

An average maximum drop in mean blood pressure of 17 per cent was noted. The most striking effect of this agent was the production of marked tachypnea. There was a consistent increase in respiratory rate of 100 per cent or more in all stages of narcosis with a concomitant decrease in tidal volume. An over-all increase in minute volume of 8.5 to 20 per cent occurred, however. No significant change in arterial or venous oxygen content or saturation was observed. There was a slight increase in arterial carbon dioxide content of 3.5 volumes per cent. No significant change in arterial pH was noted.

Electroencephalographic patterns of anesthesia were in agreement with those described for hydroxydione by Bellville and Howland. We found that stage I levels were very transient and that the patient may be awake at level I or II during the recovery phase. All patients, except those who reached level IV with the induction dose alone, showed marked generalized muscular twitchings and rigidity.

Evaluation of Inhalers for Trichloroethylene, Chloroform and Fluothane. S. H. NGAI, M.D., HENRY D. GREEN, CAPT. MC, JACK R. KNOX, M.S., AND HARVEY C. SLOCUM, COL. MC, Department of Experimental Surgery and Biophysics, Walter Reed Army Institute of Research and the Anesthesia and Operative Service, Walter Reed Army Hospital, Washington, D. C.

IN the process of investigating the analgesic properties of trichloroethylene, chloroform, and Fluothane (1, 1, 1-trifluoro-2,2-bromochlorethane) and their possible application in the anesthetic management of mass casualties a series of anesthetic inhalers were evaluated. These included the Duke inhaler, a modified Duke inhaler, the Emotril inhaler, the Tecota inhaler, an experimental chloroform Tecota inhaler, and the Airlene inhaler.

Analysis of anesthetic vapor concentration as delivered from these inhalers was accomplished with a Perkin-Elmer double beam recording infrared spectrophotometer. The inhaler was charged with one of the three agents and connected to the intake tube of a Bird respirator pump with the infrared sampling cell interposed to achieve a total and continuous sampling. Anesthetic vapor concentration in relation to the available settings on the inhaler and the tidal volume and stroke frequency of the respirator was determined. The ability of the inhaler to maintain a given vapor concentration was also tested.

With the Duke inhaler the trichloroethylene vapor concentrations obtained were at slight variance with the information provided by the manufacturer. When charged with chloroform the increment in vapor concentration with each higher setting was of considerable magnitude. The modified Duke inhaler gave a more gradual increase in vapor concentration in this respect. The ranges of vapor concentrations were: trichloroethylene, 0.00 to 0.98 per cent; chloroform, 0.00 to 1.66 per cent; and Fluothane, 0.00 to 1.63 per cent. Lower concentrations were maintained for a period up to 60 minutes. With both the Duke inhaler and the modified Duke inhaler the vapor concentrations were sensitive to position changes of the inhaler, becoming higher when the inhaler was held horizontally. They were also sensitive to changes in air flow rate. Concentrations decreased when the minute volume was less than 7 liters.

With the Emotril inhaler an initial period of approximately twenty minutes was necessary for the vapor concentration to become stabilized. After stabilization, with a minute volume of 8 to 10 liters, the vapor concentrations were: trichloroethylene, “weak,” 0.27 to 0.33 per cent, “normal,” 0.43 to 0.49 per cent; chloroform, “weak,” 0.70 to 0.95 per cent, “normal,” 1.0 to 1.3 per cent; and Fluothane, “weak,” 0.33 to 0.53 per cent, “normal,” 0.50 to 0.80 per cent. The critical minute volume was 6 liters.

With the Tecota inhaler the vapor concentration became stabilized within the first few minutes. With a minute volume of 8 to 10 liters the vapor concentrations were: trichloroethylene, “minimum,” 0.27 to 0.30 per cent, “maximum,” 0.37 to 0.46 per cent; chloroform, “minimum,” 0.71 to 0.75 per cent, “maximum,” 0.90 to 1.16 per cent; and Fluothane “minimum,” 0.44 to 0.65 per cent, “maximum,” 0.80 to 1.0 per cent. The critical minute volume was 8 liters. With both the Emotril and the Tecota inhalers

vapor concentration was maintained as long as there was liquid agent in the vaporizing chamber.

The experimental chloroform Tecota inhaler was calibrated to deliver from 0.2 to 2.0 per cent of chloroform vapor. With the control set at 0.8 per cent or less the vapor concentration was maintained but with the control set at 1.0 per cent or more the vapor concentration decreased rapidly and became stabilized at a lower level. The critical minute volume was 4 liters.

The Airlene inhaler has defects similar to those of the Duke inhaler. Furthermore, changes in minute volume caused irregular changes in vapor concentrations at different settings. (Dr. Ngai is now at The Presbyterian Hospital, New York.)

Potency of Intravenous Barbiturates in Man. LOUIS R. ORKIN, M.D., GEORGE A. MORALES, M.D., MASAO FUJITA, M.D., AND RODRIGO L. GABUYA, M.D., Departments of Anesthesiology, Bronx Municipal Hospital Center, Albert Einstein College of Medicine, New York, New York.

THE problem of evaluating the potency of intravenous barbiturates has been approached previously by comparing the dose required for anesthesia per unit time. Variation among individuals is so marked that large numbers of patients must be followed before reliable differences are demonstrable. In addition, the influence of surgical stimulation cannot be divorced from the data. The utilization of a patient in cross-over studies prior to manipulation nullifies these difficulties. This investigation entailed two phases. The first was a study of the variation between individuals versus the variation within an individual, and the second was a comparison of the dose of barbiturate to reach the "thiopental end-point."

Patients from the Psychiatric Service scheduled for repeated electroconvulsive therapy two to three times per week were the subjects. Trials were made in a separate quiet room with the patients under basal conditions. The barbiturate was injected into the antecubital vein in increments of 1.0 ml. at the start of every 30 seconds until the patient failed to respond to the command, "open your eyes!" shouted into their ears 15, 10, and 5 seconds prior to the next scheduled injection. This is the "thiopental end-point." The variation with concentrations ranging from 1 per cent to 10 per cent was investigated. Random selection of the order of administration was followed.

Seventy-five patients received thiopental on at least three occasions varying from 43 to 96 hours apart. Analysis by variance demonstrates that the difference between individuals and within individuals is highly significant (f ratio = 55.2). Applying Student's t test to a group of 10 patients each receiving 3 trials of the same drug, the standard deviation of a single determination was ± 21.3 mg. The 95 per cent confidence limits of a single determination was ± 44.2 mg., and 95 per cent confidence limits of the mean of 3 determinations was ± 25.8 mg. The $P = 0.05$ between two single determinations of different drugs in the same individual was ± 63.3 mg. and between the mean of 3 determinations each was ± 36.5 mg. No correlation was found between age, sex, surface area, total weight, fat or lean body weight, basal metabolic ratio, or daily dose, and the amount of thiopental.

Four groups of more than 10 patients each received various concentrations of thiopental (1, 2.5 and 5 per cent), thiamylal (1, 2.5 and 5 per cent), methitural (2, 5 and 10 per cent), and Baytinal (2, 5 and 10 per cent). There was a tendency to decrease the total dose of drug as the concentration increased. This was not marked or clinically significant. However, the time for loss of consciousness decreased significantly since the drugs were administered in 1.0 ml. increments.

Thiamylal was compared to thiopental by three determinations of each drug in each patient in four groups of 10 patients each. In the first group, the drugs were known to the observer but in the second, third and fourth groups both thiamylal and thiopental were coded in a double blind technique. Assigning thiopental a potency of 1.000, the relative potencies of thiamylal were 1.078, 1.080, 1.055 and 1.099 respectively.