer was found to be accurate at 0.1, 0.2, 0.3, 0.4, 0.8, 1.0 and 1.5 per cent graduations. Graduations of 0.5, 0.6 and 0.7 per cent were found to produce virtually the same (0.7 per cent) concentrations of halothane. At 4 liters gas flow for vaporization, the metered concentration was the one the patient received, except at 0.5, 0.6 and 0.7 per cent. At these flows, all received 0.7 per cent halothane.

TABLE 1

AGE DISTRIBUTION AND PHYSICAL STATUS OF 124 PATIENTS RECEIVING HALOTHANE ANESTHESIA

Age Distribution

Age (years)	0–10	10–20	20–30	30–40	40–50	50–60	60–70	70–80	80–
Number	10	10	16	15	28	28	9	7	1

Physical Status

Status	1 and 5	2		3 and 6		4	7		
Number	29	52		22		16	5		

TABLE 2

AVERAGE DURATION OF ANESTHESIA FOR EACH CONCENTRATION OF HALOTHANE

Concentration (per cent)	1 or over	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1
Minutes	5.5	1.1	5.8	1.2	8.8	10.6	31.2	32.9	40.7	19.5

The duration of administration of halothane was measured and summated for the 124 cases (table 2). The average duration of anesthesia was 157 minutes. In 52.9 per cent of that time the patient received 0.3 per cent halothane or less. Four-tenths per cent or less was administered 80 per cent of the time, and 0.7 per cent or less was used in 92.3 per cent of the average duration of anesthesia. In 77 of the 124 patients, a flow of 0.8 per cent halothane was never exceeded, and in 46 of the 77, 0.6 per cent was the maximum concentration employed.

Hypotension due to halothane concentration was noted in 20 patients (maximum drop, 40 mm. Hg, average drop 21 mm. Hg). This was treated by rapid reduction of alveolar concentrations of halothane. A vasopressor was used three times to treat hypotension thought due to traction reflexes which appeared to remain active under halothane in the concentrations employed. Bradycardia, thought due to an active carotid sinus reflex, was observed in one patient. This was treated with atropine.

SUMMARY AND CONCLUSIONS

The anesthetic records of 124 patients anesthetized with halothane were analyzed to ascertain the concentrations needed for anesthesia. We found that low concentrations of halothane were needed when this agent was used with 2.5 l. nitrous oxide–1.5 l. oxygen after barbiturate induction. The halothane concentrations were under seven-tenths per cent 92.5 per cent of the time. From this experience it would seem advisable and advantageous for manufacturers to calibrate halothane vaporizers in tenths below 0.5 per cent.

We would like to thank Dr. Walter L. Shepeard, Professor of Clinical Pathology, Medical College of Georgia, for his help in this study.

REFERENCES

1. Brindle, G. F., Gilbert, R. G. B., and Millar, R. A.: Use of Fluothane in anaesthesia for neurosurgery, Canad. Anaesth. Soc. J. **4**: 265, 1957.
2. Junkin, C. I., Smith, C., and Conn, A. W.: Fluothane for pediatric anaesthesia, Canad. Anaesth. Soc. J. **4**: 259, 1957.
3. Stephen, C. R., Grosskreutz, D. C., Lawrence, J. H. A., Fabian, L. W., Bourgeois-Gavardin, M., and Coughlin, J.: Evaluation of Fluothane for clinical anaesthesia, Canad. Anaesth. Soc. J. **4**: 246, 1957.
4. MacKay, I. M.: Clinical evaluation of Fluothane with special reference to controlled percentage vaporizer, Canad. Anaesth. Soc. J. **4**: 235, 1957.
5. MacKay, I. M., and Kalow, W.: Clinical and laboratory evaluation of four Fluothane vaporizers, Canad. Anaesth. Soc. J. **5**: 248, 1958.