

because of the delay of surgery. Both of these patients required large amounts of drug and consequently the tests required excessive amounts of time. An interesting observation was the marked variation in the reflexes exhibited by the patients in this study. Two patients were eliminated from the study because they did not cough spontaneously when they recovered from the muscle paralysis. The results of this study indicate that lidocaine was an effective suppressant of cough without producing respiratory arrest. Both thiopental and meperidine produced respiratory arrest in a high percentage of patients before the cough reflex was suppressed.

Glutethimide (Doriden) as an Anesthetic Agent. C. R. STEPHEN, M.D. *Division of Anesthesiology, Duke Medical Center, Durham, N. C.* For several years *alpha*-ethyl-*alpha*-phenyl-glutarimide (Doriden) has been utilized as an orally effective nonbarbiturate hypnotic compound. Recently a preparation for intravenous administration (each cubic centimeter containing glutethimide, 50 mg., dissolved in polyethylene glycol 400) became available for trial. This report summarizes the results of animal and clinical investigations conducted to evaluate this drug as a hypnotic for induction of anesthesia. Eight dogs were given succinylcholine, 0.5 mg./kg. intravenously. Endotracheal intubation was performed immediately and the dogs maintained on artificial respiration with oxygen, employing a Palmer pump, while a femoral artery cutdown was done, a vein cannulated, and electrocardiographic and electroencephalographic leads connected. Respirations were monitored by means of a pneumotachygraph. Recordings were made on a Grass electroencephalographic machine with suitable transducers and demodulators. Control recordings were made as the animal was recovering from the succinylcholine apnea and then various amounts of glutethimide were administered intravenously. An original dosage of 40 mg./kg. produced usually a profound hypnotic and analgesic effect. With this dosage apnea persisted an average of 10.5 minutes. Normal respirations were present in about 20 minutes, with the animals gagging and moving on the table. Subsequent doses of 20 mg./kg. rarely

produced apnea, but resulted in an adequate state of hypnosis for approximately 20 minutes. Each administration of glutethimide produced marked slowing of electroencephalographic activity, with sometimes burst-suppression activity and occasionally complete absence of electrical activity for several minutes. Moderate to marked hypotension accompanied these dosages. No electrocardiographic abnormalities of significance were noted. Several days after recovery the experiment was repeated in the same dogs utilizing thiamylal sodium (Surital) instead of glutethimide. Thiamylal sodium, 40 mg./kg., produced apnea lasting more than 60 minutes. This dosage also resulted in profound depression of electroencephalographic activity for several minutes, although hypotension was not a significant factor. The principal differences in the two drugs in these dosages were: (1) the shorter duration of activity of glutethimide, (2) the more profound respiratory depression of the ultra-short-acting barbiturate and (3) the greater degree of hypotension seen with glutethimide. Induction of general anesthesia was carried out in 58 adult patients, utilizing glutethimide in a manner similar to the ultra-short-acting barbiturates. In the majority of patients induction was rapid, smooth and free of apprehension, although seven patients (12 per cent) became garrulous or went through a short but well-defined "second stage" of anesthesia. The average amount of drug required to produce sleep or hypnosis was 500 mg., with the range varying between 200 and 1,500 mg. The average total dose administered was 850 mg., with one patient receiving 3,500 mg. over a period of four hours. The most remarkable differences between glutethimide inductions and ultra-short-acting barbiturate inductions were related to the character of respirations and oropharyngeal reflex activity. With glutethimide the respiratory rate was unchanged and the tidal volume reduced minimally if at all. At the same time, glutethimide obtunded reflex activity in the upper respiratory tract in a satisfactory manner. Oropharyngeal airways could be inserted without reaction within two minutes of the time sleep was produced. In 21 patients glutethimide induction was followed by rapid administration of nitrous oxide, oxygen and

ethyl ether, and in only one patient were any of the irritative phenomena seen commonly with ether noted. A transient reduction in blood pressure occurred in most patients following glutethimide administration, and in six (10 per cent) the systolic pressure fell more than 40 mm. of mercury. Sixteen patients (27 per cent) complained of a burning type of pain in the arm during injection. In several patients a small area of thrombosis was noted at the site of injection 24 hours later.

An Application of Analog Computational Methods to Physiological Measurements. WILLIAM THORNTON, B.S., DAVID A. DAVIS, M.D., KENNETH SUGIOKA, M.D., AND CHARLES W. FOWLER, M.D. *Department of Anesthesiology, University of North Carolina, Chapel Hill, N. C.* The term "analog computer" often creates visions of enormous and complicated electronic machines. Actually the functional elements of computers which can add, multiply, integrate, differentiate and carry out other mathematical operations are quite straightforward. Complexity and size of these instruments are increased by the number of functions required of the instrument. The function of integration described here is performed by a relatively simple and mass-produced circuitry easily contained in a shoe box. Calculations on other functions which lend themselves to conversion into electrical impulses can be handled by equally simple operational amplifiers. Accuracy and stability of performance depend on the quality of instrumentation and hours or days of uncorrected operation are quite possible. One application of analog computational methods concerns the conversion of gas flow rates into volume. It is desirable to make accurate and immediate measurements of respiratory volumes in anesthetized patients without disturbing the anesthetizing technique or equipment. Previously this has been difficult, especially when employing a semiclosed technique, controlled or assisted breathing. It is easy to insert into an anesthesia circuit a differential pressure transducer of the screen or baffle-plate type. A baffle-plate type is used in these studies and through a low-pressure Statham transducer and strain-gauge coupler the flow rate pattern is

displayed on a type A Offner Dynograph recording system. So far this is a standard method of recording flow rates. Next the voltage from the pen motor recording flow rate is applied to the integrating system, where summation into volume is accomplished and displayed on a second recording channel in a pattern identical to that produced by a spirometer. Calibration is carried out by the use of some convenient and known volume standard (spirometer). Linearity and accuracy exceed 95 per cent and the instrumentation is stable over a period of several hours. The transducers and recording systems were chosen by convenience but an absolutely stable recording system such as the Offner chopper amplifier is imperative. In these studies the only inherent defect in instrumentation noted is attributable to an asymmetrical baffle plate transducer. "Steady state" signals such as those offered by a continuous flow of gases (semiclosed system) or even the asymmetry of the transducer may be compensated for by the addition of a large capacitor between the flow rate amplifier and the integrator input. This introduces a small (1-2 per cent) error and may over a period of time necessitate resetting of the base line (accomplished by the flick of a switch) but does not introduce any appreciable error from cycle to cycle. Because a differential pressure transducer is used, measurements made under positive or positive-negative ventilation are quite accurate. Although tested only in the field of anesthesiology, applications of this system in other areas requiring measurements of respiratory volumes are quite feasible, as are other applications of analog computers in physiological measurements.

The Effect of Certain Anesthetic Agents and Techniques on the Twenty-Four Hour I-131 Uptake. WM. H. WRIGHT, MAJOR MC, AND ALAN D. RANDALL, CAPT. MC. *Madigan Army Hospital, Tacoma, Wash.* Thiobarbital has been used in the treatment of hyperthyroidism in humans and the effects of thiopental and thiamylal on the I-131 uptake have been studied in mice and compared with the effects of ether and cyclopropane. This study attempts to delineate the effect of thiopental, thiamylal, methitural, low spinal anesthesia